DISSERTATION

THE RELATIONSHIP OF INSTITUTIONAL SUPPORTS/CONSTRAINTS AND INSTRUCTORS' CHARACTERISTICS TO EFL TAIWANESE TEACHERS' USE OF TECHNOLOGY

Submitted by

Shiaoli Pai

School of Education

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WE HEREBY RECOMMEND THAT THE DISSERTATION PREPARED UNDER OUR SUPERVISION BY SHIAOLI PAI ENTITLED THE RELATIONSHIP OF INSTITUTIONAL SUPPORTS/CONSTRAINTS AND INSTRUCTORS' CHARACTERISTICS TO EFL TAIWANESE TEACHERS' USE OF TECHNOLOGY BE ACCEPTED AS FULFILLING IN PART REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY.

Committee on Graduate Work

Cliff Harbour

Karl Krahnke

George Morgan, Adviser

Don Quick, Co-Adviser

Rick Ginsberg, Director

ABSTRACT OF DISSERTATION

THE RELATIONSHIP OF INSTITUTIONAL SUPPORTS/CONSTRAINTS AND INSTRUCTORS' CHARACTERISTICS TO EFL TAIWANESE TEACHERS' USE OF TECHNOLOGY

The purposes of the study are to investigate (a) the aspects of the availability, frequency of use, and complexity of technology use in teaching English speaking/listening skills in Taiwan; (b) the relationship between institutional supports/constraints and EFL teachers' frequency and complexity of technology use; (c) the relationship between EFL teachers' personal characteristics and their frequency and complexity of technology use, and (d) to find a combination of variables that predict the frequency and complexity of the use of technology in teaching English speaking/listening skills.

Nine software and twenty hardware technologies were selected for analysis; 181 EFL teachers from post secondary institutes in central part of Taiwan participated in this research. Results indicate that the average availability of technology is moderate to high (53% for software and 71% for hardware technology). Technology frequency use appears to be moderate while the levels of technology complexity used are toward the easier end. Only one variable that related to institutional supports/constraints (i.e., colleague support) had significant relationships with the frequency and complexity of the use of technology in teaching. However, the effect sizes were small. Several personal

characteristics (e.g. using the computer in preparing teaching, using computers in the class/ in the lab, length in years of teaching, etc.) have significant relationships with their frequency and complexity of technology use in teaching. The strongest predictor that related to personal characteristics derives from EFL teachers' frequency of using computers in preparing teaching.

The researcher conclude that instead of increasing the availability of the technology or providing technical support in the institute, encouraging more colleague interaction in using technology, facilitating activities for preparing teaching as well as promoting computer usage in the class and in the lab will actually motivate EFL teachers use more complex technologies and use them more frequently.

Shiaoli Pai
School of Education
Colorado State University
Fort Collins, CO 80521
Summer 2005

CONTENTS

CHAPTER 1: INTRODUCTION

The purpose of Chapter 1 is to provide an overview of the research study and introduce teaching English as a Foreign Language (EFL) teachers' use of technology in Taiwan. The chapter also defines the purpose of the study, outlines the research problem and research questions, defines the terms used, explains the study's delimitations, explains the significance of the study, and the researcher's perspectives.

Purpose of the Study

Technology is broadly used in all teaching areas at the present time. It is important to understand how EFL teachers use different types of technology in their classrooms in order to provide in-depth insight for designing curricula for future EFL teachers' professional development programs. This study, focusing on EFL Taiwanese teachers' instruction of speaking and listening skills, intends to develop an instrument to assess EFL teachers' perceived use of various types of instructional technology and tries to investigate whether their individual characteristics and institutional supports/constraints have any influence on the frequency of their use of different types of technology, as well as the complexity of their use of technology.

Before developing the instrument, the content validity and internal consistency of the instrument were investigated through the method of expert consultation with ESL professionals. EFL teachers' demographics and their institutional supports and constraints are recognized as two main groups of independent variables that have the capacity to predict the frequency of their use of different types of technology, as well as

the complexity of their use of technology. The researcher is trying to discover three aspects of EFL instruction in regard to technology use in the classroom: first, what are the availability, frequency of use, and complexity of use of technology, if various software and hardware technologies are used to teach English speaking and listening skills in Taiwanese post secondary language institutes? Secondly, how different instructor characteristics (e.g., overall teaching experience, years of using computers in teaching, frequency of using computers for non-teaching activities, frequency of using computers for preparing teaching materials, for use in the classroom, and for use in the lab, etc.) and institutional factors (i.e., availability of technology in the institute, annual formal computer training, workload, support system provided, and teacher collaboration on projects or teaching activities, etc.) are related to EFL teachers' frequency of different types of technology use, as well as the complexity of their use of technology. Thirdly, what is the possible combination of instructors' characteristics and their institutional supports/constraints that can predict their frequency of technology use, as well as their complexity of technology use? The answers to these questions will provide a clearer picture of how future EFL instructors' professional development programs can be designed to improve the technology use in the classroom.

Background of the Research

Warschauer (1999) introduced the historical perspective of literacy indicating that from the earlier Pre-Gutenberg era to the recent twenty-first century, the way people define literacy was changed by the presence of new technology. Literacy was depicted from broader social, political, and economic transformation. People recognized literacy as simply articulating speeches and sermons (Olsen, 1996; Ong, 1982) to survival skills

necessary to function in society, which appears as the "fourth revolution in the means of production of knowledge" (Harnad, 1991, p. 39). As some researchers believe, it is no longer possible in language education to ignore this global-changing reality (Sokolik, 2001; Zhao, 2003). It is no longer a "whether teachers use technologies?" question, but a "how they use technologies and what they should know about technologies?" question (Zhao, 2003). Therefore, it is important for researchers to investigate how teachers implement technology into their instruction in order to encourage student critical thinking, interpretation, expression, and negotiation of the meaning encountered in the computer-mediated social life and workplace. The advent of technology has impacted not only on how people gather and share information, but also on how people conceptualize reading and writing (Burbules & Callister, 1996; Gibson, 1996; Tuman, 1992). The shift from merely material production to information-processing activities entails changes from manufacturing to service. As a result, forces that came from outside of the ESL profession, especially the use of technology, have impacted language teaching.

Statement of the Research Problem

Influences from the English as a second language (ESL) profession concurrently pursue the more cognitive, affective, comprehensive, as well as communicative, methods in language teaching (Celce-Murcia, 2001). Such new trends indicate that current second language teaching has combined the evolution of methodologies and the practices of technology-implemented instruction. However, not all the ESL/EFL teachers are competent in the new ways of teaching. Mubireek (2001) contends that ESL teachers have taken on the additional responsibility of being computer-technology instructors

besides teaching English. But it seems that the lack of access to the Internet in the classroom, lack of training, and lack of time for training seriously limit their use or adoption of the technology in their instruction. Teachers' difficulties in facing changes, especially how they implement new technology in language teaching, have been relatively less studied in the past.

On the other hand, policy makers in language institutes also require knowledge of how ESL/EFL instructors use different types of technology in order to decide what kinds of staff professional development training needs to be provided, as well as what other factors influence their use of different types of technology. This study intends to investigate what these potential factors or the combination of factors are in regard to EFL teachers' use of different types of technology in teaching speaking/listening skills. The aspects of these relationships among individual characteristics, institutional supports/constraints, and EFL teachers' use of different types of technology will project a clearer picture of how future professional development training should be designed once implemented.

Research Questions

The study is designed to investigate how personal characteristics of EFL teachers in Taiwan and their institutional factors might influence the frequency and complexity of their use of technology in teaching speaking/listening skills.

The research questions are:

1. What are the availability, frequency of use, and complexity of use of technology, if various software and hardware technologies are provided to teach English speaking and listening skills?

2. What are the relationships between EFL teachers' personal characteristics and the frequency and complexity of their use of technology in teaching English speaking /listening skills?
   A. Are there associations between the levels of EFL teachers' frequency of using computers (1) for non-teaching activities, (2) to prepare teaching materials, (3) in the classroom, and (4) in the lab in regard to the frequency and complexity of their use of technology in teaching English speaking/listening skills?
   B. Is there an association between EFL teachers' years of teaching and the frequency and complexity of their use of technology in teaching English speaking/listening skills?
   C. Is there an association between EFL teachers' years of computer use in teaching and the frequency and complexity of their use of technology in teaching English speaking/listening skills?
3. What are the relationships between institutional supports/constraints and the frequency and complexity of the use of technology in teaching English speaking/listening skills?
   A. Is there an association between EFL teachers' hours of annual formal computer training and the frequency and complexity of their use of technology in teaching English speaking/listening skills?
   B. Is there an association between EFL teachers' teaching hours per week and their frequency and complexity of their use of technology in teaching English speaking/listening skills?

C. Is there an association between EFL teachers' perception of workload and the frequency and complexity of their use of technology in teaching English speaking/listening skills?

D. Is there an association between EFL teachers' perception of their institutional technical support and the frequency and complexity of their use of technology in teaching English speaking/listening skills?

E. Is there an association between EFL teachers' perception of colleagues' support in using technology and the frequency and complexity of their use of technology in teaching English speaking/listening skills?

F. Is there an association between EFL teachers' perception of teacher collaboration on projects or teaching activities and the frequency and complexity of their use of technology in teaching English speaking/listening skills?

4. Is there a combination of teacher characteristics and institutional supports/constraints that predict frequency and complexity of the use of technology in teaching English speaking/listening skills?

Definition of Terms

The following definitions of terms are used in this study:

Authoring: computing the creation of programs and databases for computer applications such as computer-assisted learning or multimedia products: an authoring system.

Complexity of technology use score: This is a score that represents the second set of dependent variables. Before the instrument was developed, 19 ESL experts were invited to rate the complexity of each technology based on a 0(extremely easy) to 100 (extremely

difficult or complex) scale. A list of averaged median weight was created based on these experts' ratings. Whenever the participant of the study answered, "yes" for the availability question, the subject obtained the same averaged median weight rated by19 ESL experts. Whenever the participant answered "no" or "don't know" for the availability question, the subject got a zero (0) as his/her complexity score for that technology. This complexity of use score indicates the level of complexity of the technology the person uses in his/her teaching English speaking/listening skills.

Computer graphics: visual images produced by computer processing.

CD-ROM: a compact disc used as a read-only optical memory device for a computer system (origin: 1980s acronym from *compact disc read-only memory*).

CD Video: a video system in which sound and picture are recorded on compact disc.

Courseware: computer programs or other material designed for use in an educational or training course.

DVD: a high-density videodisc that stores large amounts of data, especially high-resolution audio-visual material (abbreviation of *digital videodisc or digital versatile disc).*

EFL/ESL: ESL represents English as a second language while EFL represents English as a foreign language. Usually, when people mention ESL, the person could mean either ESL or EFL. ESL is a broader term that includes EFL and ESL.

EFL teachers' personal characteristics: These predictor variables are the attributes of EFL teachers, such as their overall teaching experience, years of using computers in teaching, frequency of using computers for non-teaching activities, frequency of using

computers to prepare for teaching materials, computer use in the classroom, and in the lab, etc.

Frequency of technology use score: This is a score that represents the first set of dependent variables. Each subject in this study rated the frequency use of the technology based on a 0 (never used it) to 6 (always use it) Likert scale, if the technology item were said to be available. The average scores of the ratings of either selected 9 software technologies, or 20 hardware technologies were calculated as the first two dependent variables, i.e., frequency of use score for software technology, and frequency of use score for hardware technology.

Graphics: the use of diagrams in calculation and design.

Institutional supports/constraints: These predictor variables are related to or provided by the institute, e.g., availability of different kinds of technology in the institute, annual formal computer training offered through or outside of the institute, EFL teachers' perception of their workload, perception of institutional technical support, perception of colleagues' support, and perception of teacher collaboration on projects or teaching activities, etc.

Internet: an international computer network providing e-mail and information from computers in educational institutions, government agencies, and industry, accessible to the general public via modem links.(original: late 20th cent.: from INTER- "reciprocal, mutual" + network).

Interactive CD: (with a computer or other electronic device) A compact disc allowing a two-way flow of information between it and a user responding to the user's input.

Listserv: an electronic mailing list of people who wish to receive specified information from the Internet.

Overhead projector: a device that projects an enlarged image of a transparency placed on it onto wall or screen by means of an overhead mirror.

PDA: a palmtop computer used to store information, such as addresses and telephone numbers, and for simple word processing and spreadsheet. (Original: late 20th century: abbreviation of *personal digital assistant*).

Scanner: a device for examining, reading, or monitoring something.

Slide projector: a piece of equipment used for displaying photographic slides on a screen.

VCR: videocassette recorder.

Word processor: a dedicated computer or program for storing, manipulating, and formatting text entered from a keyboard and providing a printout.

World Wide Web: a widely used information system on the Internet that provides facilities for documents to be connected to other documents by hypertext links, enabling the user to search for information by moving from one document to another.

Limitation and Delimitations

The study is delimitated primarily to one geographic area of Taiwan and the EFL teachers in this area. The sample will be selected mainly from central part of Taiwan, including Taichung City District, Shin-chu, Chia-yi, Miaoli, and nearby suburban areas. Post secondary language institutes, including those at universities, institutions of technology, junior colleges, and vocational colleges, were selected to be the sampling frame. Based on the number of the EFL teachers in such varied types of institutes, the study is capable of reflecting Taiwanese EFL instructors' use of technologies and related

factors. However, the results should be carefully interpreted when generalizing results to a larger population.

Studies based on respondents' perceptions or self-reports have a certain level of bias, due to trying to make the expectations of the participants/audiences politically correct, to avoid insulting existing authority, or to deconstruct current regulations. Similarly, this study's results may be unintentionally exacerbated based on respondents' reporting invalid use of technology. Because of the requirement from the Education Ministry in Taiwan to report annual expenses on technology, it is possible that some of the EFL instructors may hesitate to declare their actual low use of technology, as well as the availability of technology in their institute. These potential threats should be considered together before interpreting the results.

Significance of the study

The study is intended to develop a model that explains how Taiwanese EFL instructors use different types of technology in their teaching of English speaking/listening skills. Two groups of factors were considered: individual characteristics of the EFL instructors and institutional constraints. These factors were compared to determine what individual factor or the combination of these factors can explain how EFL instructors use different types of technology in their teaching of English speaking/listening skills. The result will provide a clear picture that describes future professional development programs' focus and what needs should be met in regard to EFL instructors' self reports. Therefore, the survey questions developed in this study could be used as an instrument that can clarify the needs and depict current use of technology in each institute.

Researcher's Perspectives

The researcher has been teaching English as a second language in EFL, as well as ESL settings for students from varied age and cultural groups. The experiences have brought about her interests in exploring how different characteristics of the instructor, student, and the learning environment have impacted the teaching and learning processes, especially the recent trends of utilizing technology innovations in the classroom. The researcher would like to investigate the nature of how technology intervention is capable of changing the reaction of all three aspects, i.e. the instructor, the student, and the learning environment, into what level of interaction during the learning and teaching process.

Accompanied with the advent of technology innovations, which is progressing with an unprecedented speed, more and more new ways of instructional technology have been developed. Needless to say, diverse opportunities and activities have been created in the classroom setting. But the complexity of the advanced technology and the combination of the varied needs that come from different areas (e.g. curriculum design, teacher beliefs, teaching context, technical troubleshooting, etc.) may contribute the difficulties for instructors to solve one problem over another. The researcher found that it is possible that the interpretation of the results may be over-generalized into another teaching and learning context. Therefore, the aspect of the implementation of technology in EFL settings needs to be carefully interpreted before any conclusion can be made.

CHAPTER 2: LITERATURE REVIEW

Technology innovation in second/foreign language learning has mushroomed in the past few decades. Lindenau (1984) states, "we are all in the midst of a microelectronic revolution,"(p. 19) and suggests the potential drawback of resisting such revolutions: "A blackboard-and-textbook system of education in the age of microelectronics will inevitably promote detrimental and far-reaching consequences" (p. 19). Later, in the mid-1990s, Kulik (1994) found that educators in a variety of professions had supported the use of technology.

Several authors have expounded reasons for its popularity (Kern, 1995; Warschauer, 1997). The first impact results from technology's capacity of providing quality feedback and varied types of interactions in the classroom. Kern and Warschauer point out the potential effectiveness of using technology particularly in second language learning. Another influence is derived from the fast evolution of advanced technologies, which continually redefines the use of technology and its possibilities (Holt & Thompson, 1998). More importantly, the marriage of increasingly reduced cost of technology, trends of globalization, and the support from government and administrators have gradually increased the efforts exerted in research and technology implementation (Alistair, I., Ling, P., & Joosten, V., 2002). Furthermore, the increased demands of computer literacy at the workplace also contribute to the formulation of this popular trend in second language learning (Reiser, 2001; Warschauer, 1999).

This chapter introduces the trends of twenty-first century second language teaching and learning, focusing on technology use, as well as revealing the varied factors

influencing the use of technology in the second language classroom. The literature review includes four major sections: (a) current trends of instructional technology in second/foreign language teaching, (b) technology innovations in second/foreign language teaching and learning (c) teaching style and technology, and (d) institutional supports/constraints in technology use.

Current Trends of Instructional Technology in Second/Foreign Language Teaching

Quality Feedback and Varied Interactions

A school system is expected to provide the most supportive learning context for a diverse population of students (McCombs, & Whisler, 1997). A teacher no longer takes the role as an exclusive knowledge provider, nor is the student the single receiver of knowledge. Rather, students are allowed to obtain more control of their learning process while instructors tend to serve as facilitators. In other words, the role of teachers, as well as students, has been transformed. Such modification has rendered itself as the stepping-stone for the popularity of technology innovation that provides opportunities for both teachers and students to re-evaluate their behavior in the teaching/learning exchange process (Miller, Martineau, & Clark, 2000).

With such transformation, learners are provided with more opportunities to interact dynamically and in many forms. They can and are encouraged to socially collaborate with peer students and, therefore, enhance their mastery of the content learned (Dwyer, 1994; Robichaud, 1986). More researches (Robichaud, 1986; Warschauer, 1998) have indicated the positive results from the use of varied technology innovations in the learning environment. In Robichaud's comparative study (1986), several subjects

expressed their preference of a computer-assisted learning environment. They felt that they learned more and learned it faster.

The major changes from the use of technology innovation are the nature of interaction and the quality of feedback learners receive. Salaberry (2000) suggests that "there is a difference between the type of feedback provided by human tutors and machine tutors, and that intelligent Computer Assisted Language Learning (CALL) represents an explicit attempt at mimicking the highly contextualized nature of feedback provided by humans" (p. 25). Such major changes seem to offer a potential solution for the lack of authenticity of the materials in a traditional classroom. In a traditional way of teaching, constraints of feedback are influenced by various factors, such as the instructor's teaching style, time allowed, location presented, and even the speed of the articulation the instructor possesses.

Kern (1995) suggests that technology has the capacity to offer students with "the freedom to choose topics, to repeat input, to increase or decrease task difficulty, and to get help whenever it is needed" (p. 457). In his study, four aspects of the interaction were found when a synchronous electronic environment was compared with an asynchronous one: first, learners are virtually encouraged to participate more and produce more language output. Second, more time is allowed to develop and refine statements. Third, more opportunities are created for collaboration among learners. Fourth, learners are motivated to learn more and their anxiety is lowered.

According to Warschauer (1997), technology has the capacity to provide more opportunities for interaction with people around the world (i.e., Internet) and diminish the limit of time frames (e.g., email is available 24 hours a day). Learners are encouraged to

publish their work and use the World Wide Web to distribute their multimedia documents. Teachers can manage learning activities differently in terms of "turn taking, interruption, balance, equality, consensus, and decision making"(p. 473). Warschauer also suggests that Computer Mediated Communication (CMC) "creates the opportunity for a group to construct knowledge together, thus linking reflection and interaction" (p. 473).

However, not all researchers support technology-based innovation. Computer technology's capacity of offering the same quality of feedback has been challenged. Walther, Anderson, and Park (1994) argue that missing paralinguistic information in the media will hinder communication. For example, it is questionable if emotions can be presented identically through the use of written communication (e.g., email). Crook (1994) also questioned whether computer technology could offer identical feedback to that typically provided by human beings. He states, "Effective tutorial dialogues are embedded in more extensive contexts of shared classroom experience. Such dialogues are normally made possible by the history of this experience" (p. 15). Other researchers warn that such a broad contextual backdrop might not be perfectly presented with current technology (Holland, Kaplan, & Sams, 1995). In addition, Walther et al. (1994) also claim "due to cue limitations of CMC, the medium cannot convey all the task-related as well as social information in as little time as multi-channel face-to-face communication" (p. 465). These statements suggest that more investigation needs to be conducted in order to discover the optimal use of technology innovations in the future.

The Marriage of Cost Saving, Globalization, and Support from the Policy Makers

The question frequently asked by policy makers when considering changes of learning systems is: whether the shifting to digital delivery is likely to yield overall cost savings. Bush (1997) points out that the increasing sophistication of software and hardware has provided teachers with alternative options in curriculum design and, therefore, increased the cost effectiveness. However, he reminds us that without undertaking certain planning and budgeting, "students in schools with above-average resources will not have the level of access to technology necessary to affect positive impact on learning outcome" (p. 131). There are still maintenance costs, upgrade costs, and budgets for teacher training that will influence the life cycle for implementation of technology.

Similar concepts were suggested by Inglis, Ling, & Joosten (2002). They contend that one of the major reasons education and training providers have been shifting to online delivery has been to save costs. They believed that technology drives globalization, and it is inevitable that school systems will follow this trend in changing circumstances, teaching, and learning technologies. As a result, more and more institutes in higher education, and even governments, support the direction of using information and communication technology (ICT) in instruction.

Such major shift from traditional methods to online delivery has impacted a school's learning system. Kendall (1999) describes The Birmingham Grid for Learning (BGfL) in UK. He points out the support from the government has encouraged the transform of the school from their traditional ways of teaching into communication-type of instruction. Through the partnership from different public and private sectors, the

learning communities have been turned to be a computer-based networking system. Apparently, this is evidence that with sufficient support, financial aid, and guidelines from the experts, many schools could start to develop varied strategies and plans regarding technological instructions.

Demands of Computer Literacy in the Workplace

Another force of the new trend comes from the demands of computer literacy from workplaces. Literacy has never been clearly defined through research history. Warschauer (1999) states "being literate has always depended on mastering processes that are deemed valuable in particular societies, cultures, and contexts". He contends, "literacies are not context-free, value-neutral sets of skills"; rather, "being literate has always referred to having mastery over the processes by means of which culturally significant information is coded" (de Castell & Luke, 1986, p. 374). In today's global society, we are required to change our way of communication through the use of alternative technology innovations. Technologies can, thus, change the way we define literacy.

The demand for computer literacy has appeared in workplaces more intensively than ever before. In Reich's (1991) analysis of society and education in the informational era, he categorized three types of quality that will be required from jobs: the first type is routine production services (e.g. factory workers, data processors, payroll clerks); the second type is in-person services (e.g. waiters, janitors, hospital attendants), and the third type is symbolic analyst services (e.g. software engineers, management consultants, strategic planners). Because of the third information revolution, he predicts that the income for the first two types of workers will be gradually diminishing while the

symbolic analysts' incomes are increasing in the United States and other countries. In workplaces, people are required to interact and judge instead of merely transmitting information. In order to be qualified for the job, their training involves teaching of abstraction, system thinking, experimentation and collaboration. They learn how to "seek and accept criticism from peers, solicit help, and give credit to others" (p. 233). It is also important for them to "negotiate – to explain their own needs, to discern what others need and view things from others' perspectives and to discover mutually beneficial resolutions" (p.233).

Future education that involves literacy practices will cultivate learners to be individuals who are competent in participating fully in modern global society (Reich's, 1991). Reading and writing will no longer be the sole concern for citizens who want to survive in the modern world. In addition to that, they need to be computer literate in exchanging and receiving information from alternative types of communication. Therefore, the responsibility of second/foreign language instructors will need to be expanded to include the teaching of technology and communication.

The Evolution and Merging of Technology Innovation and L2 Methodology

When technology is advanced with unprecedented speed, the methodologies in second language (L2) are also developing into a new stage of integrating multiple methods into its original teaching repertoire. The well-matched timing for the progress made by both methodologies and technology innovations in L2 teaching prepared the implementation of technology innovations in second language teaching. Predictably, this embedded meaning of change has stimulated tremendous experimental research and discussion of the new ways of L2 acquisition (Celce-Murcia, 2001).

The Evolution of L2 Methodology

From the mid 1940s until the end of the 1960s, formalist linguistics, such as Skinner (1957), believed that linguistic structures could be isolated and studied. They believed that language could be divided into small units and described scientifically. In second language instruction, the instructor usually neglected the use to which language is applied. During this period of time the grammar translation method prevailed in L2 teaching. Mother tongue was used the most as the means of instruction in the classroom. No oral use of the target language was stressed. After World War II, audiolingualism emerged. Oral skills started to be emphasized by the teaching of linguistic patterns in isolation through a process of memorization and repetition (e.g. drill and practice).

In the 1960s, the generative-transformational linguists, such as Noam Chomsky, focused on the competence of language among users instead of their performance. The focus was on cognitive process and challenged Skinner's behavioral theory. According to Chomsky (1959), performance related to the observable production of the language, while the competence reflects an idealized speaker-hearer who has no problem in using correct grammar in communication.

Functional linguists, such as Dell Hymes, started to challenge Chomsky's notion of linguistic competence during the 1970s, and the beginning of the 1980s. Bloom (1971) challenged the theory that children learn just the order of the language structures. Rather, they learn the variety of meaning in different contexts. This group of functionalists was the first to emphasize the communicative or interactional function of language. Halliday (1973) contends that the meaning of an utterance is generated by its function, the social

structure, and the context of the situation. During this time, the famous communicative language teaching method emerged.

From the beginning of the 1970s until the end of the 1980s, communicative language teaching approaches prevailed. Second language (L2) instruction started to focus not only on functions of the language in context, but also on the cognitive and affective factors that influence the acquisition of the second language (Pujol-Ferran, 1993). The scope of learning areas is expended into a deeper understanding of the target language culture and non-linguistic features of communication. In general, the more authentic and spontaneous activities the learning environment can provide, the more effective the learning experience could be. Other approaches including community language learning (Curran, 1982), the silent way (Gattegno, 1972), suggestopedia (Lozanov, 1982), the natural approach (Krashen & Terrel, 1983), and notional and functional curricula (Van Ek & Alexander, 1975) appeared during this era.

The brief description above, however, cannot cover all the methodologies that have appeared in second language teaching. Celce-Murcia (2001) listed nine twentieth-century approaches in language teaching: (a) grammar-translation, (b) direct approach, (c) reading approach, (d) audio-lingualism (in United States), (e) oral-situational approach (in British), (f) cognitive approach, (g) affective-humanistic approach, (h) comprehension-based approach, and (i) communicative approach. She explains that all the approaches have their own emphasis and usually represent a reaction to the former approach (es). Indeed, there is no single valid methodology for every situation. Her suggestion for ESL/EFL teachers to face the variability of methodologies is to "make wise decisions to learn more about the various approaches and methods available and to

find out which practices have proved successful" (p.10). She points out five factors for decision making: the first step is to understand student needs and purposes for learning English; the second step is to examine all the instructional constraints, such as time, class size, materials, physical factors in order to decide what can be taught; the third step is to assess student attitudes and learning styles, as well as developing activities and materials corresponding to these characteristics; the fourth step is to determine the discourse genres, speech activities, and text types that the students need to learn; and finally, decide the method of assessment. With the selection of the methodology in regard to technology in second language teaching, teachers still need to consider the evolution of the technology innovation as part of the process when designing the instruction.

The Evolution of Technology Innovation

The evolution of technology innovation in varied professions has affected the pedagogy in second language acquisition. Salaberry (2001) provides a brief analysis of the articles addressing the use of technology for second language learning and teaching published in *Modern Language Journal* since 1916. This description could be recognized as the brief picture of the evolution of technology innovation. The following is the brief analysis of the evolution of technology innovation:

Audiovisual communication tools. Audiovisual communication tools, such as television, film, radio, and video were prevalent from the earliest stages. Technology, at this point, represents the alternative media for learners to receive feedback in addition to conventional teacher presentation. Simultaneously, conventional and unconventional tools are used in second language areas. The blackboard, overhead projector, and audio-

active voice reflector are some of them. During the 1960s and the 1970s, the language lab was welcome by the theories, such as Audiolingualism (Salaberry, 2001).

Computer assisted instruction (CAI). In the mid 1960s, computers actually were introduced into language teaching for the first time. Because of the invention of the computer, Computer Assisted Instruction (CAI) prevailed. Computer usage, such as drill and practice provided learners with instant feedback and offered teachers with alternative ways of presentation and evaluation. B.F. Skinner's (1957) theory provided a model for such instruction that relied heavily upon positive reinforcement. CAI, then, was used with less student control over the process of learning experience (Petersen, 1990). Whenever students respond correctly, they are rewarded; on the other hand, they are punished for every failure. For evaluation, every details of the interaction between student and computer are recorded. This model had provided a strong theoretical basis for the Audio-Lingual Method (ALM) in second language teaching (Butler-Pascoe, 1990).

Computer assisted language learning (CALL). During the1970s research in CALL focused on the result of a tutorial or a drill-and-practice type of software. Until the 1980s there existed a shift "from form to function and from product to process" (Pennington, 1989, p. 33). At this time, instruction was more student-centered and group work activities were encouraged. Several researchers claimed that it is possible that the negotiation of meaning between the computer and the user can be made natural and meaningful (Gale 1983; Kramsch, Morgenstern, & Murray, 1985). More and more humanistic communicative language teaching approaches were created.

Underwood (1984) recognized CALL as a communicative approach and specified 13 premises that differentiate CALL from CAI. For Underwood, CALL was the instruction method that deals with (a) acquiring rather than learning, (b) presenting implicit rather than explicit grammar, (c) generating original utterances, (d) not being judgmental, (e) avoiding telling students they are wrong, (f) not rewarding students for good behavior, (g) not being cute, (h) using the target language exclusively, (i) being flexible, (j) allowing students freedom to explore, (k) creating a natural environment for using the target language, (l) not merely mimicking what a book could do, and (m) being fun to use.

Other researchers, such as Warschauer & Healey (1998), divided CALL into three stages: (a) the behaviorist stage, (b) the communicative stage, and (c) the integrative stage. In the behaviorist stage (beginning in the1950s and implemented in the 1960s and 1970s), CALL was recognized as a subset of CAI. Drill-and-practice activities were most common at that time. Language learners were exposed to the same material repetitively. In the mean time, the computer provided judgmental feedback and was not subject to exhaustion. In addition, students were allowed to work individually or at their own pace.

The advent of microcomputers created additional possibilities for language acquisition, while the behaviorist approach was challenged and abandoned during the 1970s and early 1980s. The second stage, communicative CALL, initiated and encouraged communication-based activities in language teaching. The focus was shifted from form to meaning and from product to process. Teachers introduced grammar implicitly rather than explicitly. Instruction encouraged students to generate original utterances rather than manipulating prefabricated language. Due to the influence of the

cognitive approach, CALL software provided text reconstruction and simulations. Computers were, thus, used as a stimulus to encourage communication and interaction; as a tutor by providing students more choices and control; and as a tool to empower students to use language through word processing, spelling and grammar checking, and desktop publishing programs (Warschauer & Healey, 1998).

By the late 1980s and early 1990s, the dissatisfaction or reaction to communicative CALL language instruction had brought about the third stage: integrative CALL. In this stage, social or socio-cognitive approaches to language teaching were used. This stage emphasized the integration of four language skills (i.e., listening, speaking, reading, and writing). Technology, at this point, was integrated into the process of language learning. Authentic materials and social settings were emphasized. Instructors used task-based, project-based, and content-based approaches to integrate learners into authentic environments. Multimedia platforms offered different ways for delivering content. With the benefits of advanced technology, students were encouraged to use a variety of technological tools as an ongoing process of language learning and use (Warschauer & Healey, 1998).

Computer-mediated communication (CMC). The use of Computer-Mediated Communication (CMC) attempts to avoid the overly emphasized effectiveness of student-machine interaction. Instead, it intends to increase the amount of varied interactions and opportunities for learners to construct their knowledge (Salaberry, 2001).

Due to the rapid growth of Internet, CMC has created a great deal of popularity (Thombs, 1998). This popularity may result from several intrinsic benefits of communication. Warschauer (1997) categorizes five distinctive features that differentiate

CMC from other communication media. First, *text-based and computer-mediated interaction* (e.g., chatroom) increases opportunities for students to interact synchronously and reflect on the words they use or receive. Second, CMC diminishes the limit of participants in the learning group, which allows *many-to-many communication* among people in the entire group (e.g., listserves or online newsgroups). Third, as CMC is *time and place independent communication* (e.g., email), the learners' physical restriction is decreased which allows more time for reflection and analysis before they respond. Fourth, it allows *long distance exchanges* via the Internet. Fifth, *Hypermedia links* enable the exchange of multimedia documents and encourage collaborative projects among different geographic locations and participants.

Walther (1996) has identified several benefits of CMC. In his study comparing 16 face-to-face groups and 16 CMC groups to observe the development of relationships among the subjects, he found that all groups showed similar increase in personal affiliation. However, the CMC groups were more socially oriented in their communication. This difference implies that CMC groups may desire further interaction and, thus, could increase more opportunities for social interaction, which is important in second language acquisition.

Walther (1996) also identified three levels of personal interaction in CMC: (a) impersonal, (b) interpersonal, and (c) hyperpersonal. CMC communication media, such as email, was recognized as impersonal due to its insufficient non-verbal cues. He contended that CMC has the capacity to surpass face-to-face communication due to its levels of affection and emotion. Learners can expand their perceptions about their partners and obtain information based on their common interests. For those who have

physical impairments, the reduction of physical cues may help to reduce the anxiety and make a more malleable impression.

Equal participation of shy and more extrovert students is another benefit of CMC. In Warschauer's (1996) study comparing electronic discussion and face-to-face communication in the ESL classroom, he found that students had more time to monitor their output and tended to use more formal and complex language in electronic discussion than they did in face-to-face communication. Shy students, as he observed, benefited in the CMC setting and participated equally to more extrovert students.

The Merging of L2 Methodology and Technology

Both the evolution of technology innovation and L2 methodology have reached a stage of integration and supported each other's development. The merger of both sides resulted in several questions: Whether to emphasize teaching language or teaching technology or how the instruction design could be restructured to address the needs from the gradual globalization of economic society. Ginsburg (1999) contends the goals of learning should go beyond technology. He declared that it ought to be the curriculum design that drives the use of technology rather than vice versa. According to Ginsburg, students need to be cultivated with the following four fundamental skills: (a) *interpersonal skills*, such as working on teams and teaching others; (b) *informational skills*, i.e., acquiring, evaluating, interpreting, and communicating data; (c) *systems skills,* which include understanding social, organizational, and technological systems; and (d) *thinking skills*, such as thinking creatively, solving problems, knowing how to learn and reason.

In Reiser's (2001) article, *A History of Instructional Design and Technology*, he briefly describes the evolutionary process of instructional design and its relationship with technology. In the 1980s, researchers were interested in how the principles of cognitive psychology could be applied in the instructional design process. Attention was placed on the production of computer-based instruction with emphasis on "front-end analysis, on-the-job performance, business results, and non-instructional solutions to performance problems"(p. 62). In the 1990s, there were six major influences that impacted instructional design. They were (a) the performance technology movement; (b) the growing interest in constructivism; (c) the rapid growth in the use and development of electronic performance support systems; (d) rapid prototyping; (e) increasing interest in using the Internet for distance learning; and (f) knowledge management.

The integration of L2 methodologies and technology innovation, especially the media, will be critical in providing well-positioned language teaching pedagogy. Holt, & Thompson (1998) mentioned, "earlier information technology (IT) development efforts were focused on discrete technologies like computer-assisted learning (CAL) packages, interactive multimedia (IMM) CD-ROMs, and online automated assessment programs. But with the increasing use of the Internet, more efforts have been focused on developing integrative online technologies combining CAL, IMM, computer-mediated communication (CMC) and computer-managed learning (CML) around the Web"(p. 207). This suggests that abundant educational opportunities are created for learners while alternative administrative functions are provided for teachers. Thus, the quality of learning and the productivity of teaching will be simultaneously improved.

Instructional Technology in Second Language Teaching and Learning

Types of Media

Media have been used in improving effectiveness of instruction for over five decades. However, researchers who have studied its productivity have shown that media do not influence learning under any conditions (Clark, 1983). Even though a few studies detected changes in performance from the use of media (Schramm, 1977), most of the researchers recognized media as a vehicle rather than the cause for improvement in student learning. However, through the recent advancement of various media or mix of media, more studies have discovered additional advantages for their use in teaching (Nagata, 1993; Spear, 1994; Salaberry, 1999; Warschauer, 1997). The large number of recent studies focusing on different media has lead to the question whether the former aspects of the use of media discovered two decades ago have completely addressed their contributions in language learning.

As the process of language learning related to the use of media is discussed, three factors of the instruction are usually considered. First, what is the relationship between the course objectives/learning outcomes and the selection of media? Will expected outcome behavior relate to the types of media selected? Second, to what extent should the instructor reconsider the relationship between the use of media and student characteristics (e.g. learning styles) in regard to their learning outcomes? Third, what attributes of media can facilitate the desired instructional events, which are planned to achieve learning objectives? Several studies have focused on these research questions in order to generate a theoretical framework for the selection of media in the classroom (Reiser & Gagne, 1982; Tobias, 1982)

Tobias (1982) encourages us to reexamine students' reaction in response to the content. He contends that students' prior achievement, types of response, and the way teachers provide support are all critical for their micro and macro- processing in learning. When selecting either a type of media or mix of media in instruction, it is critical to scrutinize how these media could offer the types of support unavailable in traditional, human-based teaching.

Reiser and Gagne (1982) identify and evaluate the relevance of the major features found in ten media selection models to learning effectiveness. Based on the stimulus characteristics of media, several models group media into categories based on how they present the information, such as audio, print, still and motion-visual (with or without audio), and real objects. Others categorize along dimensions, such as the types of responses they will accept, and the ways in which they can adapt presentations on the basis of learner responses.

The following paragraphs give an introduction to the major technical categories of media in addition to the traditional human-based text presentation. They include (a) human based text; (b) one-way visual; (c) one-way audio; (d) one-way audiovisual; and (e) two-way audiovisual.

Human Based Text: Traditional Type Of Media

In general, the traditional way of instruction usually presents the information through the use of oral or written text by the instructor either with the assistance of blackboard, handout, or objects (Reiser & Gagne, 1982). This non-technical type of media is the most often used type of media in daily communication and classroom instruction. In traditional classroom practices, teachers either present content with lecture

only, or rely on textbooks or other objects to assist learning. Students interact with the instructor (audiovisual), textbook (visual), or real objects (visual and kinesthetic) at the same time. This kind of media is recognized as the most popular way of knowledge dissemination based on its convenience and low cost. Other types of media (e.g., telephone, teleprompter, or Internet) are different from human-based instruction in which students can interact with the computer (e.g., artificial intelligence) or with human beings outside of the classroom.

Real objects are usually used with the traditional type of human based text media. It is uncommon to use real objects without talking about them in the classroom. One of the exceptions is the Silent Way approach in L2 teaching (Gattegno, 1972; Larsen-Freeman, 1986; Stevick, 1998). According to Reiser and Gagne's (1982) review of several media models, real objects are appropriate for teaching motor skills when the learning objective is to perform a task with movement (Anderson, 1976; Reiser & Gagne, 1982; Romiszowski, 1988).

One-Way Visual

Reiser and Gagne (1982) point out the capability of visual displays to help poor readers to acquire and retain visual images. Other researchers also emphasize the benefits of visual media in identifying objects (Anderson, 1976; Bretz, 1971; Romiszowski, 1988), classifying spatial relationships, and performing motor skills (Bretz, 1971). In addition, color is another characteristic related to visual media. Whenever a task is related to color, Anderson (1976) suggests selecting media that utilize color.

Printed words or presentation is most helpful for visual learners. It can be used as a way to inform learning objects or to assist learning for younger learners (Gagne & Briggs, 1979, 1992). Another reason for using printed media is their lower cost and convenience (Branson et al., 1975).

Motion is another helpful feature of certain media. It interchangeably presents information either with still visual, limited or full movement visuals (Kemp, 1980). The advantages of motion media include the presentation of human performance, the animation of animals, or natural phenomena that aid with identification or imitation of movement (Anderson, 1976; Romiszowski, 1988). Silent filmstrips or pictures are some examples of it.

One-Way Audio

In addition to the utilization of visual display, the reading ability of poor readers can be improved by using audio narration (Brets, 1971; Briggs & Wager, 1981; Reiser & Gagne, 1982). Some researchers suggest that in case an assigned task is related to spoken language or recognition of sounds, the audio type of media should be chosen (Anderson, 1976; Bretz, 1971; Reiser & Gagne, 1982; Romiszowski, 1988). Bretz states that spoken words may be better for poor readers to internalize content. Teachers may need to consider adding sound media instead of visual text only. Possibly, investigating learning styles of students may be beneficial to teachers in their attempts of improving the quality of their instruction.

One-Way Audiovisual

One-way audiovisual media include television, movies, filmstrips, or computers without discussion. Students receive input through two types of media simultaneously

(i.e., audio and visual) but without interaction with another human being or machine. Bandura (1969) claims that learners' attitudes can be transformed by viewing a respected human model making choices in critical moments. The use of one-way audiovisual is appropriate when the goal is to cultivate certain levels of impressions, general ideas, or attitudes.

Hanley, Herron, and Cole (1995) conducted several studies to investigate the effectiveness of using videos as advance organizers. The data collected by Hanley et al. showed that the use of dynamic video proved to be an effective advance organizer for the comprehension and retention of a written passage in French. They also investigated two different types of advance organizers of a comprehension test: description only and description plus pictures (i.e., six sentences describing a movie with or without magazine pictures that are contextually related). The results reveal that the students obtained more benefits from the description plus picture treatment than the control group. The researchers explain that such a finding "indicates that comprehension in a foreign language is facilitated by richness of context" (p. 393).

Two-Way Audiovisual

Two-way audiovisual is a more complex type of media, using two or more media at the same time. The nature of the learning process is to encourage interaction between teacher-learner, as well as learner-learner (with or without interaction on the computer). Such type of media provides multiple sources of feedback (e. g., teacher, peer student, computer, or humans in distance) during the learning process. Examples include the use of computer software (CD-ROM), chat room, email, or video conferencing.

Several researchers have investigated the effects of the use of two-way audiovisual media in second language learning. For example, Warschauer (1997) has delineated CMC as an effective pedagogical tool to encourage collaborative learning in a language classroom. He contends that online communication increases opportunities to interact with other humans without restriction of time and places.

Pederson (1986), in his study of coding options, claims that " the computer has the capability . . . of controlling whether learners can re-inspect reading passages" (p.36). The results show that learners who did not have access to the reading passage were able to recall more of the content of that particular passage than those who did have access to the passages they read. Pederson warned that, "no coding element, including passage unavailability, can be expected to be best for all second language learners in all circumstances" (p. 41). This suggests that more complex types of media, such as two-way audiovisual, could offer more options when learners try to enrich or manage the feedback during the coding process.

Another study conducted by Bland, Noblitt, Armington, and Gay (1990) claims that in order "to help students realize that lexical representations and grammatical concepts are mutually dependent, we need to create direct links between learner queries and pedagogical explanations of related grammatical, semantic, or pragmatic issues" (p. 448). They further argue that a "CALL environment is particularly amenable to the creation of such links because of the multiple and immediate ways to access electronic information" (p. 448).

The Selection of Media

In addition to the above media categories, Reiser and Gagne (1982) emphasize the importance of identifying categories of learning outcomes in order to select matched media that are capable of eliciting a desired outcome performance. The categories of learning outcomes they described are (a) intellectual skills; (b) verbal information; (c) motor skills; (d) attitudes; and (e) cognitive strategies. Essentially, Reiser and Gagne suggest that instructors are required to clarify learning outcomes first, then plan the instructional events based on the gap between students' current abilities and the expected learning outcomes. Furthermore, identifying the type of stimuli necessary to present those events determined, and, finally, recognizing which media is capable of presenting those stimuli.

According to Reiser and Gagne (1982), computers or interactive videodisc systems are most helpful to acquire intellectual skills in varied contexts. When the goal is to obtain verbal information, visual or audiovisual display types of media, such as text or television presentation would be appropriated for recalling general ideas and organized knowledge. Acquiring motor skills often requires visual or audiovisual types of media in the beginning, but would require practice of skills directly with real equipment or realistic stimulators to receive the kinesthetic feedback. To help learners obtain their cognitive strategies, teachers need to advise students how to learn in varied contexts. Furthermore, learners need to recall and apply rules. Therefore, media, such as television, are appropriate and capable of presenting problem situations as well as providing types of strategy. For cultivating learners' attitudes, media that are capable of presenting the action of the model are ideal.

Brinton (2001) also describes the categories of both technical and non-technical media in language learning. She extends Schramm's large M media (i.e., technological innovations) and little m media (i.e., teacher-made, non-mechanical aids) concepts to explain that one is not necessarily more effective than the other. She presents teachers' reasons for not using media as: (a) teacher's inability; (b) school constraints; (c) time issues; (d) unchangeable curriculum design; and (e) no need. Brinton contends that classroom media should be non-mechanical and unthreatening to teachers and students. By continuously reusing the materials with different audiences, teachers actually can pay off the time spent. She disagrees that media are extraneous to classroom activities and urges teachers to utilize media as methods to appeal to students' senses and help them process information. In this way, teachers can reinforce the content and save time for more critical feedback. She claims that language skills are not isolated entities and need media to build bridges to new possibilities. With the function to provide multi-skill thematic units, media can guide students to more effectively process the information and, therefore, cultivate their skills in applying the knowledge in different contexts or group discussions.

The Use of Technology in the Classroom

Mandated computer technology use in language learning has caused researchers to investigate the use or non-use of computers in the classroom (Reichstetter, 1999). Factors influencing the use of computer technology in the classroom include internal as well as external ones that were investigated by several researchers (Atkins, 1997; Flagg, 1991; Kinnamon, 1996; Moore, 1991; Reichstetter, 1999, & Wiley, 1992).

Due to the continuing advances of technology innovation, there is no one single definition for types of technology used in the classroom. However, similar categories can be found in the literature. Flagg (1991) introduces types of computer technology based on software (e.g., tutorials, simulations, games, problem solving, graphics, programming language, word processing). On the other hand, Wiley (1992) specifies types of computer technology based on the functions that include word processing, research resources, programming, test design and analysis, administrative tasks, enrichment, remediation, tutorials, simulations and drill, and practice activities. Atkins (1997) categorizes three major types of computer technology training: (a) writing and communication (e.g., word processing, desktop publishing, graphics, etc.); (b) information access and management (e.g., spreadsheets, databases, telecommunications, etc.); and (c) construction/productivity (i.e. multimedia). Also, Reichstetter (1999) lists types of computer technology used in the classroom as the following: word processing, desktop publishing, graphics, multimedia, spreadsheets, data bases, internet, Web page design, telecommunications, programming language, and subject-specific software programs. These are some types of computer technology that were found in the literature to be the most prevalent categories.

Not much research has been conducted regarding factors of computer technology used in language learning. However, researchers, such as Atkins (1997), Dolgos (1991), Flagg (1990), Kinnamon (1996), Martin (1990), Meinster (1990), Moore (1991), Wiley (1992), and Zehr (1997) investigated the relationships among types and uses of computer technology and other possible factors relating to instructional computer use. These possible factors include internal and external ones, such as teacher demographics,

teaching areas, attitudes, computer use, and teacher training (Dolgos 1991; Wiley 1992). Martin (1990) and Zehr (1997) studied age, gender, and years of teaching experience related to teacher use of computer technology. According to their studies, age and years of teaching experience were not significant predictors in computer technology use. However, they found males ranked higher in positive attitudes and self-efficacy toward computers. Mathematic and English teachers were found to use computers most frequently according to the study by Flagg (1990). Meinster (1990) also studied instructional styles of teaching among traits of high school teacher computer users. A relationship was found that teachers who preferred learner-centered styles of teaching had greater computer use and more fully prepare students with critical thinking skills.

Thurston (1990) found that for better computer technology use in instruction, more effort needs to be directed at encouraging continuous, extensive and varied training, increasing access to computers, emphasizing curriculum integration, and providing technical assistance and administrative support. Martin (1990) investigated how computers in-service training help the computer use in educational tasks. Reichstetter (1999) focused on the frequency of use of computer technology by scrutinizing the following factors: teaching areas, instructional approaches, types of use, training components used by the trainer during training, and support factors following training. The results show that nine out of eleven different types of computer training were found to be significant, while no significant relationships were found between frequency of use and training in programming language or in web page design. The best combination of predicting variables toward increased computer use was teaching areas, training, and the delivery of specific training components believed to enhance knowledge transfer.

Variables that did not significantly predict increased use include instructional approaches, administration support, on-site technology coordinator support, and hardware/software availability.

Some researchers investigated reasons for the limited use of technology by teachers (Westfall, 1998; Layfield, 1998; Shoemaker, 1997; & Ruth, 1996). They found that insufficient knowledge and experience in the use of technology, lack of access to computers, absence of adequate funding; insufficient number of available computers, and lack of training were the factors that influenced their limited use of technology. They also found that factors, which may have a major impact on the successful use of technology in instruction, include appropriate advance planning, adequate funding, technical support, access to computers and the Internet, a sufficient number of computers, departmental support, and incentives for teachers who use technology in their classes.

All of these concerns point out the necessity of revealing the details of the implementation of computer technology. Merely purchasing equipment without pertinent content of teacher training, specific needs from instructors' points of view, and integration of pedagogical theory and technology will not lead to successful technological instruction (Reichstetter, 1999).

Teaching Styles and Technology

The teaching-learning exchange process is influenced by various factors, such as teacher, learner, group, content, and environment (Heimlich & Norland, 2002). Teachers, in particular, have been determined as one of the most important factors in educational activities. Their distinct and consistent characteristics that transform information into useful knowledge display teachers' beliefs and philosophies in teaching activities

regardless of the setting or the content (Conti, 1998; Draves, 1997; Dunn and Dunn, 1979; Fisher & Fisher, 1979; Gauld, 1982; Zinn, 1998). This pervasive teaching quality is referred to as style that is congruent with specific teaching behaviors and beliefs (Heimlich and Norland, 1994).

Among the studies investigating the relationship between teaching style and student achievement (Conti, 1984; Welborn, 1986), Conti's results are contrary to adult education literature in that students of teacher-centered instructors show the greatest gains. However, when total hours of student attendance were controlled, the results changed. Further investigation between teaching style and the nature of the courses also showed that the different nature of courses requires different teaching styles to achieve higher learning efficiency.

Welborn (1986), in his study, *Influences of achievement among non-traditional adult health professional students,* discovered that the greatest achievement lies among students of teachers who conduct activities with slight modification of the collaborative mode. He contended that merely measuring student's learning style and teacher's teaching style are not enough. Teachers need to scrutinize every step of their instructional practices based on findings from these measures and, then, provide the appropriate learning strategies to their students. The learning climate formed by appropriate teaching style does improve student achievement. He suggests that administrators could initiate faculty development activities by using assessment of instructor's teaching style as the first step of the activities. After obtaining better insight into teacher's styles of instructional behavior, learning resources and their allocation should be made clear to the teachers to strengthen their instructional practices.

Results from these studies indicate that either teacher-centered or learner-centered teaching styles have their own merit of promoting the desired achievement in different learning contexts. These observations reveal the importance for teachers to assess their own teaching style in order to be aware of their own behavior and, therefore, be more competent in making appropriate decisions regarding their instructional practices (Conti, 1984). Since diverse factors in the teaching-learning process usually have different influences on learning outcomes, appropriately adjusting the teaching style in different contexts is critical for successful instruction. In other words, a tendency toward one teaching style or another does not imply one is good and one is bad (Seevers & Clark, 1993). Teaching styles can be adjusted and there is no specific style recognized as the optimal method for learners from varied backgrounds and characteristics.

Conti (1984) and Pearson (1980) list three factors that could influence a teacher's teaching style: (a) teachers' educational philosophy; (b) increased support of the collaborative mode by providing more academic training; and (c) knowledge of one's teaching style. They suggest that assessing one's teaching style and philosophy may offer information not only for teachers but also for administrators in considering future objectives of faculty development-training programs. Similarly, Elias and Merriam (1980) support an awareness of the factors behind a teacher's basic behavior as the way to identify novice teachers from professionals (p. 9). The advantage of knowing one's teaching style is to help teachers identify their weaknesses and strengths for future development.

For the past two decades, information technology has been advanced in terms of variety, availability, lower cost, and ease of use (Florini, 1989). Researchers have

investigated effects derived from the use of technology and the impact of teachers' preferences in using it in regard to their teaching styles. In a conference report (Cambridge, Massachusetts, June 1985), several studies determined that computers may provide teachers with opportunities to increase their knowledge about learning methods, prompting some teachers to revise their teaching styles, as well as prompting teachers and administrators to engage in a critical examination of the regularities of schooling. These statements correspond to Heimlich & Norland's (2002) postulation that "understanding one's teaching style can serve as a foundation for the improvement of instruction and serves not only learners but also the educator"(p.17).

Implementing technology into a curriculum often influences teachers' decisions about changes in their beliefs and teaching behaviors. Florini (1989) explained why these changes have impacted the teacher's beliefs and behaviors. First, without face-to-face contact in the instruction, teachers can hardly maintain their independence and flexibility. Second, the characteristics, limitations, and strengths of different technology vary. The quality of the instruction can only be maintained through certain training and experience. She contends that "the more sensitive to the factors, the better the teacher is able to design instructional approaches compatible with their teaching styles" (p. 49). She suggests four critical aspects associated with the use of technology in regard to the compatibility with one's teaching style: (a) understanding of one's own teaching style; (b) familiarity with the mediums' characteristics; (c) knowledge of specific circumstances (e.g., applicable organization policies and procedure, relevant hierarchical relationships, and others); and (d) sense of appropriate use (e.g., attitudes and skills of learners, cost-effectiveness, etc.).

Institutional Supports/Constraints

Administrative Commitment

Teachers will not feel the availability of the support without the administrative commitment (Lauber, 1997). Especially when mandates are issued, lack of administrative commitment can inhibit the force of change in the process of school reform. In Little's (1982) study, two norms were evident in a successful school: first, these schools exhibit a *norm of collegiality* and, second, there is a school-wide *norm of continuous improvement*. Teachers believe that improvements in a school are not temporary and expect that their needs will be continually supported (Millett, 2002). This study showed that teachers were highly motivated with expectations for further analysis, evaluation, and experimentation.

Implementing the use of technology in the classroom requires involvement of teachers in the changing process of the school system. Pechman's (1993) research identified six factors that are essential for successful school reforms. A successful reform requires (a) a stable and safe school environment; (b) ongoing support from district staff; (c) the involvement of teachers and leaders from within the school; (d) the collaboration and the support of the entire staff; (e) the acceptance and commitment by the staff to participate in the change process; (f) a principle leader who facilitates the changes and encourages collegiality. It is obvious that merely mandating the rules and regulations will not warrant a successful school reform.

In an Ontario study by McDiarmid (1994), teachers reported to be disturbed by the policy guidelines of the mandated curriculum. Similarly, in a survey of teachers using technology, Ham (1997) discovered that teachers show a desire to be more

involved in technology policy and decision-making with long-term planning. The support and the encouragement from the administration influence the change force in teachers' instructional practices. Reviewing school improvement studies, Hord (1994) identified five categories of intervention in the change process, including (a) the development of a vision; (b) the provision of resources and a supportive environment; (c) training of skills; (d) monitoring and evaluation; and (e) the provision of the continued assistance through dialogue and feedback.

Similarly, in Ham's (1997) study, teachers believed that the long-term success of continued use of a short-term training program depends on three factors: (a) a clear rationale for incorporating technology into the curriculum (i.e., adequate time and opportunity for teacher exposure to, and familiarity with, technology; teacher assertiveness in obtaining needed resources); (b) active support of teachers with computer expertise; (c) active support of administration when facility management systems were put in place. Such administrative commitment is critical and it is related to the support system provided by the policy makers and the opportunities they offer for instructors to get involved in the preparation/planning of technology implementation.

Cost, Budget, and Availability of Technology

Sachs and Long (1998) examined approaches for integrating computers into ESL classrooms. They found that funding often indicates the availability of the resources to ESL classes and, therefore, also determines the teaching approaches that can be used. Due to more affordable cost of varied technologies, budget planning for implementing technology into the classroom is easier than ever before. Technology implementation

requires careful, well-thought-out planning with a sufficient budget to cover necessary expenses.

Hungtington (1997) and Rath and Rieck (1997) suggest that funding proposals need to consider expenses of hardware, peripheral, and software purchases, upgrades, maintenance, replacement costs and facilities. Well-equipped schools have an advantage regarding students who are more interested in learning. Because computer availability and access appear to influence the use of computer technology by teachers and their students, such schools would have an advantage in making learning a more active experience (Education Week, 1997). Roblyer, et al. (1996) point out the inequality in access to technology may influence how ESL students learn. ESL students are usually economically disadvantaged and, therefore, may not receive full benefits affordable to economically privileged students. The authors stated:

> "Studies indicate that when economically disadvantaged students do get to use computers, they are used primarily for remediation and basic skills. They learn to do "what the computer tells them to do" while the more affluent, already advantaged students use it as a tool to develop higher level thinking skills." (p. 10)

In Flagg's (1991) study involving teachers, lab coordinators, and principals in Washington, D.C., the results show that lack of equipment and appropriate software were the deterrents toward the use of computer technology. In Ham's study in the New Zealand, the demand of technology again far exceeded the supply of the equipment. Similar results were found in Al Mubireek's (2001) study: in a group of 42 ESL teachers who advocated the use of the Internet in ESL instruction, the level of adoption of the Internet was influenced by factors such as lack of access to the Internet in the classroom, lack of training, and lack of time for training. All of these resources and support systems

are related to the extent of cost, budget and availability of the technology that the institution is capable of providing. How to raise more administrative commitment or support in terms of budget planning for the implementation of technology in the classroom will directly influence how teachers enrich their teaching environment. Support and budget planning are determined by various factors, including patterns of the use of computer technology by teachers, the extent to which staff technology training can be transferred to the classroom, and possibilities to improve student performance.

Technology Training

Teacher training programs have not keep pace with the changing conditions in the American public schools (Thombs, 1998). In a 1995 Electronic Learning survey, the results show that on average only eight percent of school technology budgets was spent for teacher training. Nearly one fourth of responding technology coordinators reported that no money was spent at all for technology training of staff. In addition to the shortness of budgets, Faison (1996) discovered that many teachers complained about the lack of systematic exposure to or integration of technology in their teacher training programs. Similarly, the National Council for the Accreditation of Teacher Education (NCATE) (1997) also claimed that the majority of teacher education programs are unable to fully equip future teachers for the use technology in the classroom. The reasons for this observation included insufficient hardware and software, lack of knowledge and skills of teacher education faculties in the area of technology, and limited vision of the changes occurring in the classroom due to technology.

The unbalanced management between the concern of increasing technology hardware purchases and the budget spent on staff-technology training is another reason

for the ineffectiveness of teacher training (Harrington-Lueker, 1996). Maddox (1997) suggests that more than half of a technology budget needs to be invested for non-hardware costs (i.e., staff technology training). Without appropriate portions of a budget spent on technology training or hardware/software purchasing, teachers will be hindered in adopting technology effectively in their instruction.

Kassen & Higgins (1997) state that teachers might need to consider four factors when determining whether to use technology in their classes. First, teachers need to think about how to integrate the technology into their curriculum. Second, the evaluation method needs to be determined before using technology. This means that the efficiency and appropriateness for the technology used in different teaching and learning situations should be confirmed. Third, before the use of technology in their instruction, teachers may need to train their students in basic technology. Fourth, teachers need to have sufficient training that prepares them to appropriately integrate technology into their curriculum.

The importance of the efforts exerted in the integration of technology in the classroom is obvious (Algabe, 1997). Researchers indicate the effective ways to promote the efforts by conducting pre-service and in-service teacher education or technology-preparation programs and workshops (Bush 1997, Kassen & Higgins, 1997; Warschauer & Healey, 1998; Kent & McNergney, 1999). Some premises for effective technology preparation programs include clearly articulated goals, adequate allocation of time for education and training, sufficient and constant funding for these preparation programs, and ongoing support (Kassen & Higgins, 1997).

Merely investing time for technology training does not guarantee the retention or transfer of the use of technology in the classroom. In a study of computer use by teachers, the results showed that computer-training courses did not increase classroom computer usage (Harrison, 1992). Frame (1991) investigated a model of computer training through a case study of two institutes and five workshops. The results pointed out the need for further assistance in restructuring instruction in order to accommodate computer implementation. Obviously, administrative commitment, teachers' workload, time allowed for establishing teaching materials, whether or not the collegial group is established, and on-site technology coordinators are all related to the transfer of the computer technology used in the classroom.

Workload and Time-Related Factors

Researchers have found that time is the biggest barrier in teacher use of technology (Adams, 1990; Frame, 1991; O'Neil, 1995). More time is required for teachers to develop instructional technology lessons (Ham, 1997). Exactly how much additional time needed by teachers is hard to define, and it varies depending on what is to be accomplished. Millet (2002) reviewed some research conducted on the time needed for teachers to implement innovative programs and practices. He cited Prunell and Hill (1992) who summarized estimates of teacher time needed for reform as the following:

1. 178 principals in urban high schools undertaking major change efforts reported that lack of time, energy, and money as the key implementation problems. On average, teachers devoted 70 days of their time to implementing a project while the more successful schools used 50 days a year of external assistance for training, coaching, and capacity building.
2. Staff of the effective School Network report that it takes 10 to 20 days per month to develop and implement improvement plans.
3. To learn a moderately difficult teaching strategy could require that teachers receive 20 to 30 hours of instruction of its theory, 15 to 20 classroom

> demonstrations, and 10 to 15 coaching sessions before mastering the technique and incorporating it into routine classroom practice (p.2).

According to Millett (2002), research on teachers' use of technology indicates that teachers spend one year or less to integrate computer-based drill-and-practice exercises into their classroom practice. However, it takes at least 5 or 6 years to learn how to use technology in ways of supporting higher-order thinking, decision-making, collaboration, etc. (Sheingold & Hadley, 1990, p.44).

Heavy workload usually prevents teachers from utilizing instructional technology in preparing their teaching materials, planning, curriculum development, trying out the technology in the classroom, and collaborating or exchanging information with other colleagues about technology (Darling-Hammond, 1995). In a study of implementation of computer training, Heape (1990) concluded that poor time allotment in staff training restrained the implementation of computer training. As teachers did not have enough time for reflection and discussion, they spent most of their time using traditional ways of instruction and continued to work in isolation.

Rogers (1995) investigated 1,392 faculty members teaching in four California State universities concerning their perceptions and attitudes toward the instructional use of technology. Participants were classified as innovators (20 %), early adopters (29%), early majorities (28%), skeptics (14%), and resisters (9 %). In terms of motivation factors, the skeptic group rated "release time" as the most important factor while the innovators group rated "availability of equipment" as the most important factor, and the early majority group rated "technical support" as most important. Rogers (1995) concluded that lack of time and resources were important factors that inhibited faculty members' instructional use of technology.

Voytyuk (1997) investigated the level and efficiency of computer usage in the teaching of foreign languages upon 100 faculty members of foreign language departments from colleges and universities of Virginia, West Virginia, and Maryland. Respondents indicated that full-fledged multimedia capabilities (e.g., sound, video, etc.) were not in wide use because of insufficient budgets or lack of time needed to master the technology. Less than half of the respondents use commercial foreign language software because of lacking time for adapting the software or because of the software was not compatible with the syllabus and textbooks.

In a study, Life On & Off the Job: A Time-use Study of Nova Scotia Teachers (Harvey & Spinney, 2000), teachers reported that they had insufficient time to reflect on their teaching. Due to time limitation collaboration with peers was limited. In addition, the surveyed teachers complained about the limited in-service training time (Kilpatrick, 1992). There seems to be inadequate time for effective instructional improvements. Therefore, the National Education Commission on Time and Learning (NECTL, 1994) contends, "the whole question of teachers and time needs to be rethought in a serious and systematic way" (p. 36). The literature clearly suggests that teachers must be given adequate time to "reflect, to engage in collective inquiry, to collaborate, and to participate in continuous improvement processes" (Millett, 2002, p.45).

Ongoing Support System

Ongoing support systems have been proven by several researchers to be critical (Alexander, 1997; Flagg, 1990; Ham, 1997; Maddox, 1997; Mason, 1987; Rogers, 1995; Siegel, 1994b). In Rogers' (1995) study, the availability of departmental technology support and consulting staff was the most unsatisfactory support item, indicating that an

ongoing support system is necessary for implementing technology in the classroom. Instructional policy and guidelines for using technology may need to be revised and more attention may need to be put on the diverse requirements and attitudes of faculty members.

According to Ham's (1997) study, the use of technology is affected by equipment breakdowns and computer configuration delays. Researchers found that adequate support, especially technical support, is one of the determinants for using computer technology in teaching (Ham, 1997; Maddox, 1997). The restructuring plan for implementing technology in teaching usually requires hiring a consulting engineer to set up a network, directories, and to familiarize the instructors with the network mapping process, as well as providing instant assistance and troubleshooting (Siegel, 1994b). In Mason's (1987) study, which examined the critical technical support that influences computer lab use in four junior high and middle schools in the Washington D.C. area, the presence of full-time lab coordinators on-site was found as an important positive factor. A few years later, Flagg (1990) also investigated the purpose, extent of use, and factors affecting computer use by teachers in fourteen Washington, D.C. high schools. The results again indicated that a school-based full-time coordinator contributed positively toward teachers' computer use. In the same vein, Alexander (1997) found that the level of on-site support availability was rendered as one of the factors that affect teacher use of computers.

A lack of vision, commitment, and clear rationale from the administration regarding a support system for technology use is obvious (Jensen, 1998; Lauber, 1997). As mentioned above, there exists a need to provide teachers with lesson preparation time

(or decrease of their workload), training opportunities, facility infrastructure, and funding for maintenance support. In addition, some studies indicate the importance of factors, such as equipment and software availability, access opportunities (Kinnamon, 1996; Flagg, 1990; Ham, 1997), and an on-site technology coordinator or resource teacher (Alexander, 1997; Flagg, 1990; Ham, 1997; Mason, 1987).

In another study, Foxon (1995) investigated action-planning effects on training transfer and individual perceptions of administration support following training. The results from 104 employees indicated that the individual perceptions of administrative support proved to be more important than action planning in influencing the transfer of the training course. Pang (1997) also found a strong correlation between technology training transfer and the level of support following training.

Collegiality

As mentioned above, Little (1990) describes collegiality as one of the two norms exhibited in a successful school. Collegiality is specified through four specific types of behavior: first, adults in schools who have collegial relationships talk about practice; second, adults also observe each other engaged in the practice of teaching and administration; third, colleagues engage together in work on curriculum by planning, designing, researching, and implementing it; fourth, collegiality is exhibited when adults teach each other what they know about teaching, learning, and leading.

Collegiality relates to the environment for teacher planning and sharing in regard to teacher roles and behaviors, classroom practices, curricula, and classroom activities in order to increase the effectiveness of technology implementation (Atkins, 1997). The National Staff Development Council (NSDC) has recommended that at least half of the

staff development resources should be devoted to follow-up activities, such as spending time for reflection and collaboration built in for effectiveness (Harrington-Lueker, 1996). Siegel (1994a) also contends that training needs to be ongoing with follow-up coaching either from experts or among peer learners. Teachers may require instructional technology support of co-teaching, demonstrations, and suggestions after being observed.

Some researchers believe that integrating technology fully into instruction may take three to eight years (Siegel, 1994b, 1995). It is necessary that a gestation period for reflection be provided after workshops, and then a follow-up session to reinforce the effects. The NSDC agrees that spreading the training out over time is an important factor and up to 20 sessions may be necessary before teachers master the use of technology (Harrington-Lueker, 1996). Then, arranging a collegial group among teachers could be an ideal method to promote collaboration of projects or activities. Thus, teachers may observe, find new ways, reflect, evaluate, and reconstruct their instructional practices.

Meskimen (1989) suggests that a school-based technology coordinator can be assigned to promote collaborative problem solving, resource-adding, an enthusiastic attitude, teaching expertise, and initiative between the coordinator and department chair. With the provision of a collegial group among teachers, the transfer of the training is more likely to be effective and lead to continuing usage of technology in their instruction.

Summary

Technology, as its popularity in second language learning indicates, has caused much attention in discussing its reasons, impact, and trends from researchers in varied professions (Kulick, 1994). Its capacity of providing quality feedback and a variety of interactions has resulted in its implementation in varied education settings. Accompanied

with fast evolution of advanced technologies, more and more instructors as well as administrators/governors are persuaded to utilize technology in order to reduce cost and fulfill the demands of today's global society (Reiser, 2001; Warschauer, 1999).

Current trends of instructional technology in L2 teaching suggest that both teachers and students reevaluate their behavior in the teaching/learning exchange process (Miller, Martineau, & Clark, 2000). Neither teachers nor students are the single knowledge provider or receiver. They both share the responsibility to contribute their efforts in the process of knowledge exchange. While some researchers questioned the effectiveness of technology in providing the same quality feedback as those in the traditional human based instruction (Crook, 1994; Walther, Anderson. & Park, 1994), others confidently report the advantages of utilizing technology innovation (Dwyer, 1994; Kern, 1995; Robichaud, 1986; Warschauer, 1997, 1998). Such transformation, as they believe, cannot be easily achieved without the assistance of technology. More importantly, the marriage of cost saving, globalization and support from government and policy makers enhances the possibility of the implementation of technology (Bush, 1997; Kendal, 1999).

In addition, the evolution of technology and L2 methodology has synergistic effects in promoting change in L2 acquisition. From Skinner's behaviorism where the language was divided into small segments to Chomsky's theory (1959) of performance and competence, L2 methodology has experienced stages of changes and finally leading toward Communicative Language Teaching (Bloom, 1971; Halliday, 1973; Krashen & Terrel, 1983). Alongside this timeline, the development of technology innovation also proceeded from the implementation of Audiovisual Communication Tools (before 1960s

and up to 1970s), followed by Computer Assisted Instruction (from mid 1960s to1990s) and Computer Assisted Language Learning (1950s to 1990s), to Computer Mediated Communication (from1990s till now).

Researchers interested in instructional technology also investigated how different types of media elicit the desired behaviors according to the objectives determined. Reiser and Gagne (1982) identify and evaluate ten media selection models based on stimulus characteristics of media or along dimensions. These models can be categorized into five types of media: traditional human-based text, one-way visual, one-way audio, one-way audiovisual, and two-way audiovisual. As Reiser and Gagne suggested, it is important for teachers to identify categories of learning outcomes before selecting matched media that are capable of eliciting desired outcome performance.

However, according to Brinton's analysis (2001) some teachers may not implement technology into their instruction at all due to their inability, school constraints, time limitations, unchangeable curriculum design, or the perception of no necessity. Other factors influencing teachers' use of technology include internal as well as external factors (Atkins, 1997; Flagg, 1991; Kinnamon, 1996; Moore, 1991; Reichstetter, 1999; Wiley, 1992), including teacher demographics, teaching areas, attitudes, computer use, and teacher training (Dolgos, 1991; Wiley, 1992), age, gender, years of teaching experience (Martin, 1990; Zehr, 1997), subject matter (Flagg, 1990), instructional style of teaching (Meinster, 1990), accessibility to computer, emphasis on curriculum integration, technical assistance, administrative support, effects of computer in-service training (Martin, 1990), instructional approaches, types of use, training components used by the trainer during training, and support factors following training (Reichstetter, 1999).

Other researchers investigating institutional support/constraints, including Pechman (1993), Mcdiarmid (1994), Ham (1997), and Hord (1994), emphasized the importance of the administrative commitment in schools. It is recognized that well-equipped schools usually show higher levels of adoption of technology (Mulbireek, 2001). However, the availability of resources and support systems is not directly correlated to the success of the technology implementation. More balanced management of technology purchase and budgets spent on technology training, understanding the integration of technology into a curriculum, conducting pre and in-service teacher training preparation programs, and time allowed for teachers' reflection and collaboration should be seriously considered (Harrington-Lueker, 1996; Kassen & Higgins, 1997;Warschauer & Healey, 1998; Kent and McNergney, 1999).

Time constrains were found to be the biggest barrier in teacher's use of technology (Adams, 1990; Frame, 1991; O'Neil, 1995). Heavy workload leads to insufficient time for teachers and hinders preparation of teaching materials, planning, curriculum development, trying out technology capabilities, and collaborating with colleagues (Darling-Hammond, 1995; Rogers, 1995). Heape (1990) also points out that poor time allotment in the staff training can affect technology implementation. Teachers complain about having inadequate time to reflect, collaborate, inquire, and participate in continuous instructional improvement (Millett, 2002). It requires more time and ongoing support, in particular technical support or on-site technology coordinators, to allow instructors to familiarize themselves with the instruction and obtain instant assistance for troubleshooting (Flagg, 1990; Siegel, 1994b; Ham, 1997; Maddox, 1997).

All the factors discussed above may finally constitute to the degree of collegiality in the school system. Continuous collegiality was found to reinforce the productivity after teacher development workshops or training (Siegel, 1994b; Harrington-Lueker, 1996). The commitment from the administrative level can largely affect how the resources are allocated and allow for appropriate workloads (i.e., more time for reflection, collaboration, etc.). Thus, teachers can exert more efforts on technology pedagogy and attend developmental training programs more frequently. Finally, assigning a school-based technology coordinator may improve the ongoing support and enhance the transfer of professional development training.

CHAPTER 3: METHODOLOGY

The following methodology was employed in order to answer the research questions regarding the availability, frequency, and complexity of use of technology; and the associations between EFL Taiwanese teachers' personal characteristics as well as the institutional supports/constraints in regards to their teaching of speaking/listening skills. This chapter discusses the research approach, participants, measurement, data collection procedures, and data analytic plan.

Research Approach

The study focuses on the investigation of EFL teachers' individual characteristics, and their institutional supports and constraints in regards to their use of different types of technology. The study intends to investigate patterns of differences and relationships among attributes of participants. In other words, there will be no manipulation of the variables. Based on the questions proposed for this dissertation research, a quantitative paradigm using a non-experimental approach was employed. According to Gliner & Morgan (2000), these types of non-experimental approaches are categorized as associational and comparative approaches and are very common in survey-type research. The type of approach depended on the level of the measurement of each independent variable selected in the proposed research questions. For example, individual characteristics, such as gender, and their relationship with the EFL teachers' use of different types of technology, were comparative questions due to a small number (i.e., 2-4) of levels of the independent variable. On the other hand, associational questions were

used when an independent variable, such as the number of hours per year of computer training, with many ordered levels, is related with the EFL teachers' use of different types of technology.

Participants

Sample Identification

The target or theoretical population is intended to include all the adult EFL educators in Taiwan. The sample includes five types of post secondary institute in Taiwan: (a) vocational colleges with five-year and two-year programs without graduate schools; (b) vocational colleges with five or two-years programs with graduate schools; (c) non-vocational private colleges with graduate schools; (d) institutes/universities of technology; and (e) general public universities. Based on their websites, the accessible population or sampling frame was approximately 1700 to 1900 EFL instructors including full-time and part-time EFL teachers in Taiwan. Due to their different educational missions under the different types of colleges or universities, EFL instructors usually work for departments named either as Applied Foreign Languages Department, Foreign Languages Department, or English Language and Literature Department. In order to precisely investigate the aspects of the teaching of English speaking/listening skills on which this study focuses, the sample frame was placed on those colleges/universities whose mission is related to the teaching of applied foreign languages instead of those aimed at teaching literature.

Selecting less than the total population has the advantage of saving time and money, as well as getting better quality control during the data collecting process. Therefore, the criteria for the selection of the sample were to include all adult EFL instructors in central

part of Taiwan who currently teach either in college-level programs (i.e. five-year or two-year programs), or private or public institutes/universities in central part of Taiwan.

Sampling

According to the definition stated in *Research Methods in Applied Settings* (Gliner & Morgan, 2000), sampling is "the process of selecting part of a larger group of participants with the intent of generalizing from the smaller group, called the sample, to the population, the larger group". Based on the criteria stated above, the researcher selected thirty-three institutes from post secondary institutes in central part of Taiwan. The approximate number of EFL instructors that can be accessed was about 800 to 1000 with the average number of 24-30 in each institute. With the fact that some of the part-time instructors may be involved in teaching in more than two institutes, the actual number of the subjects may be less than 800. In addition, the information posted on the websites may not be updated before the data was collected. Some of the name lists might include those who already resigned from the institutes or exclude those who just newly joined the teaching before the websites updated. In other words, the exact number of the participants will be less than expected.

The number of the questionnaires sent during September and October in 2004 was 861. Only 204 participants returned their response. After excluding those who teach 0 hour of English speaking/listening courses and three empty responses, the total number of participants was 181. The response rate is about 21%. Even though the number is comparatively low, the responses are still capable of contributing results that can be generalized to represent adult EFL educators' use of technology in their teaching of speaking/listening skills in Taiwan.

Measurement

An instrument was developed specifically for this study. The survey questions include four types of questions: (a) the use of software technology; (b) the use of hardware technology; (c) EFL teachers' demographic information; and (d) information about the institutional supports or constraints for using technology.

Software and Hardware Frequency of Use

In Appendix B, the questionnaire includes 16 technology items listed as software technologies and 25 technology items as hardware technologies. Each of the hardware and software question asks about the availability of the technology in the institute. The participant can choose one answer from "yes", "no", or "don't know" to indicate the availability of the technology item in their institute. If the availability question of that specific technology was answered "yes", the participant was asked again to rate his/her frequency of use of that technology based on a Liker scale from never (0) to always (6). Otherwise, a blank was expected for the answer of the frequency of use question.

The results indicate that some of the availability of different kinds of technology in the institutes was lower than 50%. It is very likely that the potential of threat of bias can influence how we analyze all of these 41 software and hardware technologies. Therefore, the researcher decided to analyze only those technologies whose availability percentages were above 50%. This resulted in 9 software technologies and 20 hardware technologies selected as the scope of the analysis in this study.

Frequency of Use Score

For each technology item that was said to be available, the participants had a 0-6 rating for the frequency of that technology use. The average score of either these 9, or 20

ratings were calculated as the first two dependent variables, i.e., frequency of use score for software technology, and frequency of use score for hardware technology.

Software and Hardware Complexity of Use

In a previous pilot study, a panel of 19 ESL experts from four Colorado post secondary institutes rated the complexity of each technology item (see Appendix A). Each technology item was given a weight ranging from 1 to 100 according to these experts' perception of the difficulty or complexity of that technology used in teaching EFL speaking/listening skills.

Complexity of Use Score

The median of each technology's complexity weight was, then, used in the current study. Whenever the participant answered "yes" for the availability question, the subject obtained the same median weight, which was rated by ESL experts mentioned above, as the person's complexity weight for that specific technology. Whenever the participant answered "no" or "don't know" for the availability question, the subject got a zero (0) as his/her complexity score for that technology. This complexity of use score indicates the level of complexity of the technology the person uses in his/her teaching ESL speaking/listening skills. After this, the third and fourth dependent variables are ready for further analysis of variance. Table 3.1 is the list of the complexity weight of each software and hardware technologies.

Table 3.1.
Means of Software and Hardware Complexity Scores

Software Technology	Mean	Hardware Technology	Mean
Word processing	8.4	Overhead Projector	8.3
Presentation software	19.5	Audio CD	9.8
Electronic text	11.9	Slides	36.4

concept mapping tool	13.8
graphic organizer	5.6
Email	10.2
authoring tool	28.4
Course ware	15.9
Computer games	14.8
Research software	26.0
Internet/WWW	8.1
Online Database	13.4
WebCT(discussion Board)	17.2
Chat rooms	25.2
List serve	8.4
Messenger	28.0
Total Mean	15.9

Scanner	39.3
Digit. Camera	12.6
Printer	8.4
PDA	18.1
Interactive CD-Rom	22.1
Tape Recorder	7.9
Computer	11.0
Radio	8.8
Telephone	8.1
VCR	8.4
CD-ROM	16.1
Electronic Board (e.g. smart board)	11.7
DVD	15.4
Interactive DVD	16.4
TV	12.3
Film Camera	10.3
Camcorder	9.5
Headphones	8.1
Microphone	10.5
Computer Projector	36.8
Sound Speaker	8.9
Laser Pointer	6.4
Total Mean	14.5

Demographic and Institutional Information

EFL Taiwanese teachers' demographic information was obtained either by participants filling in the blanks or by checking a frequency categories. Demographic information includes teaching experience (how many years the participant has taught), computer usage (the frequency of time spent in using computers), computer training (hours of training the participant had received in the past two years), and personal information (gender or age). In a similar way, institutional information requires respondents to answer each question by selecting a five-point Likert scale ranging from SA (strongly agree), A (agree), N (no opinion), D (disagree), to SD (strongly disagree). For detailed survey questions, please see Appendix B.

Reliability and Validity

According to Gliner & Morgan (2000), internal validity requires equivalence of groups on participant characteristics and control of extraneous experiences and environment variables. In this study, the research approach is a combination of descriptive and associational research instead of manipulating independent variables as in experimental research; therefore, the internal validity was diminished. Participants' characteristics in the sample are similar based on the criteria of selecting only EFL instructors in applied foreign languages department in central part of Taiwan. Those who teach literature in these departments were eliminated from the list of subjects. This means that differences between the independent variable (e.g., computer usage), groups with other participant characteristics were probably smaller than in the general population. In addition, due to the survey method, the extraneous experiences and environment variables were somewhat controlled. Every participant received the survey within the same period of time in the semester. Similarly, the external ecological validity was adequate because the survey was accomplished in the school setting. No authority influenced their answers, and the condition, time, testers, and procedures were similar and relatively natural for each subject.

In order to achieve face validity and content validity, the researcher invited 19 ESL professionals from the Intensive English Programs at Colorado State University; the University of Colorado, Boulder; the University of Northern Colorado; and Front Range Community College to rate 16 software technologies and 25 hardware technologies. This group of experts either had worked in the ESL profession for over 10 years or obtained a Master's or Ph.D. degree in ESL areas. Among 25 hardware technologies selected, 22

technologies were rated relatively easy (difficulty weight less than 50 in a full scale of 100) to be used in teaching English speaking/listening skills, while among the 16 software technologies, all except one software technology listed were rated easy to use. However, 5 out of 16 software technology items were said to be inappropriate for teaching EFL by half of the experts. This result indicates that 90% of the hardware and 74% of the software technologies selected appear to be appropriate and the content of the instrument is representative of the concept that the researcher is attempting to measure.

Data Collecting Procedure

Three steps were executed in the data collecting process. The first step is to target selected college-level institutes/universities in Taiwan as the accessible population or sampling frame. Thirty-three post secondary institutes/universities were selected due to geographical convenience; i.e., selected mainly from central part of Taiwan. Due to the limited number of instructors in most of the Applied Foreign Languages Departments, all of the EFL teachers in the selected institutes/universities were included in the mailing list. Therefore, no random selection was made from each institute. The third step was to collect data from the actual sample, which was from those instructors who voluntarily participated.

Before actually visiting the participants, a pre-notice letter and follow-up contact cards were prepared to increase the response rate. A pre-notice letter through email was sent to all the targeted subjects in order to prepare them for answering the survey. Or an ordinary mail was sent to the participant if the instructor does not have contact email address listed on the website. Then, the questionnaire was given a week later. Each of the questionnaires was sent with a posted envelope inside for the participant's

convenience to return the responses. No return address was requested and no serial number was indicated on the envelope in order to keep the anonymity of the respondent.

Finally, a follow-up letter was given to all the participants to thank them for participating in the survey, or remind them if they had not returned the survey. This letter asked those who did not return the survey if they have any questions or if any help can be provided.

Timeline

A planned schedule was developed before the data was collected. Table 3.2 display the exact date the researcher planned to collect the data.

Data Analysis Procedure

This study aims to investigate the relationships among EFL instructors' personal characteristics, their institutional supports or constraints in regard to (a) the frequency of use of available technology and (b) the difficulty/complexity of technology they use in teaching speaking and listening skills. The researcher was trying to explore whether any individual independent variable or a combination of independent variables exists to explain EFL instructors' (a) frequency of technology use and (b) difficulty/complexity of technology used in teaching English speaking/listening skills.

Table 3.2
Timeline for Data Collection

Date	Do what?	To who?	Note
Sep 9, 2004	Send pre-notice letter	All the teachers in selected	The purpose is to inform them the questionnaire

		institutes/universities	will be coming.
Sep 16, 2004	Send the questionnaire	All the EFL teachers in college level institutes	No serial number added on the envelope or address asked from the participant.
Sep 23, 2004	Keep tally of all the responses received	Self-work	Start to record the data.
Oct 15, 2004	Finish the recording of the data received	Self-work	
Oct. 16, 2004	Send out follow-up letter	All the participants	The purpose is to thank them for participation, as well as encouraging those who did not participate to return the response.
Oct 20, 2004	Prepare for data analysis		Calculate the response rate and determine the next step of action.

The theory was explored but not fixed before the study was designed. Therefore, a series of research questions were developed based on two major independent variables: (a) EFL instructors' personal characteristics, and (b) EFL instructors' institutional supports or constraints. The types of research approach include several associational and one complex associational designs. Statistical tests used to analyze the associations among variables were Pearson Moment-Product correlation tests, Spearman rho correlation tests, and four simultaneous multiple regressions analysis. Table 3.3 displays the details of the independent variables and their levels of measurement, research approaches, and statistical tests used in the analysis. Since each independent variable was accompanied with these two categories of dependent variables: average frequency of using any type of available software and hardware technologies; and average complexity

of available software and hardware technologies used, each statistical test in the right column of Table 3.3 was performed four times.

Table 3.3
Independent Variables, Their Measurement, Approach and Analysis

Independent variable	Levels of measurement	Type of research approach	Statistical test used in analyzing the result
1. Frequency of using computer for non-teaching activities	5 levels	Associational	Spearman rho
2. Frequency of using computer for preparing teaching	5 levels	Associational	Spearman rho
3. Frequency of using computer in the classroom	5 levels	Associational	Spearman rho
4. Frequency of using computer in the lab	5 levels	Associational	Spearman rho
5. Annual formal computer training	Continuous	Associational	Pearson r
6. Length in years of teaching	Continuous	Associational	Pearson r
7. Length of using computes in teaching	Continuous	Associational	Pearson r
8. Annual formal computer training	Continuous	Associational	Pearson r
9. Workload	5 levels	Associational	Pearson r
10. Perception of technical support	5 levels	Associational	Pearson r
11. Perception of colleagues' support in using technology	5 levels	Associational	Pearson r
12. Perception of teacher collaboration in projects or teaching activities	5 levels	Associational	Pearson r
13. Teachers' characteristics and institutional supports/constraints	NA	Complex associational	Multiple Regression

As indicated above, several kinds of statistical tests were utilized to analyze the data. The statistical tables include correlation matrix that displays correlations between dependent and independent variables and inter-correlations among independent variables; multiple regression coefficients table, analysis of variance, etc. For research questions using associational approach, Pearson r and Spearman rho were employed while research

question four using a complex associational approach, i.e., using a simultaneous multiple regression for data analysis.

CHAPTER 4: RESULTS

This chapter discusses the result of the responses obtained from 181 EFL Taiwanese teachers in regards to their use of technology in teaching English speaking/listening skills. The analysis includes data screening procedure, descriptive information, general aspects of technology availability, frequency of the use of technology, the complexity of the use of technology in teaching, as well as answers for four research questions.

Data Screening Procedure

As mentioned in Chapter Three, the questionnaires were sent to 861 instructors from 33 post secondary institutes in central part of Taiwan during September in 2004. There were 204 responses returned total. After eliminating invalid responses either from those who taught no (0) hours of speaking/listening skills, or from those who gave empty responses, the total number of valid questionnaire responses was 181. Therefore, the response rate in this research is about 21%.

The possible reasons for the lower response rate are three fold: first, the instructors' names listed on the websites may not be fully accurate. It is common that the institutes may include retired or resigned staff members, or have replaced staff members before the researcher collected the data. Second, some of the teachers' contact email addresses were either absent on the websites or not valid anymore before the researcher sent out the pre-notice letter, questionnaire, and the follow-up letter. Third, a small

portion of the staff members may have currently been studying abroad for further degrees and, therefore, could not respond before the data had been analyzed.

These reasons potentially decreased the response rate. In theory, if the differences between the characteristics of two groups of the participants (i.e., the earlier respondents and the later respondents) were not significantly different from zero, the capability of the generalization from the sample to the population can be enlarged because the late responders are assumed to be similar to non-responders. In order to test this theory, the researcher separated the participants into two groups and tried to compare characteristics of each group of respondents. The first group of participants was the 141 responses received during the first two weeks after the questionnaires were sent. The second group was the last 40 responses obtained after the follow-up letters were sent. Several sets of descriptive information were performed to learn the mean of each variable. Several *t*-tests were employed to compare means of these variables from each group. The purpose is to confirm the similarity of these two groups. The results of these tests indicate that all of the variables from each group are similar and have no significant difference from each other. Thus, even though the response rate was lower than expected, the researcher is reasonably confident that these two groups of participants were from the same population and generalizations made from the results of these 181 subjects should be able to predict aspects of the general population.

Prior to the analysis, the researcher examined the 181 subjects' responses for accuracy of data entry, missing values, and fit between their distributions and the assumptions of the statistical analysis. Two cases in the teachers' annual formal training hours were detected as extreme outliers and, therefore, were both modified into value 60,

the maximum for other participants, in order to avoid the distortion on the distribution. Test of normality was conducted through the use of Kolmogorov-Smirnov statistics. The results were not significant, which indicate that the assumption of normality is fulfilled.

Descriptive Information

EFL Taiwanese Instructors' Personal Characteristics

Gender, Age, Education Completed, and Years of Teaching

Concerning the variable gender, the majority of the sample was female (63.5% for Female and 36.5% for Male). The range of EFL teachers' ages was from 26 to 63 years, with a mean of 41 and standard deviation of 8.2. Most of the participants had master's degrees (58.7%), while others possessed either a bachelor's degree (2.8%) or a doctoral degree (38.5 %). Only five people had a bachelor's degree as their highest degree. Those who possessed a bachelor's degree tended to have more years of teaching while the master's degree holders tended to have a shorter length of teaching experience. Overall, the average length of teaching was nearly 10 years (M=9.8).

Computer Use

Average length of computer use for these instructors barely exceeded 4 years; 83% of them have used computers no more than 6 years. Almost one quarter of them never use computers in class (see Table 4.1.). However, more than 55% of them used computers in the class either a few times a week or a few times a month. In the same vein, 23% of them never use computers in the lab, and more than 55% of them used computers in the lab either a few times a week or a few times a month. Very few of them claimed they never use the computer in preparing teaching or non-teaching activities. Actually, 45% of them use computers daily for preparing teaching while 79% of them use

computers daily for non-teaching activities. This indicates that they are computer frequent users and use computers more for personal reasons than for teaching.

Table 4.1.
Percentage of the Frequency of Computer Use

	Infrequent Users		Moderate Users	Frequent Users	
	Never	Once a Mon.	A few times a Mon.	A few times a week	Daily
Freq. of non-teaching activity	0.6	0.6	4.4	15.5	79.0
Freq. of preparing teaching materials	1.7	3.9	14.4	34.8	45.3
Freq. of in-class computer use	24.9	11.6	29.8	26.5	6.6
Freq. of lab computer use	23.2	11.0	28.7	27.1	8.8

Institutional Supports/Constraints for EFL Taiwanese Instructors

Formal Computer Training

Institutional support is related to the amount of resources the institute can provide for teachers' professional development. This implies administrators' supporting teachers with budget planning for professional development programs, encouraging colleagues to collaborate, and providing technical support. One of the important resources, formal computer training, has the potential to assist teachers to transfer the way they implement technology into their teaching. The results show that their annual formal training hours were less than a mean of 7 hours per year. The results revealed that more than 55% of them never had any computer training in the past two years.

Hours of Teaching Per Week, Hours of Teaching Speaking/Listening Skills Per Week

The average hours of teaching per week for EFL Taiwanese teachers were less than 14 hours. Among these hours, they taught speaking and listening skills

approximately 5 to 6 hours per week. Table 4.2 shows that teachers' opinions differed about their workload. About half of the people agreed or strongly agreed that their workload was heavy while more than one quarter had no opinion. Another quarter of them either strongly disagreed or disagreed with the statement.

Table 4.2.
Percentage of the Perceptions of Institutional Supports/Constraints

	Strongly Disagree	Disagree	No opinions	Agree	Strongly Agree
Workload is too heavy for me.	5.5	20.4	26.5	23.8	23.2
Enough technical support	4.4	29.3	11.0	44.2	11.0
Colleagues support me.	1.7	19.3	18.3	47.5	11.6
Teachers' collaboration	7.2	30.4	26.0	32.0	3.3
My technology skill is strong.	7.7	39.8	17.7	28.2	6.6
All technologies are available for me.	6.1	36.5	10.5	34.8	11.6

Technical Support

More than 55% of EFL Taiwanese teachers either strongly agreed or agreed that enough technical support was provided in their institute. Not too different from that, there were still 34% of them who strongly disagreed or disagreed with the statement. Therefore, the perception of their institutional technical support was actually split into two major categories; that is, either agree or disagree with enough technical support in their institutes (see Table 4.2).

Colleague Support

As the literature suggested in Chapter Two, more colleague support and collaboration does have positive effects on teachers' transferring skills from formal training into their daily teaching. On a 1 to 5 Likert scale rating (1 = strongly disagree, 2 = disagree, 3 = no opinion, 4 = agree, 5 = strongly agree), colleagues' support was rated high in their institutes (see Table 4.2.). Nearly 60% of the participants either agreed or strongly agreed that their colleagues support them when they have problems in using technology in teaching. Only 21% of the participants either strongly disagreed or disagreed with the statement.

Teachers' Collaboration on Projects or Teaching Activities

Similar to the ratings on technical support were found in teachers' collaboration on projects or teaching activities; 38% strongly disagreed or disagreed that teachers in their institutes collaborate on projects or activities, while 35% agreed or strongly agreed with the statement. Of the participants, 26% had no opinion.

Self-perception of Technology Skills

The results show that nearly 48% of the participants felt they either strongly disagreed or disagreed that they had strong technology skills in teaching. However, 35% of them agreed or strongly agreed that they had strong technology skills. Only 18% of the participants had no opinion.

Overall Availability of the Technology Teachers Needed

Again, responses about the availability of the technologies teachers needed varied; 43% of the participants either strongly disagreed or disagreed that all technologies are available for them. On the other hand, 46% of them either strongly agreed or agreed

with the statement. Only 11% of them had no opinions. In other words, while more than one third of the teachers thought the technologies they need were available, a similar number of teachers did not think the technologies they desired were available to them.

Research Question 1

What are the availability, frequency of use, and complexity of use of technology, if various software and hardware technologies are provided to teach English speaking and listening skills in Taiwanese post secondary institutes?

Technology Availability

The technologies selected in the questionnaire were categorized into software technologies and hardware technologies. Table 4.3 displays the 16 software technologies. Based on the responses, availability of the 16 software technologies varied from 90% down to 16%, averaging 53%. The participants claimed that unavailability of the software technologies ranged from 40% down to 11%, averaging 23%, while unknown software technologies range from 52% down to 0%, and averaging 23%. Table 4.3 indicates that the top four available technologies are Internet, Email, Presentation software, and Word Processing. The most unavailable technology discovered was computer games, and the most unknown technologies were Listserve and Authoring Tool.

Hardware technologies, on the other hand, include the overhead projector, audio CD, and so on (see Table 4.4.). The mean of 25 hardware technology availability scores is 71%. On average, 19% of the respondents said that the technology was "not available", while an average of only 9% said they "don't know". In general, most of the

software (53%) and hardware (71%) technologies listed in this research are available to most of the EFL teachers in post secondary institutes in central part of Taiwan.

Table 4.3.
Percent of Software Technology Availability

Software Technologies	Available	Not Available	Don't know
Internet/WWW	89.5	10.5	0.0
Email	87.8	11.6	0.0
Presentation software	81.2	14.4	4.4
Word processing	80.1	14.9	4.4
Electronic text	65.2	22.1	10.5
Research software	64.1	22.1	12.2
Chat rooms	61.9	26.5	10.5
Online Database	61.3	22.7	13.8
Messenger	53.0	26.5	20.4
Computer games	43.6	40.3	13.8
WebCT (discussion Board)	40.3	25.4	32.6
Course ware	36.5	23.2	38.1
Graphic organizer	29.8	23.2	46.4
Concept mapping tool	23.2	24.9	50.8
Authoring tool	22.1	23.8	51.9
List serve	15.5	30.4	51.9
Mean	53.4	22.7	22.6

Note. Technologies available to greater than 50% were used in further analysis.

Eleven out of 25 hardware technologies have availability percentages more than 80%, while only 4 out of 16 software technologies were said to be available to more than 80 % of the respondents (see Tables 4.3. and 4.4). Obviously, hardware technologies were felt to be more available in the institutes than software technologies.

There were 12 technologies with a percentage of availability rated lower than 50% by the participants. In order to reduce the potential bias in discussing the aspects of technology use of either unavailable or unknown for EFL teachers in these institutes, the researcher decided to narrow down the scope of the analysis by selecting only those technologies

whose availability percentages were over 50 %. This resulted in 9 software and 20 hardware technologies selected for further investigation. The following data analysis will focus only on these 29 technologies. The researcher assumed technologies that were rated as available by at least 50% of the participants were, in reality, available to all, if they requested them. These technologies are provided to post-secondary institutes by the government in Taiwan.

Table 4.4.
Percentage of Hardware Technology Availability

Hardware Technology	Available	Not Available	Don't know
Audio CD	98.3	1.7	0.0
Tape Recorder	97.8	1.1	0.6
Microphone	93.4	4.4	1.7
Computer	92.8	6.6	0.6
Overhead Projector	89.0	7.2	2.8
Headphones	86.2	9.4	4.4
DVD	85.6	6.1	6.6
VCR	84.5	11.6	3.3
CD-ROM	84.5	9.9	3.9
Printer	82.3	15.5	1.7
TV	82.3	14.9	2.2
Sound Speaker	79.0	9.9	11.0
Radio	77.3	19.3	2.8
Interactive CD-Rom	74.6	14.9	9.9
Computer Projector	73.5	14.4	11.0
Slides	65.7	22.7	9.9
Scanner	65.2	26.0	8.8
Digit. Camera	65.2	28.2	6.1
Telephone	59.7	35.9	3.3
Laser Pointer	55.8	30.9	13.3
Film Camera	49.7	32.0	17.7
Camcorder	47.5	34.8	17.1
Interactive DVD	43.6	28.2	26.5
PDA	23.8	56.4	18.8
Electronic Board (e.g. smart board)	11.0	38.7	48.1
Mean	70.7	19.2	9.3

Note. Technologies available to greater than 50% were used in further analysis.

Frequency of Technology Use

In a 0 to 6 Likert scale (0 represents "never using it," and 6 indicates "always using it"), participants were asked to rate their frequency of technology use in teaching if the technology is available in their institute. The averaged frequency of technology use suggests a moderate usage for both software (2.5) and hardware (3.2). As Table 4.5 indicates, 11 out of 20 hardware technologies were rated more than 3, which represents "frequent" usage in a 0 to 6 Likert scale. On the other hand, only 2 out of 9 software technologies (i.e., Internet and Word Processing) were rated more than 3. Apparently, EFL teachers in Taiwan use hardware technologies slightly more often than software technologies in their teaching English speaking/listening skills.

Table 4.5
Means for the Frequency of the Use of Each Technology

Software Technology	Mean	Hardware Technology	Mean
Internet/WWW	3.9	Microphone	4.8
Word processing	3.7	Audio CD	4.7
Email	2.8	Tape Recorder	4.7
Online Database	2.8	Sound Speaker	4.4
Presentation software	2.6	Printer	4.1
Electronic text	2.1	Computer	4.1
Research software	2.1	Headphones	4.0
Messenger	1.1	VCR	3.5
Chat rooms	1.1	CD-ROM	3.5
		DVD	3.2
Mean	2.5	Overhead Projector	3.2
		Computer Projector	2.9
		TV	2.5
		Radio	2.3
		Interactive CD-Rom	2.3
		Laser Pointer	2.2
		Slides	2.1
		Scanner	1.9
		Telephone	1.9
		Digit. Camera	1.6
		Mean	3.2

Complexity of Technology Use

As discussed in Chapter Three, the complexity weights for the software and hardware technologies were obtained from 19 ESL experts in three universities and one local private adult education institute in Colorado. These experts in the ESL profession were asked to rate from 0 to 100 to specify the difficulty level for using each technology in teaching English speaking and listening skills (See Appendix A). The obtained median score represents the complexity weight for the technology and the weights could range from 0 (the easiest) to 100 (the most complicated). These weights, then, were used to calculate the complexity scores for each EFL teachers' use of software and hardware technology. Detailed complexity weights can be found in Chapter Three, Table 3.1.

Whenever the participant rated the availability as "yes", the complexity weight provided by these 19 ESL experts was assigned as the participant's complexity score for that technology. A zero (0) weight was given to the participant whenever they answered "no" or "don't know" to the question of technology availability. This means that the person did not use the technology and should not have a complexity score for the use of that specific technology. Then, a general software complexity score and a general hardware complexity score for each respondent were calculated by averaging the complexity weights for each technology used and the zeros for technologies not used.

For example, if a subject's answers for the availability of the software technologies were all available except for research software and messenger, the person's general software complexity weight would be calculated as below:

$$CMPXS = (0 + 0 + 25.2 + 19.5 + 13.4 + 12.0 + 10.2 + 8.4 + 8.1)/9 = 10.7$$

The person's general software complexity score will be 10.7.

Table 4.6.
Participants' Mean Complexity Score for Each Software Technology

Software Technology	Mean
Messenger	28.0
Research software	26.0
Chat rooms	25.2
Presentation software	19.5
Online Database	13.4
Electronic text	12.0
Email	10.2
Word processing	8.4
Internet/WWW	8.1
Mean	16.7

With the same procedure, both the software and hardware complexity of use scores were calculated for all 181 subjects. Tables 4.6 and 4.7 list the averaged final complexity scores for each software and hardware technology. After the mean scores of these technologies' complexity weights were averaged, the general software technology complexity score obtained was 16.7. Using the same process, the general hardware technology complexity score obtained was 14.8. In a 0 to 100 scale like this, the software and hardware complexity scores obtained were similar and toward the easier end. In general, EFL teachers in Taiwan tend to use easier technologies and use slightly more complex software than hardware technology in their teaching English speaking and listening skills.

Research Question 2

What are the relationships between EFL Taiwanese teachers' personal characteristics and the frequency and complexity of their use of technology in teaching English speaking/listening skills?

Table 4.7
Participants' Mean Complexity Score for Each Hardware Technology

Hardware Technology	Mean
Scanner	39.3
Computer Projector	36.8
Slides	36.4
Interactive CD-Rom	22.1
CD-ROM	16.1
DVD	15.4
Digit. Camera	12.6
TV	12.3
Computer	11.1
Microphone	10.5
Audio CD	9.8
Sound Speaker	8.9
Radio	8.8
Printer	8.4
VCR	8.4
Overhead Projector	8.3
Telephone	8.1
Headphones	8.1
Tape Recorder	7.9
Laser Pointer	6.4
Mean	14.8

Relationships Related to EFL Teachers' Personal Characteristics

Using Computers for Non-teaching Activities

Is there an association between Taiwanese EFL teachers' frequency of computer use for non-teaching activities and the frequency and complexity of their use of technology in teaching English speaking/listening skills?

Since the independent variables under this subset question are ordinal, the Spearman rank-order correlation (rho) is selected to interpret the relationship between the independent and dependent variables. Preliminary analyses were performed to ensure no violation of the assumptions of normality, linearity and homoscedasticity. Table 4.8 explains the relationship between EFL teachers' computer use for non-teaching activities

and their frequency and complexity of the use of technology. For the frequency of the use of technology, the results show that there is no significant relationship between EFL teachers' frequency of computer use for non-teaching activities and either their frequency of the use of software or hardware technology in teaching English speaking/listening skills.

For the second set of dependent variables (i.e., the complexity of the use of software and hardware technologies), there was no significant correlation between the complexity of the use of software technology and their frequency of computer use for non-teaching activities. However, a positive significant correlation was found between the complexity of the use of hardware technology and the frequency of computer use for non-teaching activities ($r_s = .19$, $n = 181$, $p < .05$). The coefficient of determination ($r_s^2 = .035$) is pretty small and indicates that only 3.5 % of the variance was explained by EFL instructors' computer use for non-teaching activities. However, Cohen (1988) and Morgan, Leech, Gloeckner, and Barrett (2004) argue that a correlation of .19 is a small to medium effect size, somewhat less than typical in the behavioral sciences.

Table 4.8
Spearman Correlations Between EFL Teacher's Frequency of Computer Use for Non-teaching Activities and Their Frequency and Complexity of Technology Use

	n	r_s	*p*
Frequency of use			
Software	172	-.04	.56
Hardware	181	-.01	.91
Complexity used			
Software	181	.12	.10
Hardware	181	.19*	.01

*$p < .05$. **$p < .01$

Using Computers to Prepare for Teaching Materials

Is there an association between EFL teachers' frequency of computer use to prepare for teaching materials and the frequency and complexity of their use of technology in teaching English speaking/listening skills?

According to Table 4.9, there is no significant relationship between EFL teachers' frequency of the use of technology and their computer use to prepare for teaching materials. However, the results reveal a significant relationship between EFL teachers' frequency of using computers to prepare for teaching materials and the complexity of their use of technology in teaching English speaking/listening skills ($r_s = .31, p <. 01$ for their complexity of the use of hardware technology, and $r_s = .39, p < .01$ for their complexity of the use of software technology). The variance they share was nearly 10% ($r_s^2 = .09$) for the complexity of their use of hardware technology and 15% ($r_s^2 = .15$) for the complexity of their use of software technology, which are both moderate strength of relationships. Thus, in general the more Taiwanese EFL teachers use computers to prepare for teaching materials, the more complex technology they will use in teaching English speaking/listening skills.

Table 4.9
Spearman Correlations Between EFL Teacher's Frequency of Computer Use to Prepare for Teaching materials and Their Frequency and Complexity of Technology Use

	n	r_s	*p*
Frequency of use			
Software	172	.05	.56
Hardware	181	-.05	.54
Complexity used			
Software	181	.39**	.00
Hardware	181	.31**	.00

*$p < .05$. **$p < .01$

Using Computers in the Classroom

Is there an association between EFL Taiwanese teachers' frequency of computer use in the classroom and the frequency and complexity of their use of technology in teaching English speaking/listening skills?

Using computers in the classroom does have significant relationships with Taiwanese EFL teachers' frequency and complexity of technology use ($r_s = 0.32, p < .01$ for the frequency of the use of software technology, and $r_s = .37, p < .01$ for the frequency of the use of hardware technology; $r_s = 0.21, p < .01$ for the complexity of the use of software technology, $r_s = .17, p < .05$ for the complexity of the use of hardware technology). Comparatively, the strength of the relationship for technology frequency use seems stronger than that with the complexity of the use of technology. According to the moderate effect sizes, we may predict that the more computer use EFL instructors have in the classroom, the more frequent use of the technology they will have in teaching English speaking/listening skills.

Table 4.10.
Spearman Correlations between EFL Teacher's Frequency of Computer Use in the Classroom and Their Frequency and Complexity of Technology Use

	n	r_s	*p*
Frequency of use			
Software	172	.32**	.00
Hardware	180	.37**	.00
Complexity used			
Software	180	.21**	.00
Hardware	180	.17*	.03

*$p < .05$. **$p < .01$

Even though the relationships are significant between EFL instructors' computer use in the classroom and their complexity of use of software and hardware technology, both of the r_s^2 are small to medium, under .05. Nevertheless, in general, the more EFL

teachers' in-class use of computer, more complex the use of technology they will have in teaching English speaking/listening skills.

Using Computers in the Lab

Is there an association between EFL instructors' frequency of computer use in the lab and the frequency and complexity of their use of technology in teaching English speaking/listening skills?

Significant relationships were also found between Taiwanese EFL instructors' frequency of computer use in the lab and their frequency and complexity of their use of technology ($r = .25, p < .01$ for the frequency of the use of software technology; $r = 38, p < .001$ for the frequency of the use of hardware technology; $r = .16, p < .05$ for the complexity of the use of software technology; $r = .18, p < .05$ for the complexity of the use of hardware technology). The strength of the relationships between the lab computer use and the frequency and complexity of the use of technology were small to medium. In general, the more lab computer use for EFL Taiwanese teachers, the higher their frequency and complexity of the use of technology in teaching English speaking/listening skills.

Table 4.11.
Spearman Correlations Between EFL Teacher's Frequency of Computer Use in the Lab and Their Frequency and Complexity of Technology Use

	n	r_s	*p*
Frequency of use			
Software	170	.25**	.001
Hardware	179	.38**	.000
Complexity used			
Software	179	.16*	.03
Hardware	179	.18*	.01

*$p < .05$. **$p < .01$

Years of Teaching

Is there an association between EFL teachers' years of teaching and the frequency and complexity of their use of technology in teaching English speaking/listening skills? There is no significant relationship between Taiwanese EFL teachers' years of teaching and their frequency and complexity of the use of technology, except for a relationship with the frequency of the use of hardware technology (r = -.15, p< .05). This suggests that the fewer number of years of teaching, the more frequency of EFL teachers' use of hardware technology. However, the strength of the relationship is weak.

Years of Computer Use in Teaching

Is there an association between EFL teachers' years of computer use in teaching and the frequency and complexity of their use of technology in teaching English speaking/listening skills?

Table 4.12.
Correlations Between EFL Teacher's Years of Teaching and Their Frequency and Complexity of Technology Use

	n	*r*	*p*
Frequency of use			
Software	171	-.08	.31
Hardware	180	-.15*	.05
Complexity used			
Software	180	-.02	.82
Hardware	180	.04	.60

*p < .05. **p < .01

Again, there is no significant relationship between EFL teachers' years of computer use in teaching and their frequency and complexity of their use of technology, except for the relationship with the complexity of the use of software technology (r = .15, p < .05). This suggests that the greater number of years of using computers in teaching,

the more complex software technology EFL teachers use in teaching. However, the effect size is small and does not predict the dependent variables well.

Table 4.13.
Correlations Between EFL Teacher's Years of Computer Use in Teaching and Their Frequency and Complexity of Technology Use

	n	r	*p*
Frequency of use			
Software	168	.09	.26
Hardware	176	.08	.29
Complexity used			
Software	176	.15*	.05
Hardware	176	.13	.10

*$p < .05$. **$p < .01$

Research Question 3

What are the relationships between institutional supports/constraints and the frequency and complexity of the use of technology in teaching English speaking/listening skills?

Relationships Related to Institutional Supports/Constraints

Annual Formal Computer Training

Is there an association between EFL teachers' years of using computers in teaching and the frequency and complexity of their use of technology in teaching English speaking/listening skills?

The Pearson-product moment correlation was selected to interpret the relationship between Taiwanese EFL teachers' annual formal computer training and their frequency and complexity of the use of technology. In Table 4.14, the results show no significant relationships between EFL teachers' formal computer training and the frequency and complexity of their use of technology in teaching English speaking/listening skills.

Table 4.14.
Correlations Between EFL Teacher's Annual Formal Computer Training and Their Frequency and Complexity of Technology Use

	n	*r*	*p*
Frequency of use			
Software	168	.07	.34
Hardware	176	.13	.10
Complexity used			
Software	176	.03	.71
Hardware	176	.08	.32

*$p < .05$. **$p < .01$

Teaching Hours Per Week

Is there an association between EFL teachers' teaching hours per week and the frequency and complexity of their use of technology in teaching English speaking/listening skills?

Similar to formal computer training, there were no significant relationships between EFL teachers' teaching hours per week and their complexity and frequency of the use of technology in teaching speaking/listening skills.

Table 4.15.
Correlations Between EFL Teacher's Teaching Hours per Week and Their Frequency and Complexity of the Use of Technology

	n	*r*	*p*
Frequency of use			
Software	171	-.04	.64
Hardware	180	-.05	.47
Complexity used			
Software	180	.01	.92
Hardware	180	-.00	.98

*$p < .05$. **$p < .01$

Workload

Is there an association between EFL teachers' workload and their frequency and complexity of technology use in teaching English speaking/listening skills?

Similar to teaching hours per week, there were no significant relationships found between EFL Taiwanese instructors' workload and their frequency and complexity of the use of technology in teaching English speaking/listening skills.

Perception of Institutional Technical Support

Is there an association between EFL teachers' perception of their institutional technical support and their frequency and complexity of technology use in teaching English speaking/listening skills?

Table 4.16.
Correlations Between EFL Teacher's Workload and Their Frequency and Complexity of the Use of Technology

	n	*r*	*p*
Frequency of use			
Software	171	-.11	.16
Hardware	180	-.06	.41
Complexity used			
Software			
Hardware	180	.06	.41
Frequency of use	180	.06	.40

$^{*}p < .05$. $^{**}p < .01$

Even though the literature consistently revealed the need of more technical support for teachers, in order to encourage technology use in their teaching, the responses in this research did not indicate any significant relationships between EFL teachers' perception of their institutional technical support and their frequency and complexity of the use of technology in teaching English speaking/listening skills.

Perception of Colleagues' Support in Using Technology

Is there an association between EFL teachers' perception of colleagues' support in using technology and their frequency and complexity of the use of technology in teaching English speaking/listening skills?

Table 4.17.
Correlations Between EFL Teacher's Perception of Institutional Technical Support and Their Frequency and Complexity of the Use of Technology

	n	*r*	*p*
Frequency of use			
Software	172	.04	.60
Hardware	181	.07	.34
Complexity used			
Software	181	.02	.81
Hardware	181	-.02	.77

*$p < .05$. **$p < .01$

Statistically significant relationships were found between EFL teachers' perception of colleagues' support in using technology and their frequency of the use of technology and their complexity of the use of hardware technology ($r = .18, p < .05$ for the frequency of the use of software technology, $r = .24, p < .01$ for the frequency of the use of hardware technology; $r = -.17, p < .05$ for the complexity of the use of hardware technology). The results suggest that the more EFL teachers' colleagues support them in using technology, the more frequency of their use of technology and the more complex hardware technology they will use in teaching. However, the strengths of these relationships were from small to moderate. Therefore, the predictions of the dependent variables made from these variables should be interpreted carefully.

Table 4.18.
Correlations Between EFL Teacher's Perception of Colleagues' Support in Using Technology and Their Frequency and Complexity of the Use of Technology

	n	*r*	*p*
Frequency of use			
Software	170	.18*	.02
Hardware	179	.24**	.001
Complexity used			
Software	179	-.14	.06
Hardware	179	-.17*	.03

*$p < .05$. **$p < .01$

Perception of Teacher Collaboration in Projects/Teaching Activities

Is there an association between EFL teachers' perception of teacher collaboration in projects/teaching activities and their frequency and complexity of the use of technology in teaching speaking/listening skills?

According to Table 4.19, no significant relationships were found between EFL teachers' perception of teacher collaboration on projects/teaching activities and their frequency and complexity of the use of technology in teaching English speaking/listening skills.

Table 4.19.
Correlations Between EFL Taiwanese Instructor's Perception of Teacher Collaboration on Project/Teaching Activities and Their Frequency and Complexity of the Use of Technology

	n	*r*	*p*
Frequency of use			
Software	170	.14	.08
Hardware	179	.12	.10
Complexity used			
Software	179	-.12	.12
Hardware	179	-.01	.91

$^{*}p < .05$. $^{**}p < .01$

Research Question 4

Is there a combination of EFL teachers' characteristics and their institutional support/constraint that predicts the frequency and complexity of technology use in teaching English speaking/listening skills?

Data Screening Before Analysis

A Simultaneous Multiple Regression was performed for the relationships among 4 dependent variables and 12 independent variables. SPSS REGRESSION was used with an assist from SPSS FREQUENCY for evaluation of the assumptions.

Ratio of Cases to Independent Variables

With 181 respondents and 12 independent variables (IVs) in this research, the cases-to-IV ratio is 15:1. According to Stevens (1996), "for social science research, about 15 subjects per predictor are needed for a reliable equation". Also, Tabachnick and Fidell (1996) give a formula for calculating sample size requirements: $N > 50 + 8m$ (m = number of independent variables). Therefore, the ratio of the cases to IVs in this research fulfills the minimum requirements for regression.

Normality, Linearity, Homoscedasticity, and the Independence of Residuals

The researcher inspected the residuals scatterplot and the normal probability plot of the regression standardized residuals in order to confirm the normality, linearity, homoscedasticity, and independence of residuals. The points lie in a reasonably straight diagonal line from bottom left to top right. In the Scatterplot of the standardized residuals, the residuals were roughly rectangularly distributed, with most of the scores concentrated in the center. In addition to these inspections, histograms of the standardized or studentized residuals were normally distributed rather than highly skewed or inflated. Thus, the assumptions of normality, linearity, homoscedasticity, and independence of residuals are confirmed.

Multicollinearity

Usually, the predictor variables at least show some relationship with the dependent variable ($r > .3$, preferably). But when there are high intercorrelations among the predictors ($r = .7$ or above), the problem is referred to as multicollinearity. Tabachnick and Fidell (1996, p. 86) suggest that researchers need to "think carefully before including two variables with a bivariate correlation of, say, .7 or more in the same

analysis". In this research, even though some of the correlations between the independent variables indicate a moderate to high correlation, the bivariate correlations do not exceed .7. Therefore, the assumption of multicollinearity is fulfilled.

Table 4.20 displays the mean and standard deviation of each predictor variable. Hours of formal computer training had the largest standard deviation among these predictor variables.

Table 4.20.
Means and Standard Deviations of Predictor Variables

Variable	M	SD
1. Years of teaching	9.8	7.4
2. Teaching Hrs/ week	13.4	4.6
3. Years of computer use in teaching	4.1	3.8
4. Hours of formal computer training	6.7	13.8
5. Freq. of computer use for non-teaching activities	3.7	0.6
6. Freq. of computer use for preparing teaching	3.2	0.9
7. Freq. of computer use in the classroom	1.8	1.3
8. Freq. of computer use in the lab	0.19	1.3
9. Workload	3.4	1.2
10. Technical support	3.3	1.1
11. Colleagues' support in using technology	3.5	1.0
12. Teacher collaboration on projects/teaching activities	2.9	1.0

Data Analysis Using Multiple Regression

A Simultaneous Multiple Regression method was selected to inspect the multiple regression of the frequency and complexity of the use of technology and 12 predictor variables. Table 4.21 displays the correlation matrix of the four dependent variables and 12 independent variables. Eighteen correlations were found to be significantly different from zero.

Table 4.21.
Intercorrelations between EFL Teachers' Frequency and Complexity of the Use of Technology and Predictor Variables (N=181)

Predictor Variables	Frequency of Use		Complexity of Use	
	Software	Hardware	Software	Hardware
1.Years of teaching	-.08	-.15*	-.02	.04
2.Teaching Hrs/ week	-.04	-.05	.01	-.00
3.Years of computer use in teaching	.09	.08	.15*	.13
4.Formal computer training	.07	.13	.03	.08
5.Freq. of computer use for non-teaching activities	-.04	-.01	.12	.19*
6.Freq. of computer use for preparing teaching materials	.05	-.05	.39**	.31**
7.Freq. of computer use in the classroom	.32**	.37**	.21**	.17**
8.Freq. of computer use in the lab	.25**	.38**	.16*	.18*
9.Workload	-.11	-.06	.06	.06
10.Technical support	.04	.07	.02	-.02
11.Colleagues' support in using technology	.18*	.24**	-.14	-.17*
12.Teacher collaboration on projects/teaching activities	.14	.12	-.12	-.01

Multiple Regression Results: Frequency of the Use of Software Technology

A Simultaneous Multiple Regression was conducted to determine the best linear combination of the 12 independent variables. Table 4.20 displays the means, standard deviations while Table 4.22 shows the unstandardized coefficients, standard error of unstandardized coefficients, and beta weights. The combination of 12 independent variables significantly predicted the frequency of the use of software technology, $F(12, 164) = 2.12$, $p < .05$, with only one variable, the frequency of in-class computer use, significantly contributing to the prediction. The beta weights, presented in Table 4.22, suggest that the frequency of EFL teachers' in-class computer use contributed the most to their frequency of the use of software technology, and each of the other variables did not contribute significantly to the prediction. The adjusted R squared value was .093. This

suggests that 9.3% of the variance in EFL Taiwanese teachers' frequency of the use of software technology in teaching was explained by this model. According to Cohen (1988), this is a medium effect.

Table 4.22.
Simultaneous Multiple Regression Analysis Summary for the Frequency of the Use of Software Technology and 12 Predictor Variables

Variable	B	Standard Error	Beta
1.Years of teaching	.000	.015	.001
2.Teaching Hrs/ week	.001	.023	.002
3.Years of computer use in teaching	.001	.030	.002
4.Formal computer training	.000	.008	-.004
5.Freq. of computer use for non-teaching activities	-.087	.177	-.039
6.Freq. of computer use for preparing teaching	-.010	.128	-.007
7.Freq. of computer use in the classroom	.374	.121	.343**
8.Freq. of computer use in the lab	.011	.113	.011
9.Workload	-.055	.091	-.048
10.Technical support	-.157	.110	-.128
11.Colleagues' support in using technology	.272	.145	.195
12.Teacher collaboration on projects/teaching activities	.070	.121	.052

Note. $R = .40$; $R^2 = .16$, adjusted $R^2 = .093$, $F(12, 155) = 2.43$, $p < .01$
*$p < .05$; ** $p < .01$

Multiple Regression Results: the Frequency of the use of Hardware Technology

A Simultaneous Multiple Regression was conducted to find out the best linear combination of predictor variables for the frequency of the use of hardware technology. The unstandardized coefficients, standard error of unstandardized coefficients, and beta weights are displayed in Tables 4.23. The combination of 12 independent variables significantly predicted the frequency of the use of hardware technology, $F(12, 159) = 4.14$, $p < .001$, with two independent variables, the frequency of in-class computer use and the colleagues' support in using technology, significantly contributing to the prediction.

The beta weights suggest that the frequency of Taiwanese EFL teachers' in-class computer use contributed the most to their frequency of the use of hardware technology, and their colleagues' support in using technology contributed almost as much to their frequency of the use of technology. The adjusted *R* squared value was .18, which indicates that 18% of the variance of Taiwanese EFL teachers' frequency of the use of hardware technology in teaching was explained by this model. According to Cohen (1988), this is a large effect.

Table 4.23.
Simultaneous Multiple Regression Analysis Summary for the Frequency of the Use of Hardware Technology and 12 Predictor Variables

Predictor Variables	B	Standard Error	Beta
1. Years of teaching	-.009	.012	-.057
2. Teaching Hrs/ week	-.004	.018	-.017
3. Years of computer use in teaching	.004	.023	.014
4. Formal computer training	.003	.006	.036
5. Freq. of computer use for non-teaching activities	.094	.137	.052
6. Freq. of computer use for preparing teaching	-.112	.099	-.092
7. Freq. of computer use in the classroom	.296	.094	.329**
8. Freq. of computer use in the lab	.092	.088	.104
9. Workload	.027	.071	.028
10. Technical support	-.114	.085	-.113
11. Colleagues' support in using technology	.339	.113	.294**
12. Teacher collaboration on projects/teaching activities	-.019	.094	-.017

Note. $R = .49$; $R^2 = .24$; adjusted $R^2 = .19$, $F(12, 159) = 4.14$, $p < .001$
*$p < .05$; ** $p < .01$

Multiple Regression Results: the Complexity of the Use of Software Technology

A Simultaneous Multipe Regression was conducted to investigate the best linear combination of predictor variables for the complexity of the use of software technology. Again, the unstandardized coefficients, standard error of unstandardized coefficients, and beta weights are displayed in Table 4.24. The combination of 12 independent variables significantly predicted the complexity of the use of software technology, $F(12, 159) =$

4.03, p <.001, with one independent variable, the frequency of using the computer to prepare for teaching, significantly contributed the prediction. The beta weights suggest that the frequency of EFL teachers' use of computers to prepare for teaching materials contributed the most to their complexity of the use of software technology. The adjusted R squared value suggests that 18% of the variance of EFL Taiwanese teachers' complexity of the use of software technology in teaching was explained by this model. According to Cohen (1988), this is large effect.

Table 4.24.
Simultaneous Multiple Regression Analysis Summary for Software Complexity and Predictor Variables

Predictor Variables	B	Standard Error	Beta
1. Years of teaching	.011	.072	.012
2. Teaching Hrs/ week	.089	.111	.059
3. Years of computer use in teaching	.117	.143	.064
4. Formal computer training	.021	.036	.042
5. Freq. of computer use for non-teaching activities	-.298	.838	-.027
6. Freq. of computer use for preparing teaching	2.976	.605	.400**
7. Freq. of computer use in the classroom	.064	.574	.012
8. Freq. of computer use in the lab	.827	.537	.154
9. Workload	.453	.431	.079
10. Technical support	.458	.522	.079
11. Colleagues' support in using technology	-.089	.690	-.013
12. Teacher collaboration on projects/teaching activities	-.706	.573	-.104

Note. R = .48; R^2= .23; adjusted R^2= .18, $F(12, 159)$= 4.03, p <.001
*p <.05; ** p <.01

Multiple Regression Results: the Complexity of the Use of Hardware Technology

Based on the results of a Simultaneous Multiple Regression, the unstandardized coefficients, standard error of unstandardized coefficients, and beta weights are listed in Table 4.25. The combination of 12 independent variables significantly predicted the complexity of the use of hardware technology, $F(12, 159)$= 3.13, p <.01, with two

independent variables, the frequency of using computer for preparing teaching and the frequency of using computers in the lab, significantly contributed to the prediction.

Table 4.25.
Simultaneous Multiple Regression Analysis Summary for Hardware Complexity and Predictor Variables

Predictor Variables	B	Standard Error	Beta
1.Years of teaching	.049	.043	.092
2.Teaching Hrs/ week	.043	.066	.049
3.Years of computer use in teaching	.023	.085	.022
4.Formal computer training	.023	.021	.079
5.Freq. of computer use for non-teaching activities	.059	.498	.009
6.Freq. of computer use for preparing teaching	1.196	.359	.278**
7.Freq. of computer use in the classroom	-.109	.341	-.034
8.Freq. of computer use in the lab	.791	.319	.255*
9.Workload	.261	.256	.079
10.Technical support	.168	.310	.047
11.Colleagues' support in using technology	-.646	.409	-.159
12.Teacher collaboration on projects/teaching activities	.313	.340	.080

Note. $R = .44$; $R^2 = .19$; adjusted $R^2 = .13$, $F(12, 159) = 3.13$, $p < .01$
*$p < .05$; ** $p < .01$

The beta weights, presented in Table 4.25, suggest that the frequency of EFL teachers' using computers for preparing teaching materials contributed the most to their complexity of the use of software technology while the frequency of using computers in the lab contributed almost as greatly. The adjusted *R* squared value (.13) suggests 13% of the variance of EFL Taiwanese teachers' complexity of the use of hardware technology in teaching was explained by this model. According to Cohen (1988), this is a medium to large effect.

Additional Findings

In addition to the answers to the major research questions, other significant correlations among predictor variables were also found. Table 4.26 displays the

intercorrelations among 12 independent variables. The aspects of the findings that relate to EFL teachers' personal characteristics are the followings. First, EFL instructors, who have more years of teaching, have more years of computer use in teaching ($r = .28, p < .01$) and use computers less frequently in the classroom ($r = -.22, p < .01$) and in the lab ($r = -.19, p < .05$). It implies that teachers who have fewer years of teaching tend to use computers more frequently than those who have taught longer in the profession.

Table 4.26.
Intercorrelations between Predictor Variables (N=181)

	2	3	4	5	6	7	8	9	10	11	12
1	-.10	.28**	-.07	.00	-.02	-.22**	-.19**	-.02	-.01	-.02	-.03
2	-	.01	-.04	-.08	-.17*	-.04	-.15*	.07	-.03	.08	.03
3		-	-.01	.07	.17*	.23**	.16*	-.10	.15*	.09	.14
4			-	-.01	-.02	.13	.13	-.10	-.05	.09	.09
5				-	.34**	.14	.02	.04	.03	-.23**	-.12
6					-	.30**	.15*	.02	-.04	-.30**	-.12
7						-	.69**	-.08	.11	-.02	.01
8							-	-.11	.09	.08	.10
9								-	-.30**	-.29**	-.22**
10									-	.50**	.34**
11										-	.55**
12											-

Note. Pearson correlation coefficients are displayed. Predictor variables include: 1 = years of teaching; 2 =teaching hr/week; 3= years of using computers in teaching; 4 = annual formal computer training; 5= freq. of using computers for non-teaching activity; 6 =freq. Of using computers to prepare for teaching materials; 7 = freq. Of using computers in the class; 8 =freq. of using computers in the lab; 9 = workload; 10 = technical support; 11= colleague support in using technology; 12 =teacher collaboration on projects/teaching activities.

Second, EFL instructors, who have more hours of teaching per week, use computers less frequently to prepare for teaching materials ($r = -.17, p < .05$) and use computers less frequently in the lab ($r = -.15, p < .05$). Third, EFL instructors, who have

used computers more years in teaching, use computers more frequently to prepare for teaching ($r = .17, p < .05$), more in the classroom ($r = .23, p < .01$) and more in the lab ($r = .16, p < .05$); they also agree more with the statement that their technical support is enough ($r = .15, p < .05$). Fourth, EFL instructors who use computers more to prepare for teaching materials have more years of computer use in teaching($r = .17, p < .05$), use computers more frequently for non-teaching activities ($r = .34, p < .01$), use computers more in the classroom ($r = .30, p < .01$), in the lab($r = .15, p < .05$), and think their colleagues support them less in using technology in teaching($r = -.30, p < .01$). Fifth, those who have more frequency of computer use for non-teaching activities thought they have less colleagues support in using technology ($r = -.23, p < .01$). Sixth, those who use computers more in the classroom also use computers more in the lab ($r = .69, p < .01$).

Additional findings related to EFL teachers' institutional supports/constraints are as follows. First, EFL instructors, who had more formal computer trainings, are more likely to have master's degrees than PhDs. Second, those, who feel they have a less demanding work, agree more with the statement that their institutional technical support is enough ($r = -.30, p < .01$), their colleagues support them more in using technology ($r = -.29, p < .01$), their colleagues collaborate more on project/teaching activities ($r = -.22, p < .01$); and agree less with the statement that their self technical skills is enough ($r = -.18, p < .01$), and the technologies they desired are available ($r = -.26, p < .01$). These negative correlations suggest that lighter workload does increase EFL teachers' perceptions of the collegiality and ongoing support systems in their institute, as well as decreasing their satisfaction on their self technical skills and the availability of their desired technologies in teaching.

Third, EFL teachers who agree more with enough institutional technical support agree more that their colleagues support them in using technology ($r = .50, p < .01$) and that their colleagues collaborate on projects/teaching activities ($r = .34, p < .01$). Fourth, EFL teachers, who agree more with the statement that their colleagues support them, agree more with the statement that their colleagues collaborate on projects/teaching activities ($r = .55, p < .01$). These correlations suggest that EFL teachers' perceptions of institutional technical support, colleague support, and teacher collaboration on project/teaching activities intercorrelate with one another. Even though institutional technical support and teachers' collaboration on projects/teaching activities do not significantly predict the four dependent variables, they do have certain influence on increasing the levels of colleagues' support in the institute.

Summary

The participants in this study were mostly experienced female instructors who are on average 41 years old and had ten years of teaching experience. Nearly two-thirds of them had master's degrees, while over one-third of them had doctoral degrees. Although their average length of computer use barely exceeded 4 years, they tended to be frequent computer users. In general, they used computers more for personal reasons than for teaching. However, more than half of them never had any formal computer training in the past year. Their annual average formal training hours were less than 7 hours, while their actual teaching hours per week were less than 14 hours. As the results suggested, their perceptions of workload varied and did not reveal a strong tendency to disagree or agree with having a heavy workload. Such varied opinions were also found among other predictor variables, such as EFL teachers' perceptions of institutional technical support,

teachers' collaboration on projects/teaching activities, self-perceptions of technical skills, and the availability of desired technologies. Only a stronger tendency was found from their perceptions of their colleague's support. Sixty percent of the subjects agreed or strongly agreed with the statement that their colleagues supported them in using technology.

The results of Research Question 1 indicate that hardware technologies were felt to be more available in their institutes than software technologies. For the frequency of technology use, EFL Taiwanese instructors used hardware technologies slightly more often than software technologies in their teaching English speaking/listening skills. For the complexity of their use of technology, both of the complexity scores of software and hardware technologies were similar and toward the easier end. EFL teachers in Taiwan tended to use easier technologies and used slightly more complex software than hardware technology in their teaching English speaking and listening skills.

Table 4.27 lists 13 significant relationships found among independent and dependent variables. These significant relationships indicate that (a) the more computer use in the classroom or in the lab, the more frequently the use of software as well as hardware technology EFL teachers had in their teaching; (b) the more EFL teachers' years of teaching, the less frequency of the use of hardware technology they had in teaching; (c) the more EFL teachers' computer use in the classroom or in the lab, to prepare for teaching, and the longer they had used the computer in teaching, the more complex software technology they used in teaching; (d) the more computer use in the classroom or in the lab, for non-teaching activities, and to prepare for teaching, the more complex hardware technology EFL teachers used in teaching. Even though the

relationships were found significantly different from zero, some of their effect sizes were small. This reminds us that, when the results were generalized to a larger population, more caution should be made on interpreting the strength of these relationships.

Table 4.27.
Significant Relationships Found between EFL Taiwanese Instructors' Personal Characteristics and the Dependent Variables

Dependent variables	EFL Taiwanese instructors' personal characteristics	*Effect size*
Frequency use of software	Computer use in the classroom	M
	Computer use in the lab	SM
Frequency use of hardware	Computer use in the classroom	M
	Computer use in the lab	M
	Years of teaching	S
Complexity of the use of software	Computer use for preparing teaching	M
	Computer use in the classroom	SM
	Computer use in the lab	S
	Years of computer use in teaching	S
Complexity of the use of hardware	Computer use for non-teaching activities	SM
	Computer use for preparing teaching	M
	Computer use in the classroom	SM
	Computer use in the lab	SM

Note. The effect size was based on Cohen (1988). For example, S =small; SM =small to medium; M = medium; ML =medium to large; L = large.

Table 4.28 displays three significant relationships found from the results in Research Question 3. In general, the higher perception of EFL teachers' colleagues' support in using technology, the more frequency of their use of software and hardware technologies, as well as more complex hardware technology they used in teaching. Effect sizes calculated were small to moderate and, therefore, not much variance of the dependent variables can be explained by their colleagues' support in using technology. More conservative interpretation should be made for the strength of these relationships.

Table 4.28.
The Significant Relationships Found between EFL Taiwanese Instructors' Institutional Support/Constraints and the Dependent Variables

Dependent variables	Institutional supports/constraints	*Effect size*
Frequency use of software	Colleagues' support in using technology	SM
Frequency use of hardware	Colleague support in using technology	SM
Complexity use of hardware	Colleague support in using technology	SM

Note. The effect size was based on Cohen (1988). For example, S =small; SM =small to medium; M = medium; ML =medium to large; L = large.

Table 4.29 displays significant predictors for each of four dependent variables using simultaneous multiple regression. R squared values indicate that the model selected did significantly predict all of the four dependent variables.

Table 4.29.
Significant Predictors for Each of Four Dependent Variables Using Simultaneous Multiple Regression

Dependent Variable Significant predictor	Beta	Model R^2
Frequency of software technology use		.09
Computer use in the classroom	.34**	
Frequency of hardware technology use		.19
Computer use in the classroom	.33**	
Colleagues' support in using technology	.29**	
Complexity of the use of software technology		.18
Computer use for preparing teaching materials	.40**	
Complexity of the use of hardware technology		.13
Computer use for preparing teaching materials	.28*	
Computer use in the lab	.26*	

To sum up the results of the research questions, EFL teachers' personal characteristics do predict their frequency and complexity of technology use, especially their computer use in the classroom or in the lab, computer use for preparing teaching

materials, computer use for non-teaching activities, their years of computer use in teaching, and their years of teaching. For factors related to institutional supports/constraints, only their perceptions of colleagues' support in using technologies stands out to significantly predict EFL teachers' technology use. In general, the model selected by the researcher significantly predicts all four dependent variables.

CHAPTER 5: DISCUSSION AND CONCLUSION

This chapter presents a discussion and a conclusion based on the major findings in Chapter 4. The discussion reveals different aspects of findings that agree or disagree with the literature. At the end, the researcher concludes the results with implications and recommendations for future research.

Discussion

Availability, Frequency, and Complexity of the Use of Technology

Several researchers claimed that lack of equipment and appropriate software were the deterrents to teachers' use of technology in teaching (Al Mubireek, 2001; Flagg, 1991; Huntington, 1997; Rath & Rieck, 1997;). It is believed that well-equipped schools usually have advantages in providing students with more interests in learning. Recently, increased commitment and assistance from government and policy makers have been pervasive in helping teachers integrate technology into their curricula. In this study, more than half of the participants said that 20 out of 26 hardware technologies were available in their institutes. However, only 9 of 16 software technologies were said to be available to more than half of the participants. The results point out the fact that hardware technology tends to be more available than software technology. This indicates unbalanced purchasing plans between software and hardware technologies. EFL instructors may have failed to use a software technology merely because of its unavailability or the unfamiliarity of the technology (on average, 23% of the teachers claimed they "don't know" about the technology availability and another 23% said the

technologies were "not available" in the institute). Nevertheless, when we compared the frequency of use of software and hardware technology, there was no significant difference between their software and hardware frequency use. Apparently, other factors may have contributed to the relatively low frequency use of technology.

This study was not designed to inspect the relationships between the availability of technology use and the frequency of technology use nor the relationships between the availability and complexity of technology use. Instead, the analysis focused only on those technologies, which more than 50% of the participants indicated to be available in their institutes. Even though most of these hardware technologies were available to more than 80% of the participants, EFL teachers used these hardware technologies only moderately (M = 3.2 on a 0 to 6 Likert scale). They not only use software technologies less than expected (M = 2.5 on a 0 to 6 Likert scale), but also tend to use easier software and hardware technologies in teaching (M = 16.7 for software technology, and M = 14.8 for hardware technology in a 0 to 100 scale). In other words, there are opportunities for EFL instructors to increase the frequency and complexity of technology use. However, this does not imply that higher frequency or complexity of technology use will improve student performance. More research is required to answer this question.

Lack of updated knowledge of advanced technologies from administrators who were responsible for the purchasing plans may be one of the reasons for such a discrepancy between the availability of software and hardware technologies. It might be beneficial for administrators or program designers to reevaluate budget planning for purchasing different types of technologies, as well as understanding teachers' preferences in using different types of technologies. Seemingly, more technology training and

teaching innovation programs should be encouraged not only for staff and instructors, but should also be given to administrators and policy makers.

EFL Teachers' Personal Characteristics

Technology innovation in ESL/EFL language teaching and learning has mushroomed for several decades. Until recently, advanced computer technologies prevailed. The literature continues to give proof of the gradually increasing demands of computer literacy for the workplace, as well as for teaching (Warschauer, 1999; Reiser 2001). In fact, the roles of teachers and students have been challenged because of the advanced technologies created in society (Miller, Martineau, & Clark, 2000). It seems that the force of the changes originated on the outside rather than the inside of the EFL profession. ESL/EFL teachers were invited to reexamine the way they teach and, thus, conformed to the trend of implementing technology into their teaching instead of proactively directing such educational reform. Changes in terms of technology innovation in teaching turned out to be a responsibility rather than a by-product. The following discussion will explore two categories of the changing factors; i.e., teachers' characteristics and the teaching/learning environment.

Age, Gender, Education Completed, and Years of Teaching

The general characteristics of the subjects of this study can be described in the following statements: they are instructors with an average age of 41 years; nearly two thirds of them were female; more than half of them have master's degrees, while 39% of them have doctoral degrees; and their average length of teaching was 10 years. Based on the results of the correlation matrix, several associations related to age, gender, education completed, and years of teaching were found: (1) older EFL teachers tend to have longer

years of computer use in teaching, but have less frequency of using hardware technologies and spend less time using computers in the classroom or in the lab; (2) female EFL teachers use hardware technology more frequently than male teachers and they have fewer years of computer use in teaching; (3) the longer EFL instructors teach, the less they use hardware technologies, and they use computers in the classroom or in the lab less frequently; (4) EFL teachers with doctoral degrees tend to feel that their teaching workloads are heavy, but they have fewer hours of teaching per week, fewer hours of formal computer training, less colleagues' support and less collaboration on project/teaching activities. However, EFL teachers with doctoral degrees use computers more frequently for non-teaching activities and the preparation of teaching materials.

Such information may assist administrators and program designers in improving the effectiveness of their decisions on future professional development programs. For example, when tackling the problem of lower frequency use of technology, the priority group for participating in a professional development program may fall on older male doctoral instructors. Based on these results, male instructors may need more training in using hardware technologies than female instructors. More colleagues' support and teachers' collaboration on projects/teaching activities may need to be encouraged among doctoral instructors. However, these results do not imply that older male doctoral instructors were obsolete in the way they teach. Instead, more integration among different methodologies and advanced technologies may rely on these experienced instructors' insights and contribution to improve the quality of younger teachers' instruction. Besides, this study focuses on teaching of speaking/listening skills. Research related to different subject matters may reflect different aspects of needs and,

therefore, require more research to define the relationships. Nevertheless, respect for the expertise of these experienced instructors and also appreciation for the technical skills of young novice teachers is recommended. Corporation among instructors who have strength in different areas of expertise is important as well. Program leaders or policy makers may consider switching the focus from program management to the art of leadership through partnership, which requires more involvement from teachers and ensures the highest quality of instruction.

Significant Correlations Discovered From the Research Questions

Results of the significant associations between the frequency of the use of technology and EFL teachers' personal characteristics suggest that EFL teachers' computer use in the classroom and in the lab significantly correlate with the frequency of their use of software and hardware technology (see Figures 5.1 and 5.2). This implies that the locations where EFL teachers use computers may give insight into why they use technology in teaching. Factors that significantly correlate with their frequency of computer use in the classroom and in the lab may need to be inspected further. In Table 4.26, significant intercorrelations suggest that fewer years of teaching, more years of computer use in teaching, and more hours of annual formal computer training significantly correlate with EFL teachers' frequent computer use in the classroom and in the lab. Even though these correlations may not directly reflect cause and result relationships, these predictor variables might be worth to reexamine when assigning regulated professional development programs or training to teachers with different personal characteristics.

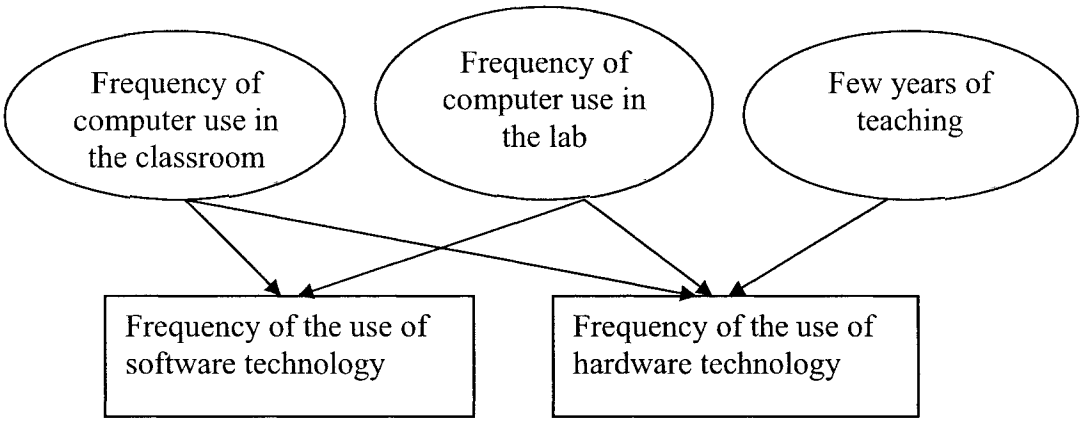

Figure 5.1. Diagram of significant correlations between EFL teachers' personal characteristics and frequency of technology use.

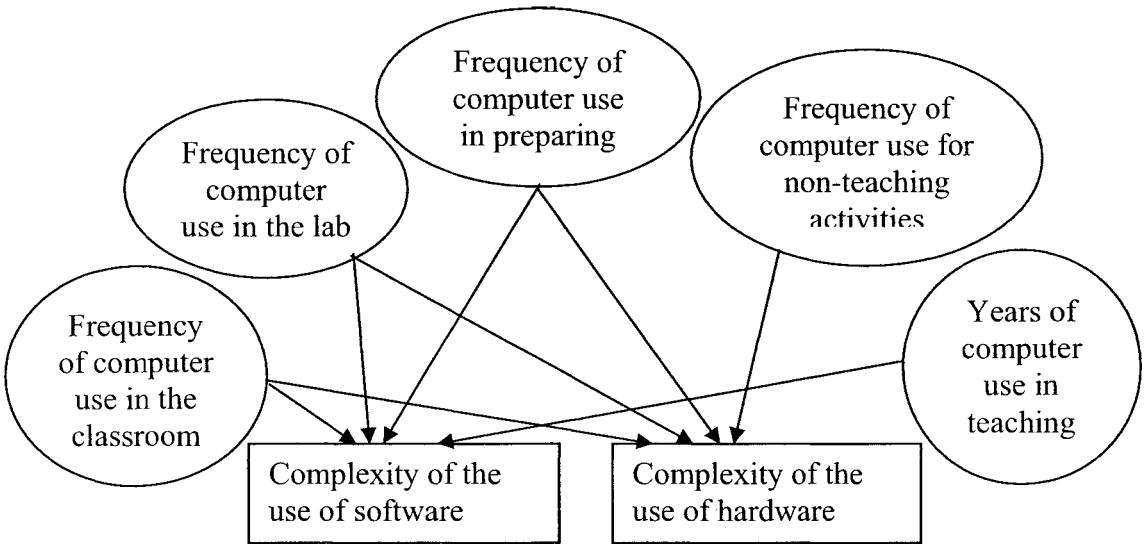

Figure 5.2. Diagram of significant correlations between EFL teachers' personal characteristics and complexity of technology use.

At the same time, more computer use for non-teaching activities and more computer use for preparing teaching materials significantly correlate with EFL teachers' computer use in the classroom but not with that in the lab. Program designers might need to observe what types of non-teaching activities EFL instructors typically do (e.g. using

email for exchanging information or using the internet for research purposes) and then provide appropriate computer training to widen or develop their teaching repertoires. Such inspection may lead to the understanding of possible reasons why some instructors use computers in the classroom or in the lab more often than others. Then, administrators may use such critical information to revise mandates or rules for computer use and training in the future. This way, more of instructors' needs or preferences in using varied types of technology can be discovered.

Even though a significant association between EFL teachers' years of teaching and their frequent use of hardware technology was found in this study, the researcher is careful in interpreting this negative relationship due to its comparatively small effect size (r = -.15). The results of the intercorrelation matrix (Table 4.26) imply that those who recently started EFL teaching tend to have more exposure to technologies and, therefore, have more skills in using computers and use computers more often in the classroom or in the lab. On the other hand, those who have taught longer in the EFL profession may prefer traditional methodologies and are more reluctant to utilize technologies in their teaching.

As shown in Figure 5.2, four significant contributors were found in predicting EFL teachers' complexity of the use of software technology. The more computer use in preparing teaching materials, computer use in the classroom, computer use in the lab, and more years of computer use in teaching, the more complex software technologies EFL teachers will use in their teaching. Four slightly different personal characteristics (i.e., computer use for non-teaching activities, computer use to prepare for teaching materials, computer use in the classroom, and computer use in the lab) were found to significantly

correlate with EFL teachers' complexity of hardware technology use. Among these personal characteristics, the frequency of computer use in preparing teaching materials had the largest effect sizes: $r = .39$ for software complexity and $r = .31$ for hardware complexity. Other significant predictors' effect sizes were small and under .21. As the results in Table 4.26 indicate, fewer years of using computers in teaching, and more frequent computer use for non-teaching activities significantly correlate with EFL teachers' frequency of computer use in preparing teaching materials. Even though increasing complexity of the use of technology does not definitely suggest the increase of instruction productivity, yet if increasing the complexity of the use of technology is the goal, these factors should be considered before giving professional development training or providing resources for EFL teachers.

In general, software technologies require more time and effort from users to master the varied functions, while hardware technologies are usually more user friendly, but require more effort to maintain and keep up to date. The time spent in using computers to prepare teaching materials suggests that teachers tend to put significant effort into improving his/her instruction. The purpose is to provide varied ways of feedback that is capable of addressing the needs of different types of students. Additional investigations are necessary to develop methods to encourage EFL instructors to spent more time using computers to prepare teaching materials.

Institutional Supports/Constraints

In terms of institutional supports/constraints, EFL teachers' perception of colleagues' support was the only variable that significantly correlated with the frequency of the use of both types of technology and the complexity of the use of hardware

technology. No variables that related to institutional support/constraints were found to significantly correlate with EFL teachers' complexity of the use of software technology. Figure 5.3 displays the significant correlations with arrows. The following discussion will focus on each variable that is related to institutional supports/constraints based on the intercorrelation matrix, Table 4.26.

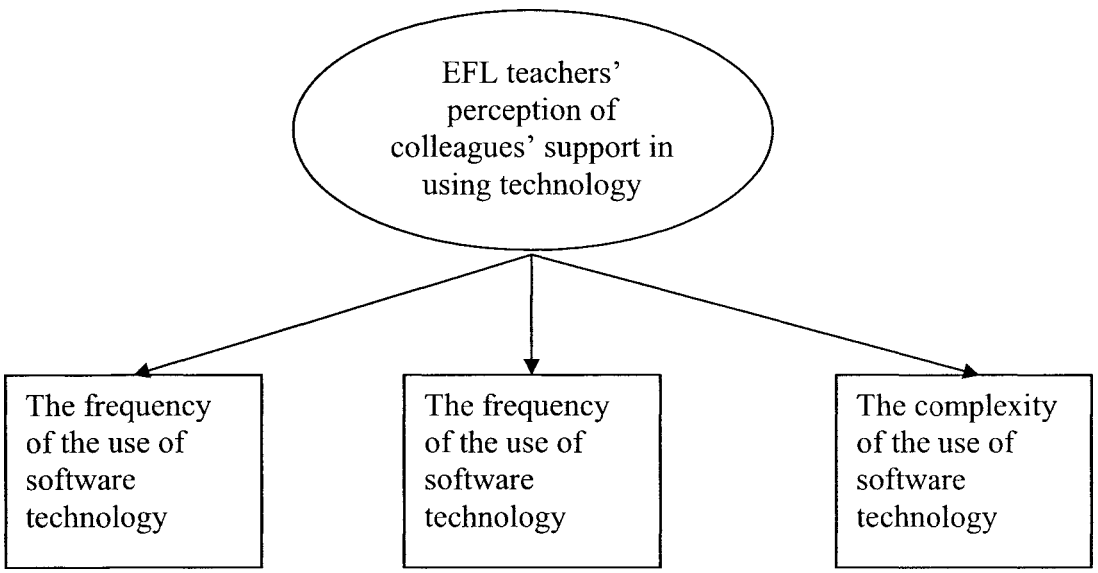

Figure 5.3. Significant correlations between EFL teachers' perception of colleagues' support in using technology and the dependent variables.

Formal Computer Training

Formal computer training was recognized in the literature as one of the support systems to improve teachers' use of new teaching strategies. However, not much monetary support has been provided for teachers' professional development programs (Electronic Learning Survey, 1995). In the literature, many teachers complain about their lack of systematic exposure to, or integration of, technology in teacher education

programs (Faison, 1996). In this study, similar results were found: more than 55% of the participants said that they never had formal computer training in the past two years. In addition, there was no significant relationship between EFL teachers' hours of formal computer training and any independent variables (except for the frequency of computer use in the classroom and in the lab) or the four dependent variables.

In Prunel and Hill's (1992) estimates of time spent in receiving instruction for reform, they contend that to merely learn the theory, teachers need 20 to 30 hours of instruction. They estimate that "teachers require 15 to 20 classroom demonstrations and 10 to 15 coaching sessions before mastering the technique". They also suggest "the more successful schools used 50 days a year of external assistance for training, coaching, and capacity building" (p.2). In this study, seven hours of formal computer training for EFL Taiwanese instructors is far removed from the required time for mastery. Therefore, it is imperative that EFL teachers' hours of formal computer training be increased for improved integration among varied technologies into their curriculum.

Time and Workload

Time has been recognized as the biggest barrier for teachers to implement innovative programs (Adam, 1990; Millett, 2002; O'Neil, 1995; Prunell & Hill, 1992). It is argued that heavier workload or lack of time affects the implementation of technology in teaching (Darling-Hammond, 1995; Heape, 1990; Rogers, 1995). EFL teachers in this study teach less than 14 hours per week on average, and their perception of heavy workloads was moderate (M = 3.4 in a 0 to 6 Likert scale). Nearly the same number of people either agreed or disagreed with the statement that their workload was heavy. In addition, when compared with the required teaching hours in post secondary institutes in

Taiwan (i.e., approximately 12 hours per week for instructors who have master's degrees), EFL teachers' average workload was not too heavy and, therefore, probably had no influence on their technology use. Obviously, the results did not correspond to the theories presented in the literature.

Nevertheless, frequency and complexity of the use of technology did not reflect the expected usage. Neither EFL intructors' teaching hours per week nor their perception of their workload significantly predicted any of the four dependent variables. These results imply that, instead of being overloaded with teaching, EFL teachers at post secondary institutes in Taiwan may spend a certain amount of their time in research or other non-teaching activities. However, the results of the intercorrelations (Table 4.26) suggest that those who thought having less workload do agree that they have more institutional technical support, more colleagues' support in using technology, and more teacher collaboration on projects/teaching activities. These results seem to support the theories in the literature. More studies need to be performed before interpreting such discrepancies from findings in the literature.

Colleagues' Support

Ongoing support systems have been proven to be critical for a successful integration of technology into teaching (Alexander, 1997; Flagg, 1990; Ham, 1997; Maddox, 1997; Mason, 1987; Rogers, 1995; Siegel, 1994b). Equipment breakdown and computer configuration delays could hinder teachers' intentions to use technology in their instructions. Instant support from either colleagues or their institutes has the potential to increase teachers' implementation of technology into their instruction. In Little's (1982) study, two norms were evident in the successful schools: a norm of collegiality and a

norm of continuous improvement. In the age of advanced technologies created every now and then, teachers may not be competent in using all types of technology. At the same time, not all types of technology contribute to the success of language teaching. Especially, more chances than before that teachers face students who actually use more advanced technologies in their learning than the technologies teachers use in their teaching. Integrating technology into teaching in such situations may cause difficulties when the instructor relies on a teacher-centered style of instruction. Therefore, to improve the productivity of instruction in today's modern world, collegiality among teachers appears to be critical.

In the findings of this study, EFL teachers' perceptions of their colleagues' support in using technology significantly correlated with three of the four dependent variables, except for the complexity of the use of software technology. The findings correspond to the theory in the literature. However, two surprising results were found; the higher colleagues' support was in using technology, the less complex was software and hardware technology use by EFL teachers in teaching (see Table 4.21). In theory, more collegiality should assist teachers in using more complex technologies in teaching. Although in this study, the results indicated an opposite direction that with more colleagues' support, teachers utilized easier technologies in teaching. Such observations lead to the question whether EFL teachers prefer the use more complex technology in teaching English listening/speaking skills. Research related to the complexity of technology use has not been fully examined yet, and, therefore, may require more investigations in the future.

Institutional Technical Support

One of the support systems is EFL teachers' institutional technical support. Ham (1997) and Maddox (1997) found the value of adequate technical support: instructors using technologies in teaching usually need to restructure their traditional way of instruction by consulting an engineer. They need instant assistance for troubleshooting and becoming familiar with the network. Nevertheless, no significant correlation in this study was found between EFL teachers' institutional technical support and the dependent variables. All of the correlation coefficients between EFL teachers' institutional technical support and the four dependent variables were extremely low.

Even though institutional technical support did not predict EFL teachers' frequency and complexity of technology use, it strongly predicted their colleagues' support in using technology ($r = .50$), and their colleagues' collaboration on project or teaching activities ($r = .34$). These results imply that EFL teachers do not use more complex technology merely because institutional technical support is present. Instead, it suggests that they prefer colleagues' support in their use of technology in teaching, and, therefore, will use technology more frequently but use less complex technologies. Again, the results remind us to investigate whether EFL teachers believe that more complex technologies definitely benefit the teaching of English speaking/listening skills. More research needs to be conducted before concluding the advantages of higher complexity of technology use in teaching.

Colleagues' Collaboration on Projects/Teaching Activities

According to the results of this study, there was no significant relationship between the colleagues' collaboration on projects/teaching activities and four dependent

variables. However, a strong correlation was found between EFL teachers' perception of their colleagues' support in using technology and their perception of colleagues' collaboration on projects or teaching activities ($r = .55$). This result implies that those who collaborate on projects or teaching activities do not always use technologies more frequently or use more complex technologies, but their colleagues assist them in using technology in teaching. To promote more collegiality among instructors, administrators might consider providing more chances and resources for EFL teachers to collaborate and support one another in their use of technology in teaching.

Analysis of Multiple Regression

The Model Developed for Predicting Dependent Variables

Based on the findings of the literature and the researcher's personal teaching experiences, the researcher developed a model, composed of 12 independent variables, for predicting EFL teachers' use of technology. There are two major categories of the model: (a) EFL instructors' personal characteristics, and (b) their institutional supports/constraints. Figure 5.4 displays the model for predicting EFL teachers' frequency and complexity of technology use that was tested with the data from the present study.

The Results of the Simultaneous Multiple Regression

The results of four simultaneous multiple regressions indicate that the model in Figure 5.4 significantly predicts the frequency and complexity of the use of software and hardware technologies. The predictor variables that significantly contribute the variability of the dependent variables are listed in Table 4.29. In general, the model developed shows the ability to predict EFL teachers' use of technology. Therefore, this

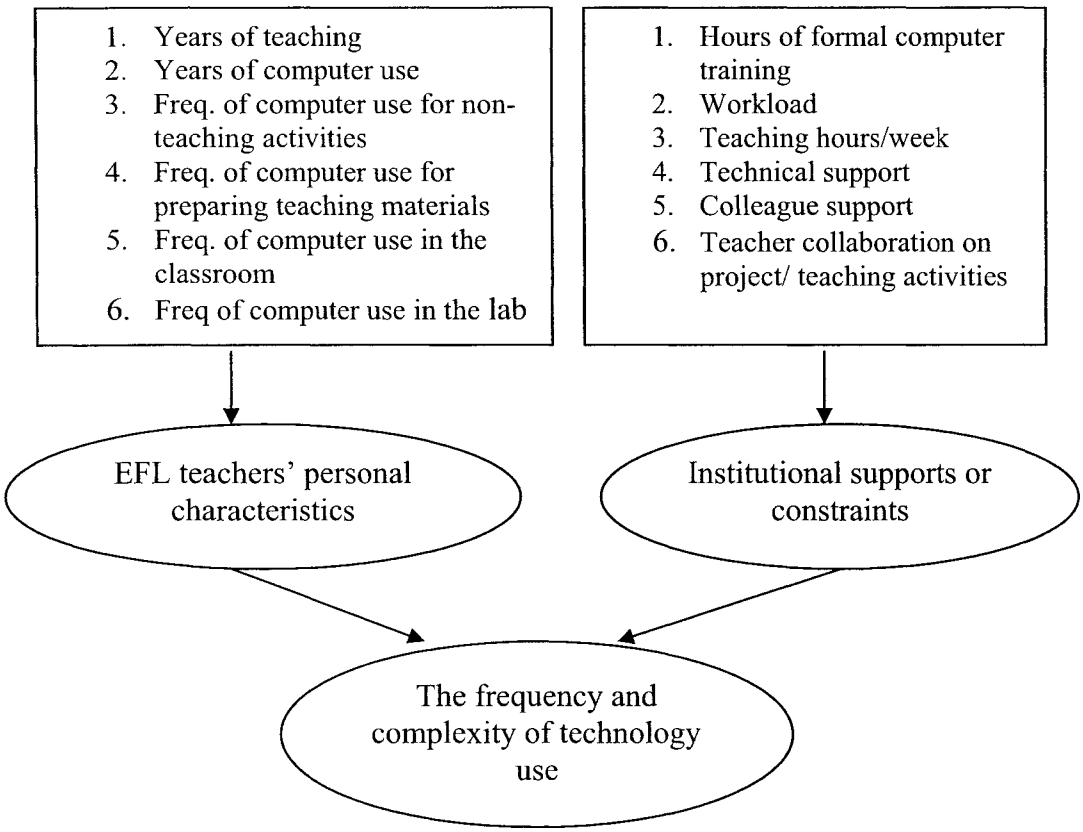

Figure 5.4. The model for predicting EFL teachers' use of technology.

questionnaire can be used for understanding EFL instructors' technology use in teaching in terms of frequency and complexity. In addition, administrators and program designers can appropriately select the content and choose the appropriate participants for future EFL instructors' professional development programs.

Conclusion

Technology innovations are broadly used in many teaching areas. Commitment and effort from government and administrators are pervasive in teachers' professional development programs. However, how teachers' professional development curricula related to the use of technology can be made effective is not clear. Even though most of

the post secondary institutes in Taiwan have provided medium to high levels of technology, EFL instructors still use technologies less frequently than expected. This study intended to investigate the reasons of this observation and to give a clear picture of the varied factors that are critical for the success of future professional development programs. In this study, the researcher found that EFL teachers use easier technologies and use technologies less frequently than expected. Technology availability was unbalanced, with software less available than hardware technologies. Such imbalance requires attention to the expenses made for each type of technology. Program designers or administrators may need to put aside their own perspectives and elicit more information from EFL teachers. It is possible that mandates and rules of using technology in the institute are not appropriate for current EFL instructors. Administrators may need to consider changes of these regulations in terms of their appropriateness, effectiveness, and consistency.

It is also beneficial for administrators to perform their leadership through partnership with EFL instructors. Technologies are created for human activities and used by people. Inviting EFL teachers to get involved in the decision making process could be a wise strategy to improve the quality of budget planning and institutional regulations. Merely considering technology availability may not tackle the major problems or increase EFL teachers' frequency use of technology in teaching as well as students' performance. More aspects of the teaching and learning exchange process should be evaluated. For example, EFL teachers' attitudes toward the availability of different kinds of technology, students' perspectives toward the use of technologies, as well as the accessibility of technology for both the instructor and the students in the institute, may

give insight into how technologies could be provided in the future. Factors, such as class size and number of computer labs, may also need to be reexamined before revising the rules and regulations.

Personal Characteristics

Technology is created for people and should be used concerning individual's preferences or needs. In this study, EFL teachers' personal characteristics do influence the frequency and complexity of the use of technology. The locations where EFL teachers use technologies in teaching significantly influence the frequency and complexity of EFL teachers' technology use. Naturally, every arrangement or regulation made for teachers in the classroom and in the lab should be inspected and discussed fully. As mentioned above, class size, the number of labs available, and how the resources are scheduled for use are all related to EFL teachers' use of technology. More careful arrangements need to be based on teachers' attitudes and preferences. Future professional development programs need to address the needs and preferences of instructors who had taught a long time at their institute. It is beneficial for more experienced instructors to coordinate with novice teachers in exchanging methods and experiences in terms of the integration of different types of technology into their teaching. Since computer use in the classroom and the frequency of computer use in the lab were two of the significant predictors of the dependent variables in this study, future research may investigate what factors influence EFL teacher's frequency of technology use in the classroom and in the lab.

Using computers to prepare teaching materials is the largest contributor in predicting the complexity of the use of technology. The word complexity implies that

more time is required from teachers to process the content, the technologies used, and the curriculum design. But more complex technology does not necessarily increase the effectiveness of the instruction. The reasons why some teachers use less complex technologies in teaching need to be studied in the future. Teachers' habits of preparing teaching activities usually signal different teaching styles and their understandings of the relationship between the content and the technology. The possible benefits of using different kinds of technology to prepare for teaching may contain critical information for future teacher education programs. It is important for administrators to carefully observe how EFL teachers use technologies in preparing teaching materials and continue to cultivate a culture of using technologies in preparing teaching materials. Such encouragement of interactions among teachers will expand EFL teachers' teaching repertoire and increase their use of technology in teaching.

Other significant predictors related to personal characteristics include EFL teachers' frequency of computer use for non-teaching activities, their length of computer use, and their frequency of computer use in the classroom and in the lab. The results of this study imply that those who use computers more for non-teaching activities have more skills in varied technologies and are more capable of transferring their computer skills to their teaching. Therefore, these instructors tend to use more complex hardware technologies, but they do not us more complex software technologies. On the other hand, the results imply that those who have used computers longer usually build up more skills in using software technologies in teaching. Administrators may need to understand EFL teachers' habits of using computers for different types of non-teaching activities. Whether the textbook selected is flexible enough to allow instructors implement

technology into the curriculum? Such understandings will help program designers clarify the gap between the skills already mastered and the skills they are required or desire to master. With such verification, future computer training can be more attractive and productive. Thus, the resources in the institute can be utilized in a more effective way.

Institutional Supports/Constraints

According to the results presented here, EFL teachers' perceptions of their colleagues' support had significant correlations with three of the four dependent variables, but not for the complexity of the use of software technology. None of the other institutional supports/constraints had significant correlations with the dependent variables. The results correspond to the literature and suggest the importance of encouraging colleagues' support among EFL teachers. Similar to the results that related to personal characteristics, technologies always require attention to the needs of the people who use them. Merely providing institutional technical support does not increase teachers' frequency and complexity of technology use. Factors involving people, such as colleagues' support in using technology, influence the use of technology in teaching.

The results of this study reveal that different institutional supports and constraints are intertwined to influence the ways EFL teachers use technology in teaching. Administrators may utilize different personal characteristics and institutional support /constraints to create win-win situations. For example, senior doctoral level male instructors may be guided to share their expertise on methodologies and practices based on their comparatively longer teaching experiences, while younger M.A. degree female instructors may contribute their knowledge about hardware technologies in teaching. Those who have more computer training could be arranged as "seed instructors" to

spread the knowledge learned to their colleagues, while instructors who have heavy workloads may share the strategies they use to prepare their courses in terms of time efficiency and content effectiveness. Through such sharing and exchanging of knowledge and experience, EFL teachers may, thus, reveal and reevaluate their ways of teaching. Increased self-monitoring and reflection of new teaching techniques may result in enhanced implementation of technologies in teaching.

Recommendations for Future Research

Technology availability is not equal to technology accessibility. Some schools may provide sufficient types of technology, but the times teachers are allowed to utilize them may be limited. If technologies are not available, or available but not enough time is scheduled for them to be accessed, the methodologies that teachers can select to promote learning are also restricted. As time advances, the availability of technologies will be increased. Future research may choose to investigate the relationship between the *accessibility* of technologies and teachers' frequency and complexity of their use. Professional development programs were suggested for their potential for upgrading and expanding teachers' expertise. Future research may try to answer the following questions. What essential elements should be included in EFL teachers' professional development programs? How are these elements integrated into the curriculum? How do EFL teachers improve the transfer of learned technology into their everyday practices after training? What are EFL teachers' pre and post attitudes toward computer training? What proportion of the budget should be spent in purchasing different kinds of technology, providing formal computer training, hiring technical support, maintaining and updating technologies?

As the current results suggest, colleagues' support in using technologies was recognized as being more critical in predicting technology use than institutional technical support. Future studies may need to focus on additional questions. Do EFL teachers in post-secondary institutes tend to be more independent learners? Do they avoid being assisted in using technologies in teaching? Do they prefer proactive ways of learning new teaching strategies instead of being told what to do? What types of approaches or teaching styles do EFL teachers prefer?

These questions need to be investigated and answers with significant evidence need to be found. Technology is a way of assisting teaching but is not the essence of the teaching and learning process. Teachers need to be equipped with appropriate tools and motivated with heart-felt theories in order to flourish in the art of teaching. Administrators need to put on their garment of leadership with the wisdom of partnership. That is, they should respect teachers' individual characteristics while managing resources productively to provide support instead of building up more constraints to stifle reform.

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Appendix A: Content Validity and Weighing Study

Cover Letter Page 1

Dear XXX ESL instructors,

I am writing to ask your help in developing our study of EFL teachers' use of technology in teaching speaking and listening skills. This study intends to investigate technology use (dependent variable) in teaching speaking/listening skills in Taiwan and its relationship to teachers' demographic characteristics and institutional factors.

It is my understanding that you are a language expert who has knowledge of second language theories as well as experiences in implementing technology in teaching. I believe that you are capable of providing substantial information for my study. Therefore, your opinions will have substantial influence of my research.

Result of the collection of your opinions will be used to verify the validity of the content of my planned survey, which will be given to EFL teachers in Taiwan in year 2004. In order to sort out the ranking of the complexity of the use of technology in second language acquisition, all the answers of the first set of questions from different instructors will be compiled. From this a new list of technology will be developed for you to rate a second time. The added technologies you suggested will be also put together for you to rate them. In other words, I will revisit you and pass the second set of questions after one week.

I appreciate your help in exploring the nature of the use of technology in second language acquisition. Your answer will be completely confidential and be viewed by the researcher only. Thank you for your time and effort in helping me with this important study. After you answering this survey, please seal it and directly mail it back to me. The stamped envelope is ready for you to use.

Sincerely,

Shiaoli Pai

Ph.D. Candidate in Interdisciplinary Program,

Colorado State University, Fort Collins

Cover Letter Page 2

The purpose of this questionnaire is to examine how you use different types of technology in your teaching of speaking/listening skills in the classroom. Your response to this survey will help us determine what types of professional development program can best serve you in the future. You are invited to participate in this research because you are currently teaching English as a foreign language in a college-level institute. This questionnaire includes four parts of questions and will require approximately 20-25 minutes of your time to complete.

Using Hardware Technology in Teaching Speaking/Listening Skills in an ESL Classroom

Instruction: On a complexity continuum from very easy to very difficult, place a mark on the line that best represents your position on the use of each technology when teaching speaking/listening skills in the classroom. Check the box whether you would suggest EFL teachers to use the technology or not.

Example:

Video game	**Very easy** ----------|---------- **Very difficult**	**Yes**	**No**
		☐	☐

Hardware Technology	**How difficult do you think the following technology is to be used in teaching speaking/listening skills?** Very easy ——— Very difficult	**Would you suggest that EFL teachers use this technology in their teaching?** Yes No
1. Overhead projector	VE ——— VD	☐ ☐
2. Audio CD	VE ——— VD	☐ ☐
3. Slides	VE ——— VD	☐ ☐
4. Scanner	VE ——— VD	☐ ☐
5. Digital Camera	VE ——— VD	☐ ☐
6. Printer	VE ——— VD	☐ ☐
7. Personal Digital Assistant	VE ——— VD	☐ ☐

(PDA)		
8. Interactive CD-ROM	VE VD	☐ ☐
9. Tape Recorder	VE VD	☐ ☐
10. Computer	VE VD	☐ ☐
11. Radio	VE VD	☐ ☐
12.Telephone	VE VD	☐ ☐
13. Video Cassette Recorder (VCR)	VE VD	☐ ☐
14. CD-ROM	VE VD	☐ ☐
15. Electronic board (e.g. smart board)	VE VD	☐ ☐
16. Digital Video Device (DVD)	VE VD	☐ ☐
17. Interactive DVD	VE VD	☐ ☐
18. Television	VE VD	☐ ☐
19. Film camera	VE VD	☐ ☐
20. Computer projector	VE VD	☐ ☐
21.Headphones	VE VD	☐ ☐

22.Microphone	VE VD	□ □
23.Camcorder	VE VD	□ □
24.Sound speaker	VE VD	□ □
25.Laser pointer	VE VD	□ □

Can you think of any other technologies that are important in teaching speaking/listening skills? Please indicate in the cells below and put a mark on the line to represent the difficulty you perceive the use of the technology.

Additional ***hardware technologies*** you may suggest EFL teachers to use in their teaching of speaking/listening skills:	How difficult do you think the following technology is when used in teaching speaking/listening skills? Very easy Very difficult
	VE VD
	VE VD
	VE VD

Using Software Technology in Teaching Speaking/Listening Skills in an ESL Classroom

Instruction: On a complexity continuum from very easy to very difficult, place a mark on the line that best represents your position on the use of each technology when teaching speaking/listening skills in the classroom. Check the box whether you would suggest EFL teachers to use the technology or not.

Example:

Video game **Very easy** **Very difficult** **Yes** **No**

----------|---------- ☐ ☐

Software Technology	**How difficult do you think the following technology is to be used in teaching speaking/listening skills?** Very easy Very difficult	**Would you suggest that EFL teachers use this technology in their teaching?**
1. Messenger (e.g. Yahoo messenger)	VE VD	Yes No ☐ ☐
2. Word Processing	VE VD	☐ ☐
3. Presentation software (e.g. Power Point)	VE VD	☐ ☐
4. List serve	VE VD	☐ ☐
5. Chat rooms	VE VD	☐ ☐
6. Electronic text (e.g. electronic newspaper)	VE VD	☐ ☐
7. Interactive discussion board (e.g. WebCT)	VE VD	☐ ☐

9. Concept mapping tool (e.g. Mind mapping)	VE VD	☐	☐
9. Courseware	VE VD	☐	☐
10. Graphic Organizer	VE VD	☐	☐
11. Internet/ WWW	VE VD	☐	☐
12. E-mail	VE VD	☐	☐
13. Computer games	VE VD	☐	☐
14. Online Database	VE VD	☐	☐
15. Research software (e.g. SPSS)	VE VD	☐	☐
16. Authoring tool	VE VD	☐	☐

Can you think of any other technologies that are important in teaching speaking/listening skills? Please indicate in the cells below and put a mark on the line to represent the difficulty you perceive the use of the technology.

Additional ***software technologies*** you may add in addition to the list above:	How difficult do you think the following technology is when used in teaching speaking/listening skills? **Very easy** **Very difficult**
	VE VD
	VE VD
	VE VD

Your comments:

Thank you for your time and effort for answering this survey!!!

Appendix B: Survey Questions

Colorado State University

Pre-notice E-mail

Dear XXX,

My name is Shiaoli Pai, a Ph. D. candidate of Human Resource Development and Education Interdisciplinary program at Colorado State University. I have developed a survey for understanding Taiwanese EFL instructors' use of technology as well as the support/constraints their institutes have provided. Based on my online search, I found that you are one of the EFL instructors in higher education. Therefore, I would like to invite you to participate in my study regarding the use of technology in teaching EFL in Taiwan.

This study intends to provide in-depth insight for curriculum designers for promoting future EFL instructors' professional development training. It also may provide some benefit for you in restructuring your practices in teaching EFL.

The survey is anonymous and no risk will fall on you under any circumstance. A stamped envelope will be attached to the survey questions. A week later from this email, the package will be sent to you. Your participation is voluntary, of course. I appreciate your time and look forward to your response.

If you have any questions, you are welcome to reply to me through E-mail. I would be glad to answer any questions you have. My E-mail address is:

pai@lamar.colostate.edu

Best Regards,

Shiaoli Pai
Co-Investigator, Ph.D. Candidate
School of Education
Colorado State University

Colorado State University

Cover letter

Dear Sirs,

The purpose of this survey, *the relationship of institutional support/constraints and instructors' characteristics to EFL Taiwanese Teachers' use of technology*, is to investigate how Taiwanese EFL teachers use different types of technology in their classrooms in order to provide in-depth insight for administrators or program designers to design curricula for future EFL teachers' professional development programs. In partial fulfillment of the requirements for the Doctoral Degree in Education at Colorado State University, the questionnaire is designed and includes four types of questions: the use of software technology, the use of hardware technology, EFL teachers' demographic information, and their institution's support/constraints for using technology. You may answer the questions by following the instructions preceding each part.

In order to protect your confidentiality, the questionnaire is anonymous. Reports generated from the research will not reveal the identification of individuals, and only aggregate results will be used. There are no known risks and no known benefits to you associated with your participation in this study.

Your assistance is purely voluntary, but your response is important to us. It will help us obtain an accurate picture of Taiwanese EFL teachers' perceptions of their use of technology in teaching speaking/listening skills in the classroom. Your response to this survey will help us determine what types of professional development program can best serve EFL instructors in the future. You are invited to participate in this research because you are currently teaching English as a foreign language in a college-level institute. It will require approximately 12-15 minutes of your time to complete. Please answer each question to the best of your ability and insert it into the stamped envelope and return it by Oct. 10^{th}.

If you have any question or concern, please feel free to reach Mrs. Shiaoli Pai at (04) 24618367 in Taiwan. Thank you for your time and effort to improve the understanding of EFL acquisition. We appreciate for your assistance.

Sincerely,

George A. Morgan, Ph.D.
Principal Investigator, Professor

Shiaoli Pai
Co-Investigator, Ph.D. Candidate
School of Education
Colorado State University

Colorado State University

Follow-up / Thank You E-mail Letter

Dear Sir,

Thank you for your participation in the study of EFL Taiwanese instructor's use of technology in teaching, speaking and listening skills. I appreciate your response. Your participation profoundly helped us understand how EFL teachers use technology in teaching speaking/listening skills. We will analyze the data soon. If you are interested in the results, feel free to contact us. The contact E-mail address is:

pai@lamar.colostate.edu

You are welcome to provide additional feedback related to this topic or second language teaching. If you have not returned the response or misplaced the survey questionnaire, please let us know. We will send you another package.

Your opinion is valuable to us. Please contact us through the above E-mail address. We will do whatever we can to answer your questions. Thank you again!!

Best Regards,

Shiaoli Pai
Co-Investigator, Ph.D. Candidate
School of Education
Colorado State University

Survey Question

Part One: The Use of Software Technology

Instruction: Please check the best answer to the following questions. You may only check one box for each technology item to identify its availability in the middle column. If the answer is "yes"(i.e. the technology is available to you), then you should check one box from 0 to 6 to indicate how frequently you use the technology item. If you never heard of the technology item, you should check the box "Don't know" and need not to answer the question on the right column.

Example:

Technology item	Availability			Never---------- always
	Yes	No	Don't know	0 1 2 3 4 5 6
Front page	☐	☐	☐	☐ ☐ ☐ ☐ ☐ ☐ ☐

	Is this technology available to you when you teach speaking/ listening skills?			If the technology is available, how much do you use the technology item in teaching speaking/ listening skills?
Technology item	**Availability**			**Never---------- always**
	Yes	**No**	**Don't know**	**0 1 2 3 4 5 6**
1. Word Processing	☐	☐	☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
2. Presentation software (e.g. Power Point)	☐	☐	☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
3. Electronic Text (e.g. electronic book/journal/ newspaper)	☐	☐	☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
4. Concept Mapping	☐	☐	☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
5. Graphic Organizer	☐	☐	☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
6. E-mail	☐	☐	☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
7. Authoring Tool	☐	☐	☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
8. Courseware	☐	☐	☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
9. Computer Games	☐	☐	☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
10. Research Software (e.g. Excel or SPSS)	☐	☐	☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
11. Internet / W.W.W.	☐	☐	☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
12. Online Database	☐	☐	☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
13. WebCT (e.g. discussion board)	☐	☐	☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
14. Chat rooms/ groups	☐	☐	☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
15. List serve	☐	☐	☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
16. Messenger	☐	☐	☐	☐ ☐ ☐ ☐ ☐ ☐ ☐

Part Two: The Use of Hardware Technology

Instruction: Follow the same instruction as part one stated above.

	Is this technology available to you when you teach speaking/listening skills?			**If the technology is available, how much do you use the technology in teaching speaking/ listening skills?**
Technology item	**Availability**			**Never---------- always**
	Yes	**No**	**Don't know**	**0 1 2 3 4 5 6**
1. Overhead projector	☐	☐	☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
2. Audio CD	☐	☐	☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
3. Slides	☐	☐	☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
4. Scanner	☐	☐	☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
5. Digital Camera	☐	☐	☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
6. Printer	☐	☐	☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
7. Personal Digital Assistant (PDA)	☐	☐	☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
8. Interactive CD-ROM	☐	☐	☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
9. Tape Recorder	☐	☐	☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
10. Computer	☐	☐	☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
11. Radio	☐	☐	☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
12.Telephone	☐	☐	☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
13. Video Cassette Recorder (VCR)	☐	☐	☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
14. CD-ROM	☐	☐	☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
15. Electronic board (e.g. smart board)	☐	☐	☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
16. Digital Video Device (DVD)	☐	☐	☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
17. Interactive DVD	☐	☐	☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
18. Television	☐	☐	☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
19. Film camera	☐	☐	☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
20. Camcorder	☐	☐	☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
21.Headphones	☐	☐	☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
22.Microphone	☐	☐	☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
23.Computer projector	☐	☐	☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
24.Sound speaker	☐	☐	☐	☐ ☐ ☐ ☐ ☐ ☐ ☐
25.Laser pointer	☐	☐	☐	☐ ☐ ☐ ☐ ☐ ☐ ☐

Part Three: Personal demographics and Institutional information

Instructions: Please fill in the blank with the response that best describes you.

How long have you been teaching at the College/ University level? _____years

How many in-class hours do you usually teach in a week? _____ hours

How many speaking/listening class hours do you teach in a week? _____ hours

How long have you used computers in teaching? _____ years

How much formal computer training (e.g. scheduled workshops) have you had in the last two years? _____hours

Your age: _____

Instructions: Please check only one of the blanks with the response that best describes you.

1. How often do you use a computer for non-teaching activities (e.g. your daily life)?
___Daily ____a few times a week ___ a few times a month ___once a month ___never
8. How often do you use a computer in preparing to teach?
___Daily ____a few times a week ___ a few times a month ___once a month ___never
9. How often do you use a computer in your classroom?
___Daily ____a few times a week ___ a few times a month ___once a month ___never
10. How often do you use a computer in the lab for teaching?
___Daily ____a few times a week ___ a few times a month ___once a month ___never
11. Your education completed:
____Bachelors degree ____Master's degree ____Doctorate degree
12. You gender: _____ Female ____Male

Instruction: Please check one box on the right side of the question to rate the statement based on a Likert scale ranging from SD (strongly disagree), D (disagree), N (no opinion), A (agree), and SA (strongly agree).

	SD	*D*	*N*	*A*	*SA*
13. I think my teaching load is too heavy.	☐	☐	☐	☐	☐
14. There is enough technical support for my teaching.	☐	☐	☐	☐	☐
15. My colleagues support me when I have problem in using technology.	☐	☐	☐	☐	☐
16. Teachers in my school collaborate on projects or teaching activities	☐	☐	☐	☐	☐
17. My skill in using technology in teaching is strong.	☐	☐	☐	☐	☐
18.All the technologies I want to use for teaching are available to me at my institute.	☐	☐	☐	☐	☐