Life in the 21st Century:
A Study of Pre-service Teachers' Uses of Technology and English

by

Yung-Hui Chien

A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
(Education)
in The University of Michigan
2012

Doctoral Committee:

Associate Professor Donald Freeman, Chair
Professor Annemarie S. Palincsar
Associate Professor Soo Young Rieh
Clinical Associate Professor Kathleen P. Graves

Dedication

To my parents,

Mr. Chung-Ho Chien and Mrs. Tao-Chih Lee,

and

my husband and children,

Kuan-Chieh Yen, Allison, and Brandon

Acknowledgements

This dissertation would not have been possible without the assistance from my teachers, colleagues, friends, and family. I feel very fortunate to have tremendous support throughout my years of Ph.D. study.

First, my deepest gratitude goes to my advisor, Dr. Donald Freeman, for his excellent guidance and continuous support that have contributed significantly to my professional and intellectual growth over the years. He is not only a mentor but also a caring friend. It has been a great pleasure to work with him.

I would like to express my sincere gratitude to my committee members, Dr. Annemarie Palincsar for her invaluable guidance through all stages of my Ph.D. study, Dr. Kathleen Graves for her advice and encouragement in my time of need, and Dr. Soo Young Rieh for her insightful suggestions regarding my research.

I owe special thanks to all faculty members who guided me through my Ph.D. trajectory. I especially want to show my appreciation to Dr. Diane Larsen-Freeman, Dr. Mary Schleppegrell, and Dr. Addison Stone, who led me into the field of educational research and assisted me in finding my way in the Ph.D. program.

I am also wholeheartedly thankful to my colleagues and friends, particularly Sheryl Leicher, Carson Maynard, Gwynne Morrissey, Chia-Ling Chen, Hyun-Ju Kim,

Pei-Chin Chang, Yaa Cole, Katherine Kim, and Florencia Gomez, who cheered me on and gave me help whenever I needed them.

Finally, I am immensely indebted to my parents, Chung-Ho Chien and Tao-Chih Lee, who stood by me through the good times and bad and provided me with unconditional love and support. I am earnestly grateful to my husband, Kuan-Chieh Yen, and our lovely children, Allison and Brandon, who gave me the strength to pursue my dream. I also wish to thank my mother-in-law, Hsiu-Hung Yen-Hu, who took care of my family when I needed time for research.

Table of Contents

List of Tables

List of Figures

List of Appendices

Abstract

In this new era of globalization, human activities have been transformed by new social relations enabled by the advance of technology and the global diffusion of English. New digital and English literacies are essential for participation in contemporary society. The new generation of pre-service teachers, who grew up with new technological development and compulsory English learning in school, is often expected to be accustomed to new forms of social participation. However, this belief is in need of verification. In addition, prior research suggests that many teachers lack adequate abilities and mindset of using technology and English for purposes of teaching. To gain an in-depth understanding of the issue, this dissertation examined the perceptions and daily uses of technology and English among 153 pre-service teachers from one institution in Taiwan, particularly focusing on exploring the relationship between their uses of technology and English as well as differences in their digital and English uses depending on personal factors.

Data were collected via a questionnaire regarding pre-service teachers' general perceptions and uses of technology and English and a web log documenting their daily activities. The analyses showed that the pre-service teachers in the study were accustomed to using technology with English in daily life. They were able to use technology and English, oftentimes together, to strengthen their existing local networks

and develop new social relations with new people. In addition, their perceptions and uses of technology were found to be interconnected with those of English. Furthermore, there were differences in their perceptions and uses of technology and English depending on gender and subject area. Issues of digital and English participation equity may need to be addressed within this population.

The implications drawn from this study are that teacher educators should recognize the important roles technology and English play in pre-service teachers' lives and design curricula that build on their existing digital and English practices and support their development of new technology and English abilities for teaching.

Chapter 1 : Introduction

The Age of Globalization

We are living in a globalized world, in which many aspects of our lives have been transformed due to the global diffusion of English and information and communication technologies (ICTs). The emergence of social media (e.g., wikis, blogging, instant messaging, social networking, and multimedia sharing) and the dominance of English in various fields (e.g., business, travel, academia, and international politics) have changed the ways in which people participate in society (Castells, 2004; Crystal, 2003). New technological inventions and global English use have promoted new types of connections among people and places in ways previously impossible (Beck, 2000). These social relations play an important role in the 21st century as countries and economies become increasingly interdependent. The new context of globalization, supported by the advance of technology and the spread of English, calls for a new understanding of social participation in the 21st century.

This study focuses on the context of Taiwan, whose economy and society have been immensely influenced by globalization. Taiwan is located in East Asia, a region that is fast growing and has become an increasingly influential economic power in the world. This region is globally known for its high-tech industry, and ICTs have been playing a key role in its economic and social development (Yusuf, 2003). Recognizing the importance of English in the changing global environment, East Asian countries have

been committed to improving the English abilities of their people, contributing to a rapid spread of English language education throughout the region (Hu & McKay, 2012). Although the smallest in terms of land area and population among East Asian countries, Taiwan is internationally recognized for its technological achievement (Mathews & Cho, 2007). Social media use (e.g., Facebook) is the highest among East Asian countries, and English language education has long been a top priority in the national education policies in Taiwan (Miniwatts Marketing Group, 2012; Taiwan Ministry of Education, 2012a). The widespread internet use and compulsory English learning in school provide a solid ground for Taiwan to respond to global changes, which provides an ideal context for this study to research technology and English uses in the age of globalization.

New Abilities for the New Age

To deal with the new way of life in contemporary society, individuals need to be prepared for social participation (that is, the act of participating in activities that are common in society for purposes meaningful to individuals) that transcends temporal and spatial boundaries. Since the advent of general public schooling, the goal of schooling has always been to help students develop the abilities for full participation in society (Reese, 2005). Acquisition of numeracy and literacy in the national language were considered the major abilities required in order to fully participate in society. However, as we enter the age of globalization, these two skills are no longer sufficient for social participation in the 21st century. People need to know how to use technology and English to participate in transnational social activities common in the new era. Therefore, if schooling is to help the young generation prepare for the future, our schools should

cultivate students' ability to participate in the social, economic, political, and educational activities in the 21st century, particularly the abilities to use technology and English for practical purposes in various social contexts (Graddol, 2006).

These 21st century abilities, namely, new literacies of technology and English, contain several features. First of all, the definitions of these literacies continue to evolve in response to the changing social context influenced by the invention and diffusion of technology and English worldwide. In addition, there are multiple types of digital and English literacies that coexist in people's lives. Each of the literacies is needed in specific contexts for particular purposes, and people need various types of literacies to participate in the social activities meaningful to them. Furthermore, the acquisition of these 21st century abilities is socially constructed as human activities are always embedded in the social settings within which they occur (Sfard, 1998). People need to be involved in new forms of social participation in order to develop digital and English abilities critical in the new era (Leu, Kinzer, Coiro, & Cammack, 2004).

Issues of Access to Technology and English

Given that new digital and English literacies are important in the globalizing world, researchers have been interested in investigating the issues of unequal access to technology and English in society. The concept of a *divide* among people was thus developed. The *digital divide* has been studied by many researchers (e.g., Guillén & Suárez, 2005; Light, 2001; Lu, 2001; Salpeter, 2006; Tiene, 2002; van Dijk & Hacker, 2003). Initially conceived as a hardware acquisition problem (i.e., a gap between those with computer access and those without), the issue is now understood as a social

participation problem (i.e., differences in opportunities to participate in social activities for meaningful purposes via the use of technology). There also exists an English divide that parallels the digital one. This language gap, once considered a problem of lacking English accuracy and fluency (i.e., a division between those with native English proficiency and those without) (Rogers, 1998), is increasingly viewed from the standpoint of meaningful participation in social practices with contextualized English use (Larsen-Freeman & Freeman, 2008).

Teachers' Social Participation in the 21st Century

School serves as an important place for our younger generation to be prepared for life in the 21st century. Because school learning environments are directly influenced by who the teachers are and what they do (P. S. Wright, Horn, & Sanders, 1997), teachers play a critical role in modeling the types of social participation central to the 21st century. What teachers can do via technology and English in social and education contexts can have a significant impact on students' experience and perceptions around these two tools. In addition, if the young generation of students is already using technology and English outside of schools, it is reasonable to expect teachers to be able to do the same themselves and to be able to bridge students' digital and English uses inside and outside of classrooms. Therefore, it is vital to investigate whether teachers can participate in social activities via technology and English for purposes meaningful to them.

The current body of pre-service teachers is a particularly important generation in this transitional time of globalization. These younger teachers grew up with the global diffusion of technology and English and have been immersed in technology and English

uses from an early age. They were educated by a generation who did not have much technology use experience and lacked quality English education in school. However, these prospective teachers will become the educators of the next generation who very likely will be fluent users of all types of new technology and be much better prepared for English uses in the future. In other words, the current generation of pre-service teachers is sitting in a very critical position, in which they are assigned the responsibility of moving the society forward, crossing from the traditional way of living to the new context of the digital and English era.

This study focuses on pre-service teachers because this is an important group to study given its vital role in the modern time. However, not much research effort has been made to understand this new generation of teachers who grew up with the global diffusion of technology and English. These teachers are believed to be universally literate in technology and English and to be accustomed to new forms of social participation. However, this belief is in need of verification. Additionally, more research is needed to understand what exactly these young teachers can do via technology and English in daily life. To address these needs, this study aims to explore pre-service teachers' digital and English perceptions and use experience in greater detail and to suggest useful implications for teacher education. Moreover, this study will look at pre-service teachers in several subject areas in order to find out whether there are disciplinary differences among pre-service teachers in terms of their uses of technology and English.

Research Purpose

Within the broader context of these social arguments**,** the purpose of this descriptive study is to begin to understand the ways pre-service teachers in Taiwan use technology and English in their daily lives. Recognizing the important roles technology and English play in the era of globalization, many non-English-speaking countries, including Taiwan, have devoted effort to ensure technology access in society (Warschauer, 2003). English learning has also been made compulsory in school, and the age at which English is introduced to children has been lowered to as early as kindergarten (Nunan, 2003). The new generation now has greater access to technology and English and is more comfortable using these two tools in everyday life.

As this present generation, who grew up with new technological developments and compulsory English learning in school, enters the teaching profession, they are often expected to be able to use technology and English effectively for social and instructional purposes. However, research with these teachers suggests that many lack adequate or appropriate ability and mindset (Butler, 2004; C.-H. Chen, 2008; de Segovia & Hardison, 2009; Lei, 2009; see review of these studies in the next chapter). If technology and English are necessary for participating fully in society and in the economy, then it is of great interest to find out how pre-service teachers use these two tools for social participation in the 21st century.

To date, not many studies have been conducted to investigate pre-service teachers' experience in using technology and English especially in contexts outside the school. In addition, little is known about the relationship between their technology and English uses.

Furthermore, no study has investigated differences in such uses among pre-service teachers across subject areas. A descriptive study that addresses all of these dimensions will significantly add to our understanding of this phenomenon. Therefore, in order to fully understand pre-service teachers' technology and English uses and to derive useful implications for teacher education, this study employed questionnaires and web logs to explore the digital and English experience and perceptions among pre-service teachers across subject areas in contexts both inside and outside the school. The issue is not whether they have access to technology and English, but how they use technology and English in various contexts for purposes meaningful to them.

Theoretical Framework

The current study adopts a sociocultural perspective which views human activities as inseparable from their surrounding social contexts. Human learning takes place through social use and interaction in meaningful contexts (Vygotsky, 1978). This view emphasizes the significant impacts of social, cultural, political, and historical factors on how people learn. From this sociocultural perspective, Gee (1986) described the acquisition of literacy as a process of socialization. "Different societies and social subgroups have different types of literacy, and literacy has different social mental effects in different social and cultural contexts" (Gee, 1986, p. 719). Therefore, various types of literacy coexist in society. Each of them is needed in particular contexts for specific purposes. Viewing technology and English as types of literacy within the sociocultural framework, this study builds on the assumption that there are different types of digital

and English literacies, each of which is associated with specific contexts and purposes and is acquired through their meaningful use.

From the sociocultural perspective, this study also recognizes the evolving roles of technology and English in society due to contextual changes. As technology and English spread and evolve in response to the changing global environment, their roles in our lives have also undergone a conceptual shift. Technology and English were once viewed as *ends* in society; that is, they are entities whose ownership constitutes an ultimate goal in people's lives (e.g., Kachru, 1985; National Telecommunications and Information Administration, 1995). This view has shifted to one that considers technology and English as tools that people adopt for the greater purposes of social participation in the 21st century (e.g., Warschauer, 2000, in press). This shift has contributed to a transformation in the way people address the issue of social equity relating to technology and English access.

In line with the traditional view of technology and English as ends, prior research (e.g., Kachru, 1985; National Telecommunications and Information Administration, 1995) primarily characterized technology and English as properties to be acquired by those with access. The major focus was on people's ownership of technology and English resources. However, mere possession of digital devices and linguistic knowledge of English is not sufficient for the 21st century. What is more critical is the ability to effectively use technology and English as tools for social participation. Therefore, past research needs to be reconsidered to reflect the move toward the new perspective of using technology and English as means. Within this new framework, more research is needed to investigate

uses of technology and English for social participation in a variety of contexts. Therefore, rather than investigating what digital and English properties one *has*, this study focuses on exploring what one *does* with technology and English. This study argues that living in contemporary society requires new sets of digital and English abilities that constantly shift, contain multiple types, and are developed through social participation.

Research Context

Taiwan was selected as the focal country in this study because technology and English play important roles in Taiwanese people's lives, and national policies have been developed to promote digital and English access in schools (Chen, 2005; Council for Economic Planning and Development, 2002). The Internet infrastructure is well developed in the country, and technology use is widespread in society. By 2011, the internet penetration rate in Taiwan was 70.0%. In 2012, 51.5% of the population uses the social networking site Facebook (Miniwatts Marketing Group, 2012). The younger generation in Taiwan is hence commonly expected to be literate in technology.

The major languages used in Taiwan include Mandarin Chinese, the national language, and Taiwanese, the most widely-spoken local language. Although English does not have an official status in Taiwan, it is regarded as the most important language to master in addition to Mandarin Chinese. Therefore, compulsory English language education has been implemented in schools at the elementary, secondary, and university levels. Many parents choose to enroll their children in English-Chinese bilingual schools or afterschool programs at ages as early as preschool. Today's youngsters have had a greater exposure to English than the older generation. In addition, English proficiency has

been adopted as one of the major requirements for entering and exiting from universities and graduate programs (Pan, 2009; Tsai & Tsou, 2009). It is also often considered an important qualification for jobs in Taiwan (104 Corporation, 2008). This has contributed to a trend of English learning in Taiwanese society because English abilities enable a greater access to a good education and career.

Research Questions

The research questions this study aims to answer include the following:

1. What do pre-service teachers think of technology and English and their abilities to use them?
2. How and for what purposes do pre-service teachers use technology and English in their daily lives?
3. What, if any, is the relationship between pre-service teachers' technology and English uses?
4. How do pre-service teachers' uses of technology and English differ depending on personal factors such as gender and subject area?

Significance of the Study

This descriptive study is innovative in several ways. First, this study employed web logs in addition to the commonly-used questionnaires as data collection instruments to investigate the research topic from multiple angles. Second, this study looked at pre-service teachers' uses of technology and English holistically, covering both contexts inside and outside the school. This should provide a new understanding of this target population from a perspective not restricted to the classroom only. Third, rather than focusing on one single subject area as most studies did, this study recruited pre-service

teachers of multiple disciplines to see whether the patterns of technology and English uses differ among them. Fourth, this study is one of the pioneers in attempting to bring technology and English together and to examine the relationship between them. Therefore, this study should substantially broaden our knowledge of pre-service teachers' social participation via technology and English in the 21st century and provide useful insights for teacher educators in their effort to help pre-service teachers develop critical professional knowledge and skills of technology and English they need for teaching.

Chapter 2 : Literature Review

In this chapter, I first discuss the influence of social globalization on people's lives in the 21st century, followed by a discussion of the critical roles technology and English play in this new context of globalization. I then explain the changing definitions of technology and English, and new types of digital and English literacies required for the 21st century. I also discuss issues of equity in social participation via technology and English by introducing the traditional concepts of the digital divide and the English divide as well as describing re-conceptualizations of these two phenomena in the new era. Finally, I review research on the digital and English abilities and mindset of the new generation of teachers.

Social Globalization in the 21st Century

The term *globalization* is often used to describe the contemporary state of the world. Many scholars have studied this phenomenon (e.g., Beck, 2000; Giddens, 1990, 2000; Sirgy, Lee, Miller, & Littlefield, 2004) and proposed different definitions, many of which focus on the effect of the global economy on other aspects of human life (e.g., Sirgy, Lee, Miller, Littlefield, & Atay, 2007). In this economy-driven model of globalization, the global economy is assumed to be the major force that changes social, cultural, and technological activities (e.g., the booming economy in East Asia has changed the quality of life in many countries). However, this definition does not take into

account the fact that the economy is itself a product of social activities and is shaped by what individuals do socially and culturally (e.g., the social structure and cultural predisposition in East Asian society has created a unique environment for the regional economy to grow); this is the position a culture-driven model takes (Luke & Luke, 2000). The proposed study takes the view of the culture-driven model, which defines globalization as a *social* rather than simply an *economic* process. This definition emphasizes the interrelationships among different dimensions of human life, and individuals' awareness that local events affect and are affected by global conditions.

With a focus on the social dimension of globalization, this study takes the definition that emphasizes the social relationships among people and places in the world. As Giddens (1990) suggested, globalization is "the intensification of worldwide social relations which link distant localities in such a way that local happenings are shaped by events occurring many miles away and vice versa" (p. 64). This globalizing world blurs national boundaries. Countries and economies have become increasingly interdependent. The mobility of people and free flow of information in the world creates new sets of relations between places which were weakly connected before. Regardless of individual consciousness of and preference for globalization, individuals are forced to live in transnational lifestyles in which they frequently encounter people, or the information and knowledge which is produced and used, outside of their local contexts (Beck, 2000). In other words, people now have greater opportunities to be involved in social activities that connect people across national boundaries.

Social activities and their participants can be grouped based on their purposes and functions and how they thus develop various types of social networks, which I call *transnational social networks*, or *transnational connections*. These networks can take various formats with diverse focuses. For example, users of Flickr share photos with self-described tags and thus form transnational social networks that connect people of similar interests. People who join online discussion groups for topics of their own interests are involved in transnational social networks that allow everyone to join via a common language (most likely English) regardless of their physical locations and linguistic backgrounds. As Castells (2000, 2004) suggested, we are now living in a *network society*, one largely structured around networks. Each network has its own values specific to the benefit of its own members. Each individual decides the kinds of networks he wants to be included in according to personal need, interest, and purpose. With the use of technology and English, all people can participate in particular social networks for purposes meaningful to themselves.

Technology and English as Critical Elements in the 21st Century

The growth of transnational social networks was made possible by the global spread of technology and English, the two essential tools that provide common platforms for people from different places to connect. In terms of technology, the advance of information and communication technologies is rapidly transforming the material basis of our society (Castells, 2000). With the invention and use of new technology, many once-costly and time-consuming tasks have become free and speedy. For example, the time and cost associated with the reproduction and distribution of information via computers

and the Internet have been lowered dramatically (Birchler & Bütler, 2007). Communications among people in distant locations have become easier due to the invention of various free web tools such as email and internet phone. This has promoted technology use worldwide. Miniwatts Marketing Group (2012) estimated that there are currently over 2.2 billion internet users in the world, with a growth of 528.1 percent since the year 2000.

Castells (2004) termed this 21st century phenomenon *informationalism*, "a technological paradigm based on the augmentation of the human capacity of information processing and communication made possible by the revolutions in microelectronics, software, and genetic engineering" (p. 8), which fundamentally differs from *industrialism* associated with the industrial revolution in the previous era. What differentiates our current information society from the industrial one is technology-enabled interdependent networks that transcend national boundaries (Castells, 2006). The idea of networks is not new to the age of informationalism. Human society has always been built on the foundation of social networks, a system with interconnected nodes where people are in contact with one another for important tasks in life, such as exchanging information. However, the advance of ICTs has made the organization of networks more powerful than ever because technology enhances the flexibility, scalability, and survivability of networks (Castells, 2004).

In addition, the spread of English has also played a role in the development of transnational social networks. While the diffusion of new technology brings increased opportunities for individuals to access transnational networks, English, because of its

global status, is the linguistic tool that allows people to engage in full social participation via these networks. Today, English is the most widely-spoken language in the world not only because of its history as a colonial language but also due to the power that comes with its use in political, technological, economic, and cultural contexts. By 2006, there were approximately 1.5 billion people capable of speaking English, which constituted about one fourth of the world population (Crystal, 2006). This population is even larger today and will definitely continue to grow in the future.

Many domains of human life are now dominated by English, including politics, economics, education, communications, the media, international relations, travel, and safety (Crystal, 2003). This means that using English allows people to connect to others across language barriers, and to participate in important social activities effectively and efficiently. The importance of English is also reflected in its role in accessing critical information. For example, English dominates both library collections and the web. O'Neill, Lavoie, and Bennet (2003) reported that 63 percent of the bibliographic records in WorldCat, an online catalog, are in English. In addition, 72 percent of the public websites presents their textual content in English. About 5 percent of websites offers content in multiple languages, one of which is always English. Therefore, English, as well as technology, has become critical elements in people's lives in the 21st century.

Changing Definitions of Technology and English

Technology and English are shaping and being shaped by how people use them. The global spread of technology and English has changed the way people engage in social participation. At the same time, people's needs to participate in transnational social

networks have resulted in changes in technology and English as well. What technology and English refer to in the 21st century differs from what they referred to in the past. In order to understand the roles of technology and English in people's lives today, we should know how technology and English have evolved, and how the new concepts of technology and English support people's participation in transnational social connections.

The Evolution of Technology

The development of ICTs started in the late 1990s and early 2000s. Unlike the technologies invented in the era of the industrial revolution, such as the steam engine and devices powered by electricity, ICTs were developed based on the revolution of microeconomics which began in the 1940s and started to grow significantly in the 1970s. This technological revolution began with the creation of the transistor in 1947 and the integrated circuit in 1957. The subsequent invention of the microprocessor (the "computer chip") ignited the diffusion of information technologies. The first commercially available microcomputer, Apple I, was produced in 1976, and new operating-system software has been in ceaseless development since. In the 1980s and 1990s, computers became portable, thus allowing the decentralization of the storage and processing of data via simple networks.

The development of the Internet took the spread of ICTs to another level. It originated in 1969, and became popular with the creation of the World Wide Web in 1990. By the late 1990s, the Internet was able to distribute computing power to isolated computers through interconnected networks using common Internet protocols (see Castells, 2000 for a more comprehensive review). However, the network function of the

Web had not been fully realized up to that point. What it meant to live in modern society was still measured via the level of ownership over computers and Internet access as well as the abilities needed to operate computers and to make use of Internet access (van Dijk & Hacker, 2003).

In the new age of globalization, new technology has developed in response to people's need for social connection and participation. In terms of hardware, we now have all kinds of technology platforms around us, such as computers, cell phones, music or video players, digital readers, and video gaming systems. In terms of software, the World Wide Web has grown rapidly since its creation in 1990. Today the Web is universally accessible. Countless websites have been created all over the world. These websites are connected to one another, and thus form networks that bring together people and places from distant locations. Navigating the networks allows individuals to easily connect to any other person or place also included in the networks (Castells, 2004).

The functions of these networks, powered by the development of the Web, are transforming as the Web gradually moves from version 1.0 to 2.0 (Anderson, 2007). The Web was once commonly understood as a global information space where people could write web pages for others to read. This concept of the Web was relatively limited in that it did not fully actualize the social nature of networks. As a range of new social technology applications have started to appear on the Web, the Web has been transformed into a space for more than just reading and writing. It is now a powerful social networking space where everyone can participate in transnational social activities. The development of new social technologies, such as wiki, blogging, social bookmarking,

multimedia sharing, and podcasting, have pushed Web1.0 into the very different Web 2.0. The nature of information flow in Web 1.0 was single-directional; that is, information flew from web page writers to their readers and there was no interaction between the two. With Web 2.0, information can now be exchanged in both directions. Users nowadays can not only gather information from web pages but also connect and interact with other people in various ways, such as commenting on other people's blog posts and discuss issues of personal interests with like minded people in digital forums.

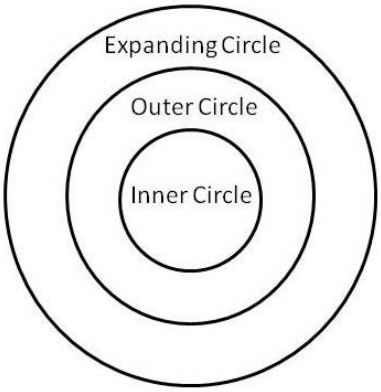
However, Web 2.0 should not be viewed as a new technological invention separate from Web 1.0, but rather an extension and improvement of Web 1.0 to make it more functional and socially-connected (Anderson, 2007). In other words, we still need to be able to read and write web content as we did with Web 1.0. This need persists in Web 2.0, with the addition of more social technology tools that allow us to fully participate in transnational social networks.

The Evolution of English

Similar to the evolution of technology, the definition of English has also undergone a transformation. The global spread of English has resulted in a conceptual shift about what the word *English* refers to. English was once conceptualized as the language used by the people who live in places where English is the primary or official language. People were believed to have unequal access to knowledge and uses of this linguistic system because of the various roles English plays in local contexts. Kachru (1985) proposed a theory about the roles of English in the world, which states that English in the world can be viewed as three concentric circles - *inner*, *outer*, and

expanding circles, each of which represents different models of English acquisition and uses (see Figure 2.1). The *inner* circle includes "the traditional bases of English - the regions where it is the primary language" (p. 12). This circle includes the countries where people speak English as their mother tongue, such as the United States, the United Kingdom, Canada, Australia, and New Zealand. The *outer* (or *extended*) circle "involves the earlier phases of the spread of English and its institutionalization in non-native contexts…these regions have gone through extended periods of colonization, essentially by the users of the inner circle varieties" (p. 12). In other words, the countries in this circle are not English-speaking countries as traditionally considered. However, the national policies of these countries assign English an official role, even though the people are mostly multilingual. Countries such as Singapore, India, Nigeria, and Ghana belong in this circle. The third circle, the *expanding* circle, contains the geographical regions that "do not necessarily have a history of colonization of the users of the inner circle" (p. 13), but recognize the critical status of English as *the* global language. This circle encompasses a large array of countries, including Brazil, China, Egypt, Greece, and Japan, just to name a few.

Figure 2.1. Kachru's (1985) three concentric circles of English



Kachru's (1985) framework places the inner circle at the center, contained by the other two circles. This suggests that the English language used by the people in the inner circle as their mother tongue is the norm, the so-called standard English, for all three circles. The distances from the other two circles to the inner one indicate their relationships to the norm of standard English. The outer circle immediately surrounds the inner one, which means that the roles of English in these two circles differ, but remain close. English is used as a primary language in the inner circle, and as an official language in the outer. Although the amount and nature of the opportunities for English use differ somewhat in these two circles, both contexts require English for practical use in their local settings. In contrast, people in the expanding circle do not have such need or opportunities to use English in their daily lives. This circle is farthest away from the inner one, indicating that the people in the expanding circle do not have the same levels of access to the norm of standard English as do the people in the other two circles.

However, the spread of English in the world has made Kachru's theory less meaningful in the age of globalization, because people in the expanding circle now have increased opportunities to use English for social participation as well (Warschauer, 2000). Crystal (2003) compiled various data sources and estimated that there were approximately 500 to 1000 million users of English in the expanding circle, which was more than the number of English speakers in the inner circle (320 to 380 million) and the outer circle (300 to 500 million). The number of English users today should be even larger. This implies that a significant portion of communications in English around the world is conducted with members of the expanding circle. Therefore, the boundaries of the three circles of English are blurred. People in one circle can be connected with those

in another, which makes the picture of English use more complex than what Kachru (1985) originally portrayed. Today, English is no longer just a language; it has become an important tool for people in different parts of the world to participate in transnational social networks.

The consequence of a language used by such a large and diverse group of people is that English has evolved into many different varieties. Cultures, norms, and practical purposes shape the English language in local contexts, and the diffusion of technology creates an even more complex environment for the global use of English. The word *English* today no longer refers to only the English language used by the people for whom it is a mother tongue. Rather, it refers to *English as a lingua franca* (ELF), which means "communication in English between speakers with different first languages" (Seidlhofer, 2005, p. 339). This term emphasizes the English interactions among the people who do not use English as a primary or official language in their local contexts, but does not exclude the participation of the people who do (Jenkins, 2006). In this way, the concept of English has shifted the focus from its origin to its use.

Everyone in the world who uses English is contributing to the shaping of English as a lingua franca in this age of globalization. When an increasing number of ELF speakers start to assume prestigious roles at the local, national, and international levels, some English expressions that were considered "foreign" in the past may become common usages (Crystal, 2006). Many English "errors" that teachers thought should be corrected (such as the omission of the third person present tense *-s* and no distinction between the relative pronouns *who* and *which*) do not appear to obstruct communications

among people (Seidlhofer, 2004). As a result, English has evolved into contextualized forms distinct from the original variety. English is not simply adopted around the world as a standardized linguistic norm. Rather, "it spreads, and as it does it gets adapted as the virtual language gets actualized in diverse ways, becomes subject to local constraints and controls" (Widdowson, 1997, p. 140). In other words, English as a lingua franca is not just a deficit version of the mother-tongue variety. Instead, it is "a linguistic phenomenon in its own right" (Seidlhofer, 2004, p. 213). As Graddol (2006) puts it, this is "English in its new global form…this is not English as we have known it, and have taught it in the past as a foreign language. It is a new phenomenon" (p. 11). Therefore, in this new age of globalization, it is the use of English as a lingua franca that allows people to participate in transnational social networks.

New Literacies of Technology and English for the 21st Century

As the world changes due to globalization and the spread of technology and English, the kinds of abilities one needs in the 21st century have changed as well. Graddol (2006) identified four basic skills that allow people to acquire critical knowledge for the future, including literacy in the national language (and the home language if different), numeracy, information and communication technology, and English. The former two skills have long been recognized as important areas to focus on in education around the world. However, as we enter the age of globalization, these two skills are no longer sufficient for social participation in the current context. It is the other two skills, the abilities to use technology and English, which are critical for participation in the social,

economical, political, and educational activities in modern society. It is these two abilities that allow people to connect to others outside of their local contexts.

In response to the diffusion of ICTs worldwide, scholars have recognized the need for new literacies of technology: that is, the abilities to understand and use technology to fulfill various social purposes. A more detailed definition of these literacies of technology is as follows:

> The new literacies of the Internet and other ICTs include the skills, strategies, and dispositions necessary to successfully use and adapt to the rapidly changing information and communication technologies and contexts that continuously emerge in our world and influence all areas of our personal and professional life. These new literacies allow us to use the Internet and other ICTs to identify important questions, locate information, critically evaluate the usefulness of that information, synthesize information to answer those questions, and then communicate the answers to others" (Leu, et al., 2004, p. 1572).

This study argues that in addition to new literacies of technology, we also need new literacies of English in the 21st century because English is one of the two fundamental tools that enable transnational connections as previously described. The New London Group (1996) proposed that people need to acquire *multiliteracies* to deal with two new features of our contemporary world: the multiplicity of technology, and the increasing cultural and linguistic diversity. While the former can be addressed by literacies of technology as proposed by many scholars, I argue that the latter can be addressed by literacies of English as a lingua franca. Globalization creates abundant opportunities that allow people from different parts of the world to participate in the same transnational activities together. Individuals are expected to work and collaborate with others who might not speak or think in the same ways as they do. In this environment,

one needs literacies of English to overcome the barriers caused by linguistic and cultural differences. For example, Ku and Zussman (2010) investigated the impact of English as a lingua franca on international trade in today's multilingual environment. Using the data collected for the Test of English as a Foreign Language (TOEFL) to measure the English proficiency of over one hundred countries for thirty years, they discovered that English communication competence has a significantly positive effect on trade flows globally, which indicates that the linguistic barriers caused by language diversity can be overcome by literacies of English. With English as the common linguistic platform, information can flow across national borders, and people around the world can connect socially despite differences in language and culture.

Situated in the new context of globalization, literacies of technology and those of English have several features in common. Leu, Kinzer, Coiro, and Cammack (2004) identified ten central principles to describe the characteristics of new literacies of technology, several of which can also be applied to describe literacies of English as well. I summarize these parallels in Table 2.1.

Table 2.1. Similarities between literacies of technology and literacies of English

Features	***Literacies of technology***	***Literacies of English***
Deictic	Literacies change as new technologies are developed, e.g., a move from Web 1.0 to Web 2.0.	Literacies change as English is spread to the world, e.g., a changed focus from English proficiency to English use.
Multiple in nature	There are various types of literacies associated with a wide variety of digital tools, e.g., blogging, social networking, video sharing, etc.	There are various types of literacies related to localized uses of English based on social contexts, e.g., academic English, business English, etc.
Socially constructed	Literacies are developed via meaningful social participation with technology, e.g., collaborating with others using web editing tools such as Google Docs.	Literacies are developed via meaningful social participation with English, e.g., attending international research conferences.

First of all, “New literacies are deictic” (Leu, et al., 2004, p. 1589). No concrete definition of literacies of technology can be determined in this new era because the forms and uses of literacies constantly shift as new technologies continue to emerge and new ideas of employing these technologies develop (Leu & Kinzer, 2000). Similarly, as English assumes the role of the global language, new structures and functions of English continue to grow in response to the global environment. As discussed previously, people start to re-conceptualize what English refers to, and what it means to know English. Both technology and English are experiencing the same phenomenon: their uses promote their development, and in turn, their development shapes their uses. Human activities are always influencing and influenced by available tools. When tools change, activities transform as well, and vice versa. Wertsch (1995) illustrated this reciprocal relationship with the example of the evolution of pole vaulting. On the one hand, vaulters’ desire to perform well in this sport results in the improvement of poles. On the other hand, the invention of new types of poles changes the ability vaulters need to acquire in order to participate in the sport.

In addition, “New literacies are multiple in nature” (Leu, et al., 2004, p. 1589). Technology provides a wide variety of tools for transnational connections. Individuals are required to be able to deal with information represented in multiple forms, and to utilize a combination of different technological means to meet personal needs. Similarly, when English spreads to various domains of human life in different parts of the world, it starts to take different shapes as people localize their uses of English for their own purposes. English uses vary based on contexts. For instance, the English language used in academic settings fundamentally differs from that of everyday conversation (Schleppegrell, 2004).

Therefore, individuals need to adapt to multiple forms of English, and know how to vary their English uses for specific social contexts.

Furthermore, "Learning often is socially constructed within new literacies" (Leu, et al., 2004, p. 1589). Literacy was once viewed as a set of discrete skills that is independent of contexts (Goody, 1977; Havelock, 1963). Today, it is considered "a repertoire of practices for communicating and accomplishing goals in particular social and cultural contexts" (Palincsar & Ladewski, 2006). This socio-cultural view of literacy defines its acquisition as "a change in how one participates in specific social practices within specific Discourses" (Gee, 2001, p. 37). In this new age of globalization, learning technology is more than just acquiring a set of de-contextualized techniques. Rather, it includes participation in social activities with the use of technology (Palincsar & Dalton, 2005). Likewise, English is not simply a context-free language which happens to be spoken by a large number of people in the world. Instead, its content and uses are very much influenced by social contexts. Therefore, learning English requires more than just acquiring its linguistic features; it requires developing the abilities to participate in activities that make use of English for transnational connections, and these abilities are best cultivated in the contexts of its uses. As Sfard (1998) suggested, human activities are always embedded in the social settings within which they occur. Learning is thus less about gaining ownership over some kind of entity but more about becoming a member capable of fully participating in the social practices of a certain discourse community.

Equity in Social Participation via Technology and English

Because technology and English are two essential elements in the new era, abilities and opportunities to participate in society via technology and English have become critical to the life in the 21st century. Those who do not have sufficient access to technology and English will be disadvantaged compared to those who do. Therefore, researchers have started to investigate issues regarding equity in social participation relating to technology and English. To have a thorough understanding of the issue, we should know what the traditional concepts of the digital divide and the English divide are, how the roles of technology and English in people's lives have changed, and how this change contributes to re-conceptualizations of the divide problems.

The Digital Divide

Given the new context of globalization, research interest has been developing to address the issue of unequal access to technology in society. The concept of a digital divide among people first appeared in the mid-1990s and has undergone a transformation in its definition. The original notion of the digital divide refers to a perceived line that separates those who have computers and Internet access from those who do not. This binary division indicates differences both in the physical access to technology devices and services and in the techniques necessary to enable the access.

The digital divide became a popular topic of study for two major reasons. To begin with, the digital divide is believed to strongly correspond to socioeconomic status (SES) and demographic background, which are important factors that are associated with

societal inequality. This phenomenon was usually measured based on the amount of digital devices (e.g., computers) and services (e.g., the Internet connectivity) a person or a region has, which is also one of the common indicators used to determine SES. Therefore, the degree of one's economic and social advantage depends on one's ownership of sufficient technology resources. For instance, the National Telecommunications and Information Administration (1995) claimed that the divide in computer penetration in America was a function of several individual and group variables, including income, geography, ethnicity, age, and education. Guillén & Suárez (2005) also stated that the higher the socioeconomic status, the more likely the adoption of technology, because people of high SES have more social and economic advantages to obtain technology resources. In this way, the digital divide mirrors the societal divide based on socioeconomic status.

In addition, the digital divide reflects *information equity*, defined as "the fair or reasonable distribution of information among individuals, groups, regions, categories, or other social units, such that those people have the opportunity to achieve whatever is important or meaningful to them in their lives" (Lievrouw & Farb, 2003, p. 503). The traditional notion of the digital divide is connected to what Lievrouw and Farb (2003) called the *vertical perspective* on information equity, which characterizes information as a commodity that people of higher socioeconomic status can acquire in exchange for more economic and social benefits. Because technology provides access to critical information (Cullen, 2001), and better information access means greater social and economic advantage, the digital divide is thus believed to be closely connected to societal inequality.

The initial concept of a gap between the technology *haves* and *have-nots* was mentioned in the first of a series of reports on home computer access in the United States, entitled *Falling through the Net: A Survey of the "Have Nots" in Rural and Urban America* (National Telecommunications and Information Administration, 1995). This report explored the telephone and computer penetration and usage rates among U.S. households and found significant gaps among groups of varying demographic backgrounds. The term *digital divide* was introduced in the subsequent reports (National Telecommunications and Information Administration, 1998, 1999, 2000) to describe this gap. Since then, the digital divide phenomenon has become well-known to the public.

The concept of the digital divide was later applied on a global level and termed the *global digital divide*. This divide was allegedly related to a nation's economic growth, separating countries of high economic power (the developed) from those of low power (the developing), as suggested in the 2001 Human Development Report by the United Nations (United Nations Development Programme, 2001). This "disparity in Internet access between developed and developing countries" began to receive global attention with its inclusion in the agenda in the G8 Summit and the APEC (Asia-Pacific Economic Cooperation) summit in the year 2000 (Lu, 2001, p. 1). The global digital divide was most commonly measured by the proportion of the population that uses the Internet. Guillén and Suárez (2005) have reported that the gap in the percentage of Internet users between developed and developing countries has continued to widen since the early 1990s. Today, the global Internet penetration rate varies widely, ranging from 78.6 percent in North America to 13.5% in Africa (Miniwatts Marketing Group, 2012). Therefore, the traditional concept of the digital divide is geographic in nature. At the

local level, it separates the places in which the people can afford computers and the Internet connection from the ones with inadequate technology resources. At the global level, the divide corresponds to the gap between developed and developing nations.

The digital divide was usually measured by the number of digital devices and services. What underlies this traditional notion of the digital divide is the view of technology as properties that can be owned and acquired by those who have access to it. Thus gaining possession of a computer and Internet connection, together with the acquisition of related technical skills, constitutes a desired goal in human life. This view of *acquiring technology as an end* originated from an individualist perspective. It emphasizes that those possess hardware, software, and Internet access can lead a better life regardless of social contexts. Therefore, those without access to computers and the Internet should work toward the ultimate goal of acquiring ownership over these technology resources.

Because the digital divide is believed to be closely related to SES and information equity, it was widely accepted that bridging the digital gap would solve societal inequality. The approach was to evenly distribute the entity of technology. The digital divide was generally perceived as a problem of unequal access to technology goods. People of low SES lack digital access due both to cost and the lack of technical expertise available in local contexts (Tiene, 2004). Once these barriers to technology access are removed, the technological gap can then be closed. Therefore, the digital divide could allegedly be addressed by providing computers, software, and Internet access to the technology have-nots (Harper, 2003; Warschauer, 2003). In order to bridge the digital

gaps, numerous efforts at the local, national, and international levels sought to supply technology to disadvantaged areas. Projects such as One Laptop per Child (OLPC Foundation, 2012) and Hole-in-the-Wall (Hole-in-the-Wall Education Limited, 2011) took this goods-distribution approach of providing low-cost computers.

The English Divide

While the digital divide became a popular topic for discussion, there existed a parallel divide, the *English divide*, which refers a division between those who have access to English linguistic knowledge and use (the English haves) and those who do not (the English have-nots). It indicates unequal levels of English proficiency, and has been used to describe the importance of English in various fields. For example, Rogers (1998) suggested that in the field of international business communications, English separates those who use it as a mother tongue from those who do not. The global spread of modern English originated from Britain's colonial expansion in the 19th century and was fueled by the rise of the United States as a world leader in the 20th century (Graddol, 1997). The political and economic power of these English-speaking countries gave their people socioeconomic advantage (Crystal, 2003). The world began to recognize the critical role English plays, the benefit that comes with its use, and the disadvantage associated with insufficient knowledge of the language. The English divide was believed to be connected to socioeconomic status (Baker, Resch, Carlisle, & Schmidt, 2001; Kang, 2008). This belief contributed to the global boom of English language learning and teaching, of which the goal was to help the English have-nots gain access to standard English and to achieve a desired level of linguistic accuracy and fluency.

If we map the concept of an English divide to Kachru's (1985) idea of English circles, the dividing line separates the expanding circle from the inner and outer ones. Therefore, the traditional notion of the English divide was based on geography. This perspective regards English as a stable linguistic system with standard forms and usage, an entity that can be owned by those who have access to it: that is, those who reside in English-speaking countries (Larsen-Freeman, 2010). The goal of the people who do not have opportunities to use English in their local contexts was then to acquire this standard English; what it meant to know English was thus the full acquisition of standard English linguistic knowledge. This view of *acquiring English as an end* was again considered from an individualist perspective, which stresses that those who own native-like English proficiency can function well in society regardless of the social contexts of English use (Jenkins, 2006). Therefore, those who do not have access to English in their local contexts should seek to acquire accurate and fluent English proficiency.

Similar to the digital divide, there was a common perception that narrowing the English gap would improve people's lives, and the best approach to bridge the gap was to provide the English have-nots with access to English knowledge. This belief contributed to the global trend of learning the so-called standard English. The concern for the English divide has influenced the education policies around the world. Many non-English-speaking countries have made the learning of English compulsory in school as well as lowered the age at which English is introduced to children to as early as preschool (Graddol, 2006; Nunan, 2003). The focus of English instructions has often been placed on the acquisition of English linguistic forms, and the English proficiency has usually been measured by the extent to which a learner can perform English accurately and

fluently like the people in English-speaking countries do (Larsen-Freeman, 2010). In places where English does not play an official role, English has been learned in school settings that do not resemble the context in which English is used for practical purposes. English acquired in such *target language-removed contexts* (Graves, 2008) as a school subject fundamentally differs from the language people use in contexts where English plays a dominant role in their lives. What learners learn in English classrooms is the knowledge of a linguistic system, rather than the ability to use English for social participation.

Re-conceptualizing the Roles of Technology and English: from Ends to Means

In the new era of globalization, the traditional notions of a divide among people regarding their technology and English ownership need to be re-conceptualized. Mere possession of technology and English as entities cannot guarantee a functional life in the 21st century. People need to be involved in transnational social networks for purposes meaningful to them, and technology and English are the two essential tools that enable participation in these networks. As a result, it is the social use rather than the ownership of technology and English that have become the focus of attention in the age of globalization. Therefore, the view of *acquiring technology and English as ends* in the previous era has gradually been replaced by the new view of *using technology and English as means*. I explain this new view as follows in terms of technology and English respectively.

In the case of technology, contemporary ICTs are increasingly packed with social functions that allow people to use them as effective means for social participation. Web

2.0 social technologies are all about connecting people around the world for various social purposes. For example, users of social networking tools like Facebook or Twitter utilize this technology to maintain and expand their social networks, and users of Skype make video calls to their contacts to facilitate and promote their personal relationships with others. The earlier versions of technology were not able to provide a social environment that would allow people to connect globally with ease. The possession of digital devices and services was considered a life goal to pursue, but this view of technology as an end no longer fits in the current context of the world as new social technologies develop. The world today is characterized not by the availability of computers and the Internet infrastructure but by "people's ability to make use of that device and line to engage in meaningful social practices, specifically to communicate with people, to access information, and to publish information" (Warschauer, in press, p. 7). Therefore, access to computers and the Internet is only the basic requirement in the age of globalization. What is more important is the use of technology as a means to the end of social participation involving transnational connections.

English was also considered an entity owned by those having its access and pursued by the English have-nots as a goal. However, the ownership idea is not very meaningful in the new era of globalization because English is no longer a unique possession of those who live in places where English is the primary or official language. It is now spoken by so many people in the world that no one can confidently claim their ownership over English. In fact, "everyone who has learned it now owns it--'has a share in it' might be more accurate--and has the right to use it in the way they want" (Crystal, 2003, pp. 2-3). The rise and spread of English as lingua franca has provided increased

opportunities for all people in the world to participate in transnational social networks via English. For instance, researchers all over the world often gather to share and discuss their work in international conferences for the purpose of collective knowledge construction, and they often select English as the language of communication. Another example is that users browsing on the Web often find that knowing English allows them to locate more relevant information because a large number of non-English websites of various origins offer an English version. In this new context, what it means to know English has shifted from the acquisition of English linguistic forms to the use of English as a means for social participation. English is not simply a foreign language for people in the expanding circle to learn, but is "more and more a tool that is being (re)shaped, actually and virtually, by a global group of users" (Larsen-Freeman & Freeman, 2008). Therefore, the goal of obtaining full accuracy and fluency of standard English appears both unrealistic and unnecessary. Instead, the focus is now on the use of English as a means to the end of social participation involving transnational connections.

Redefining the Digital Divide and the English Divide

The view of technology and English as means challenges the traditional concept of societal divides based on the amount of digital and English properties individuals possess. The issue in modern society is less about what technology and English resources people have but more about what they do with technology and English.

As the world becomes more and more socially connected, the notion of the digital divide defined by the availability of hardware and the Internet has become somewhat problematic. If the digital divide can be solved by the provision of inexpensive digital

devices and services, the numerous efforts of distributing computers and the Internet at low cost to the so-called technology have-nots should have overcome the problem. However, inequity persists in today's society. For example, a three-year longitudinal case study in Egypt conducted by Warschauer (2003) revealed that provision of technology equipment did not bridge societal gaps because technology is socially-embedded and is connected to issues of power. Therefore, the mere presence of computers and Internet access, just like the ubiquitous distribution of radio and television in the world, does not appear to completely close the gap (Castells, 2000). The hardware problem is only one of the many issues to address.

Van Dijk (2003) identified four types of barriers to digital access: 1) lack of *mental access* caused by inadequate cognitive preparedness for new technology; 2) lack of *material access* due to no ownership of computers and the Internet connections; 3) lack of *skills access* resulting from little support for the development of digital competence; and 4) lack of *usage access* because of few meaningful usage opportunities. The second type of difficulty, and very likely the first type as well, can be addressed by the offering of computers and Internet connections. However, the other two barriers are the ones in need of attention in the new age of globalization. Using technology for participation in transnational social networks is considered a necessity in today's network society, which requires people to develop digital skills in and for the social practices in the contexts meaningful to them. The definition of the technology skills referred to in the early concept of the digital divide was restricted to the abilities of operating and managing the computer and Internet access. The new context of globalization calls for more sophisticated abilities beyond the level of operation, which include the ability to

devise effective and appropriate use of new technology to participate in transnational social networks. These digital abilities are developed through significant social participation, and the quality of social participation increases as the abilities improve.

Therefore, the digital divide is more social than merely technical and geographic. The new definition of the digital divide should incorporate the cultural, economic, political, educational, and linguistic factors that affect people's use of technology for social participation. It has been suggested that we shift our focus from the *divide* to the *divided* (Harper, 2003). The approach of distributing digital devices and services can only solve part of the problem (the divide). More attention needs to be directed toward the people (the divided) who have varying capabilities and opportunities to perform digital participation for purposes meaningful to them.

Many important transnational activities that affect human life all over the world, such as market economy and international politics, are now structured in digital networks (Castells, 2004). Different types of digital networks have different values and power systems. Each individual decides the kinds of networks he wants to be included in according to personal needs, interests, and purposes. However, not everyone can achieve a desired level of inclusion in selected networks because of lacking participation opportunities or abilities. In fact, a person may be included in some networks but have difficulty participating in others. For example, one may be able to participate in informal social networks via Facebook but not have knowledge of professional networks hosted in other networking sites such as LinkedIn. The complex picture of the digital participation issue makes the word "divide" problematic in this network-based era. The so-called

"divide" no longer refers to a clear-cut binary division, but a continuum based on varying degrees of technology use (Warschauer, in press). The differences among people in terms of digital participation are not absolute, but relative and gradual (van Dijk & Hacker, 2003). Therefore, the digital divide should be redefined to address *the differences in opportunities to participate in transnational social networks for meaningful purposes via the use of technology as a means*. To capture the essence of this redefinition, I suggest a new term, *digital participation equity*, to replace the original term of the digital divide.

The new concept of digital participation equity modifies what it means to overcome the inequity problem. The traditional notion of the digital divide emphasizes the problem of lacking digital devices and services. However, it is now understood that it is what people do, not what they have, that makes a difference in their use of technology. Therefore, the issue of digital participation equity should be addressed by connecting people to the social practices that involve the use of technology for transnational connections. Those who have difficulty in using technology to participate in desired social networks lack the opportunities and abilities to engage in such practices. Once they are provided with the opportunities to participate in transnational social networks for meaningful purposes, they will develop the abilities necessary for the 21st century, and the digital participation equity can then be truly achieved.

Given the similarities between the roles of technology and English in the age of globalization, the redefinition of the English divide is expected to resemble that of the digital divide. As participation in transnational social networks becomes increasingly important, the original concept of the English divide based on English accuracy and

fluency has become less meaningful. Numerous efforts to provide English learners with access to English linguistic knowledge have insufficiently prepared them for successful social participation in contemporary society (Graddol, 2006). Acquiring knowledge in English vocabulary and grammar can only meet the minimum requirement for the life in the 21st century. It is the issue of use that needs greater attention.

Following Van Dijk's (2003) description of the four types of barriers to digital access, I argue that there are also four types of barriers to English access: 1) lack of *mental access* caused by inadequate cognitive preparedness for English; 2) lack of *material access* due to no ownership of English proficiency; 3) lack of *skills access* resulting from little support for the development of English abilities for social use; and 4) lack of *usage access* because of few meaningful usage opportunities. The first two types of barriers can be solved by the acquisition of English linguistic knowledge. The other two problems, however, require critical attention in the new context of globalization. Using English to participate in transnational social networks in modern society requires one to develop English skills beyond mere linguistic correctness and fluency. What is more important is the ability to adapt English use according to social contexts. As Larsen-Freeman and Cameron (2008) suggests from a Complexity Theory perspective, "Learning is not taking in of linguistic forms by learners, but the constant adaptation of their linguistic resources in the service of meaning-making in response to the affordances that emerge in the communicative situation, which is, in turn, affected by learners' adaptivity" (p. 135). This ability is mostly developed by actively engaging in meaningful social practices. Mastery of this adaptive ability increases the odds of successful and effective social participation.

As mentioned earlier, many domains of human life are now dominated by English, and it is now essential for people to use English to engage in core human activities through transnational social networks. The types of networks one chooses to be included in depend on one's social contexts. An individual may be fully included in one network but have difficulty participating in others because of lacking relevant participation opportunities or abilities. Therefore, the English "divide", similar to the digital divide, is in fact a far more complex issue than a mere bipolar separation problem, and the differences among people in terms of participation are relative and gradual. The issue is more social than simply linguistic and geographic. It is less about whether one can use English accurately and fluently like native speakers do but more about whether one can utilize English for effective social participation in transnational social networks. Therefore, the English divide should be re-conceptualized to take into account the effect of social contexts on English use, describing *the differences in opportunities to participate in transnational social networks for meaningful purposes via the use of English as a means*. Again, to reflect the change in this new definition, I suggest a new term, *English participation equity*, to replace the original term.

Similar to the discussion about digital participation equity, the new concept of English participation equity has changed what it means to address the inequity problem. The traditional notion of the English divide focuses on the problem of lacking English linguistic accuracy and fluency. However, the issue is now perceived as a problem of lacking meaningful participation in transnational social networks, and it can be addressed by helping people connect to the social practices that allow them to use English for transnational connections. Those who cannot use English for social participation lack the

opportunities and abilities to be involved in such practices. Once they gain the opportunities to meaningfully participate in transnational social networks, they will develop the types of English abilities needed in the age of globalization, and the English participation equity will then be realized.

New Generation of Teachers

The young generation of pre- or in-service teachers around the world has grown up in the new context of globalization. They have had a greater exposure to technology and are using digital tools in ways different from those of the older generation. Prensky (2001) named this generation the *digital natives* who think about and use technology in very different ways from the *digital immigrants* who learn to adapt to this new digital age in a process similar to those who learn a new language later in life. Digital natives are used to the environment in which they watch and use technology in their daily lives. However, this new generation is not universally competent in all technology skills and uses. Research shows that their digital experience is influenced by their personal characteristics such as gender and social and educational background (Hargittai, 2010; Hargittai & Hinnant, 2008).

The new generation of teachers is often assumed to be well equipped to use technology for instructional purposes. However, research suggests otherwise. Recognizing the fact that the so-called digital natives have joined the teaching profession as pre- and in-service teachers, Lei (2009) proposed that it is now time to examine the thoughts and experience of this new generation of teachers. He administered a survey to 55 pre-service teachers who were freshmen enrolled in teacher education programs in the

United States to investigate their technology proficiency, beliefs, and experiences. The data showed that these young pre-service teachers had a positive attitudes toward technology and were comfortable using technology for social communication, but their technology use experience was limited to social networking sites. They particularly lack sufficient abilities and experience in using technology for classroom instruction.

The situation in Taiwan is similar. Chen (2008) interviewed 12 Taiwanese high school teachers and did classroom observations on 9 of the participants for two months. She discovered that teachers did not integrate technology into teaching in ways that reflected what they believed good teaching should be. Liang and Tsai (2008) also reported that not all Taiwanese young teachers consider the role of technology in teaching positively. Their survey data from 365 undergraduate students who were pre- or in-service preschool teachers indicated that they had varying views about using Internet for purposes of teaching. Due to insufficient use experience, those who were not confident in their technology abilities had less positive attitudes toward incorporating the Internet into teaching. This suggests that the new generation of teachers in fact do not always have the confidence and experience in using technology for teaching purposes. This will certainly have an impact on how teachers structure classroom instruction as well as how their students learn in school.

In addition to technology, English is another element that has become an increasingly important part of people's lives. Countries where English is not the primary or official language have made efforts to ensure an adequate English proficiency of their citizens. Today's young generation has started compulsory English learning since

elementary school or even kindergarten. They are required to demonstrate their English proficiency at many points of their lives. For example, satisfactory levels of English proficiency have been set as one of the requirements for entering and graduating from universities and joining the workforce in many countries (Gan, 2009; Nunan, 2003; Pan, 2009; Tsai & Tsou, 2009; Zheng & Cheng, 2008). The young generation is usually asked to provide a proof of their English proficiency by submitting their scores on either an international English test, such as the *Test of English as a Foreign Language* (TOEFL) (Educational Testing Service, 2012) or the *International English Language Testing System* (IELTS) (IELTS, 2012), or a locally developed national English test, such as the *General English Proficiency Test* (GEPT) in Taiwan (The Language Training and Testing Center, 2012), the *Test in Practical English Proficiency* (EIKEN) in Japan (The Society for Testing English Proficiency, 2012), or the *Public English Test System* (PETS) in China (National Education Examinations Authority, 2012).

As the young generation enters the work force, it is unclear whether their years of English learning have a positive impact on the ways they use English in the work place. Surveys conducted by a human resource company (104 Corporation, 2008) indicated that college graduates in Taiwan generally did not have adequate English abilities critical for the job market. In 2008, about 47% of the 260 thousand posted full-time job openings required the applicants to possess certain types of English skills. However, as many as 63% of the 1997 applicants did not think their English abilities were sufficient for the jobs. Teachers are no exception. Butler (2004) investigated elementary school English teachers' abilities to use English for teaching in Taiwan, Korea, and Japan. Surveys collected from 522 teachers, 206 of whom were from Taiwan, indicated that these

teachers lacked sufficient English abilities necessary for teaching, particularly the oral communication competence.

If pre-service teachers do not use technology and English in ways that are central to the new era of globalization, we cannot expect them to help students develop appropriate digital and English abilities in the future. This study is committed to gaining a deeper understanding of this group of young teachers in terms of their technology and English uses. The majority of prior studies on the new generation of teachers used surveys as the major research instrument. However, one-time surveys may not be sufficient in providing the type of information detailed enough for understanding teachers' behaviors and perceptions in depth. Therefore, this study employed web logs, in addition to questionnaires, to obtain a deeper understanding of teachers' uses of technology and English in everyday life.

Summary of Chapter 2

This chapter described the current context of social globalization featuring the diffusion of technology and English worldwide. As technology and English evolved overtime, new types of digital and English abilities become critical to the life in the 21st century. This chapter also discussed issues of equity in social participation via technology and English as well as the ways in which the concept of equity has shifted to reflect the new changes in society. Finally, the chapter provided a review of research on the new generation of teachers and justified the need to investigate the digital and English experience of this population.

Chapter 3 : Methods

Overview

This descriptive study employs a quantitative approach to investigate the general patterns of technology and English uses and perceptions among pre-service teachers in Taiwan. In this chapter, I discuss the rationale for the research design and describe the research setting, participants, and data sources. I then detail the data collection procedure and data analysis process. A brief discussion of the validity and reliability of the study is provided at the end.

Research Design

This study adopts a two-phase research design to explore pre-service teachers' perceptions and uses of technology and English, the relationships between their technology and English uses, and the factors that influence such uses. Different instruments were used in the two different research phases, which allows us to have a holistic understanding of the phenomenon from various angles that complement each other as well as to detect confirming and disconfirming evidence (Mathison, 1988). The two phases were in a sequential order with little time gap in between so that the information provided by the participants in both phases were under the same environmental conditions. This would eliminate the need to consider the effect of factors

such as recency and contextual change in the interpretation and comparison of the data in both research phases. All the participants of the second phases also participated in the first phase, which also ensures the consistency of the data.

In the first phase of this study, a questionnaire was administered to the participants to investigate their perceptions and uses of technology and English in daily life. Administering questionnaires, or surveys, to samples of a target population has been an increasingly popular research method. This method has been used for "monitoring important trends in society, testing our theoretical understanding of social processes…and providing key indicators of what is going on in our society" (Berends, 2006). Compared to methods such as interviews and observations, the use of questionnaires is a relatively time- and cost-effective way to recruit a large group of participants. Administering a questionnaire takes less time and manpower than conducting interviews and observations and thus can be used to study a larger sample of a population, which in turn would increase the generalizability of the produced results. Questionnaires usually contain questions that provide choices to participants and thus allow researchers to see the trends within a population via a quantitative or numeric description (Creswell, 2009). Therefore, the use of a questionnaire in this study can appropriately serve its objective, which is to understand the general patterns of technology and English uses among pre-service teachers in Taiwan.

In order to generate more reliable results and gather more insights into the topic of this study, a second research phase was added to this study. In this phase, participants were asked to document their daily activities involving the use of technology and English

in a web log for two weeks. Data from this log would significantly increase our knowledge of the phenomenon because it enables a more frequent and detailed account of events happening in pre-service teachers' lives than questionnaires. While a one-time questionnaire is a good tool for pre-service teachers to express their general thoughts on technology and English use, a web log recording daily activities over an extended period of time allows them to document more details of their technology and English uses with less interference caused by memory loss. In other words, the use of web logs would increase the accuracy of the study results because, first of all, it is easier for participants to record things when they just happened than to remember how things went in the past, and secondly, multiple documentations of events from one person would represent his use patterns more accurately than a single report from the same person could do. Although methods such as interviews and observations can also produce more detailed results, the cost and labor associated with these methods are significantly higher than the use of web logs. Since the administration of web logs is relatively less expensive and time-consuming, it is ideal for detecting patterns within a large sample of participants and thus improving the generalizability of the study results (Rowan & Correnti, 2009).

Research Setting

The study was conducted in a 4-year public university located in Taipei, the capital and also the largest city in Taiwan. This university was chosen because it is the leading teacher preparation institution, which is devoted to preparing undergraduate students for secondary or elementary school teaching after graduation. There are currently more than 15,000 students studying in 59 departments at undergraduate and

graduate levels in this university, and each department offers a subject-specific teacher education program to their students (National Taiwan Normal Univeristy Office of the Secretariat, 2012). This university produces the largest population of pre-service teachers in Taiwan each year, and a high percentage of secondary school teachers currently in service received a bachelor's or master's degree from this university.

All the teacher education programs offered in this university are structured similarly even though each of them is operated independently by each department. These programs are geared toward undergraduate students, but graduate students are also allowed to participate. All first-year undergraduate students are eligible to apply to the teacher education program offered in their department after completing their first-year coursework. However, the number of students who will ultimately be accepted to the program is limited by a quota set by the Ministry of Education depending on the projected demand for teachers every year, and the quota varies among different subject areas. For example, when the study was conducted, the percentages of senior students who were accepted to teacher education programs were 70% for Chemistry, 70% for English, 50% for History, 40% for Life Sciences, and 70% for Mathematics departments. Admission to teacher education programs is usually determined based on students' academic performance in the first year. Some of the departments also consider the results from a program entrance exam that they require their students to take at the end of their first year of college.

Students who are accepted to a teacher education program take teaching-related courses in addition to regular academic ones starting from the second year. These

students have to complete a total of 154 academic credits (as opposed to 128 credits for students in a non-teaching track) as well as a one-month teaching practicum in a secondary or elementary school in their senior year in order to graduate with a teaching endorsement. These students are granted the option of graduating in late summer rather than the regular graduation date in mid-June so that they have sufficient time to fulfill the teaching requirement for graduation.

With the extra teacher education credits on their academic record, these students are eligible to participate in a six-month post-graduation teaching practicum in selected schools at a time of their choosing. Some students prefer to complete the practicum right after their college graduation while others decide to defer the practicum in order to pursue an advanced degree. Once they finish the post-graduation teaching practicum, they are allowed to apply for a teachers' certificate of secondary or elementary school after they receive a satisfactory score on a national teacher qualification exam (Taiwan Ministry of Education, 2012b).

Participants

Pre-service teachers who were in their senior year in teacher education programs were recruited from five departments of the university. These programs represent different subject areas, including Chemistry, English, History, Life Sciences, and Mathematics, to allow cross-discipline comparisons. The curriculum designs of these five programs are similar. Students in each program take courses about teaching methods and classroom management starting from their sophomore year. During the last semester of their study, they are engaged in a one-month practicum teaching in public schools

followed by weekly cohort meetings with their practicum instructors to discuss their student teaching experience until they graduate in mid-June.

This dissertation study was carried out at a time when these pre-service teachers had just completed their practicum teaching and started to attend the cohort meetings once a week. Because they were about to graduate in one month, most students had begun their job search and many of them had landed on a teaching position for the post-graduation practicum in public schools. By this time the pre-service teachers had developed an identity as a teaching professional because they had experienced practice teaching in public schools and an educational job search. In other words, these pre-service teachers were different from other university students who were not in the teaching track in that they had clearer career goals in mind and were more certain of their future plans upon their graduation.

The process of participant recruitment took a significant amount of planning. Several steps were taken in order to reach the population of pre-service teachers. Six months before the study began, I started contacting the heads of the departments to request meetings with them to introduce my study. The meetings took place in Taiwan and were successful in granting me permission to conduct research in their departments. I then met with the faculty members who were the main instructors to the senior students in the teacher education program in each department. These faculty members served not only as academic advisors but also as teaching practicum instructors to the students in the teaching track. They were supportive of my research and gave me permission to recruit their students to participate in my study. Follow-up interviews with these faculty

members were conducted right before the study started in order to gather background information about the students and the teacher education programs in general. These interviews were not fully analyzed and will only be used to illustrate points when necessary.

The participant recruitment officially took place on the date when the research orientation was conducted in each department, of which the details are described in the following section regarding data collection procedures. Of a total of 247 senior students in the five teacher education programs, 153 participated in the first-phase questionnaire study, and 63 participated in the second-phase web log study (see Table 3.1).

Table 3.1. Participant statistics

Teacher education program	# of senior students in program	# of questionnaire participants	# of web log participants
Chemistry	45	35	21
English	56	20	7
History	32	31	10
Life Sciences	30	26	5
Mathematics	84	41	20
Total:	***247***	***153***	***63***

Data Sources

Two data sources were employed in this study - a questionnaire and a web log. Each of these research instruments was available in two languages, English and Mandarin Chinese. Both instruments were tested during a pilot study phase before the official research took place.

The questionnaire was designed to look into the pre-service teachers' perceptions and general uses of technology and English in daily life. It includes three sections of questions. The first section asks for the participants' background information and their future plan. The second section consists of 7 multiple-choice questions concerning the participants' general thoughts about technology. The third section is very similar in format to the second section except that the 7 questions in this section are related to the participants' thoughts on English. In order to gain a full understanding of the issue, the questions in each of these two sections are designed to collect various types of information using the framework that distinguishes between cognitive (or knowledge), affective (or attitudes), and behavioral information (Punch, 2005). For example, this questionnaire contains cognitive questions that ask about the participants' knowledge or ability to use technology and English, affective questions that ask about their preference and feeling associated with technology and English, and behavioral questions that ask about their frequency of using technology and English for specific purposes (See Appendix A for the English version of the questionnaire).

While the questionnaire allows the pre-service teachers to report what they think they do with technology and English, the web log enables a closer look at what they actually do in daily life. This web log asks the participants to log in every day for two weeks to provide information about three daily events or activities involving technology and/or English that they think were the most important to them and the use of technology and/or English were vital in the events. For each event, participants were asked to answer 18 questions, mostly in the format of multiple choices, concerning aspects such as purpose, language used, technology tools, location, and time of the event. They also

should indicate whether they were connected to people, intentionally or coincidentally, through the event. A few of the questions allow the participants to enter texts to describe the events, explain their choices, or provide further details. These questions were set up to help the researcher to understand and confirm the participants' answers to multiple-choice questions. Answers to these text questions were not fully analyzed and will only be used to illustrate points when necessary. This web log was designed using Google Docs, a free online office tool that allows an easy creation of surveys through a graphic user interface. User responses can be collected through a web form and then be stored in an Excel Spreadsheet, which is downloadable so that the data can be easily manipulated in personal computers (See Appendix B for the English version of the web log).

Further explanations are needed on several important concepts or definitions of terms related to the questionnaire and web log. First of all, "English use" refers to an event or activity in which participants read, write, listen to, or speak English, with or without other languages, to fulfill purposes meaningful to the participants. In other words, English use is not restricted to the exclusive use of English only. Any event in which participants think English plays an important role can be considered an English use event.

Similarly, "technology use" refers to an event or activity in which participants use 21st-century technology to fulfill purposes meaningful to them. This study distinguishes between technology *tools* and technology *platforms*. Technology *tools* refers to software or applications, such as search engine or email, that people manipulate on hardware or devices, such as computer or cell phone, referred to as technology *platforms* in this study. Not all activities involving the use of a technology platform are of interest to this study.

Many technology platforms were created with a single function but now have incorporated new types of technology tools as additions to the traditional function. For example, the traditional function of a cell phone is oral communications between two people. However, cell phones have undergone dramatic transformations and have now become "smart" by including applications and internet access that enable new types of connection among people. Because this study aims to explore new types of technology use in the information age, participants were asked to document their technology use beyond the traditional function of digital devices. Therefore, rather than recording activities like talking on the phone or taking photos using a camera, participants would submit events such as sending messages via a cell phone or editing and uploading photos via a camera.

Moreover, the technology tools and platforms listed in the questionnaire and web log are categorized based on their major function or purpose even though each specific technology tools and platforms may contain multiple functions. For example, Facebook is primarily used for social networking and thus is categorized as a social networking tool even though it also includes other functionalities such as online games. Similarly, a cell phone may now be used not only for its traditional talking function but also for other ones such as taking a photo and playing music, which are the functions normally provided by devices such as a camera and music player. However, for the ease of analysis and interpretation, these technology tools and platforms are placed in the groups that best describe their primary functions. In addition, I want to emphasize that the technology tools listed in the questionnaire and web log reflects the common types of technology use at the time when this study was carried out in 2010. Technology has further developed

since then. New tools have been created and some existing ones have also been modified or redesigned. However, to better understand the results yielded from this study, readers should keep in mind that this study is situated in the context of the year 2010.

Data Collection Procedures

Data collection was conducted in the second half of the spring semester in 2010. The first-phase questionnaire study was carried out in May when pre-service teachers had just completed their one-month teaching practicum and returned to school for weekly cohort meetings with instructors to discuss their teaching experience. The second-phase web log study began immediately after participants completed the questionnaire study in each teacher education program. The entire data collection process was completed before participants graduated in late June.

Questionnaire

The first-phase questionnaire study was conducted in group settings in classrooms. I scheduled a one-hour visit to the cohort meetings, held in the context of a course named "Teaching Practice" designed to support senior pre-service teachers' teaching experience, in each of the five teacher education programs. Before I visited the cohort meetings, the practicum instructors had provided information about my research and personal background to the pre-service teachers. They also encouraged these pre-service teachers to participate in my study while emphasizing that the participation is completely voluntary. During the one-hour visit, I began by introducing myself as a researcher, a former teacher in Taiwan, and an alumna of the university in order to raise the pre-service

teachers' interest in my study. I then gave an overview of my dissertation study by describing its purpose, scale, design, and research instruments. After my presentation, I distributed the consent forms to the pre-service teachers in class and made it clear that those who opted for not participating in my study did not need to return the consent forms. I also emphasized that they could choose to participate in only one of the two research phases or to withdraw from the study at any time during the study if they wanted to (See Appendix C for the English version of the study consent form).

The recruitment of participants was smooth. The majority of the pre-service teachers who attended the research orientations agreed to participate in the study. Several factors may have contributed to this high participation rate. To begin with, I had the opportunities to describe my research in detail to the pre-service teachers in person and was able to answer questions and resolve confusions immediately. They might have felt comfortable to be able to discuss with the researcher before agreeing to participate in the study. In addition, my background as a former teacher and alumna, as well as the faculty members' promotion of my work to pre-service teachers, might have raised their interest in my study. Furthermore, distributing the consent forms in a group setting might have created a snowball effect; that is, they were more willing to participate in the study when seeing that many of their peers also agreed to be in the study as well.

After participants signed the first part of the consent form regarding the questionnaire study, I distributed the questionnaires in class and provided a brief description of every item in the questionnaire. The rationale for administering the questionnaires in group settings was that: 1) it saved time because all participants did the

questionnaires simultaneously and were able to complete the questionnaires in approximately the same amount of time, 2) it ensured that every participant had a full understanding of every item in the questionnaire because I was able to make clarifications on site when the participants have questions, 3) it guaranteed that every participant received the same instructions and explanations of the questionnaire items because I was able to describe the questionnaire to the entire class, and 4) the questionnaire return rate was high because I was present to collect the questionnaires.

The questionnaire was in the paper-based format because the cohort meetings were held in regular classrooms mostly without computers and not all participants brought their laptop to class. Although the questionnaire was offered in two language versions, all the participants chose to complete the questionnaire in Mandarin Chinese. It took an average of 15 minutes for the participants to complete the questionnaire.

Web Log

After all the participants returned the questionnaires, I led group discussions to help pre-service teachers understand several important concepts or definitions of terms related to the study and the web log in particular, such as “English use” and “technology use”. I then gave a demonstration of the web log as well as a detailed explanation of each item in the log. The major advantage of asking participants to complete the daily event log online rather than on paper is that the web log saves time, money and manpower (Berends, 2006; K. B. Wright, 2005). First, it can be distributed to a large number of participants without the cost associated with paper, printing, mailing, and data entry. Second, the web log can be easily accessible via a link and thus the researcher does not

need to go through the process of distributing and collecting log sheets every day. Third, responses to log questions can be automatically recorded in a database and are immediately available for analysis. Fourth, responses to log questions are viewable as soon as they are submitted and thus allow easy tracking of participants' daily log activities. In addition, the web log allows a more accurate data entry not only because log responses are directly saved in the database without the extra step of entering the data by the researcher but also because the time and date of log submission are automatically documented by the system to eliminate possible errors produced in participants' self reports.

After I described and answered questions about what participants were expected to do with the web log, the pre-service teachers who were interested in participating in the web log study signed the second part of the consent form regarding the web log, including providing their contact information so that the link to the web log could be sent to them daily. The meetings with pre-service teachers were concluded with the collection of all the study consent forms. On the next day, an email was sent out to all the web log participants and asked for their prompt response via Doodle, an online voting tool, in order to test the accuracy of their email address as well as reconfirm their willingness to commit to the web log study. They were also encouraged to contact me via email when they had questions at any time during the study.

The web log activities officially started on the date that followed. Participants were asked to document three events involving the use of technology and/or English every day for two weeks; that is, 14 days in total including weekends. They were

explicitly instructed not to report events directly related to this study, such as submitting web log entries or receiving emails from me. They could access the web log through the links included in the email I sent out every morning. This daily email was customized according to participant's subject area as well as the number of dates they had completed the web log. In addition to necessary information, clarifications, and reminders about the web log activities, the email contained two links to the web log, one to the log in Mandarin Chinese and the other to the log in English. Participants could choose to complete the web log in either of the languages every day. However, the majority of the events were submitted via the web log in Mandarin Chinese. In addition, although completing the log online was the preferred method, I also prepared paper-based log sheets in case any of the participants did not have a convenient internet access. However, all participants were able to submit daily log entries online.

Participants were advised to record the event information at the end of the day or early next morning while their memory was still fresh. I checked participant responses in the web log every morning to verify their web log submissions. If no response was recorded for a designated log date for a particular participant, I sent them reminders via their primary and secondary email accounts and sometimes also via text message to their cell phone. If still no response was received despite all the reminder actions just mentioned, the participant was considered withdrawn from the study. Furthermore, if a participant could not access the internet on a particular log date (due to travel, for example), they were advised to contact me, in advance if possible. In such cases, they were allowed to fill out the web log at a later time.

After the web log research phase was officially over, I selected a number of the participants to do follow-up interviews in order to verify what they reported on the questionnaire and web log. These interviews served the purpose of confirming and understanding the participants' answers to the questionnaire and web log questions. They were not analyzed on a full scale and will only be used to illustrate points when necessary.

Data Analysis Procedures

Significant time was spent on the management of the datasets. The paper-based questionnaire data were manually entered into an Excel spreadsheet. The web log data were originally stored in five online Google Docs spreadsheets, each of which collected responses from participants of the same subject area. The data from all five subject areas were then downloaded and merged into one large dataset in an Excel spreadsheet. After completing the necessary process of adding, removing, recoding, and regrouping variables, both the questionnaire and web log datasets were uploaded to SPSS (Statistical Package for Social Sciences). All subsequent data analyses were conducted using SPSS. The data analysis procedures include the following:

1. Descriptive statistics and frequency analyses were performed on all data to find common characteristics of technology and English uses among participants.
2. Factor analyses were conducted to reduce the amount of data relating to some sections of the questionnaire questions so that more meaningful interpretations could be made.
3. Correlations were carried out to uncover the relationship between technology and English in terms of participants' expertise in and attitude toward these two tools.

4. General linear regression, binary logistic regression, and ordinal logistic regression analyses (depending on data types) were performed on the questionnaire data to test whether personal factors (e.g., gender, subject area) have an impact on the participants' technology and English uses in many aspects.
5. Generalized mixed models were built on selected web log data to see whether participants' daily technology and English activities differ depending on personal factors (e.g., gender and subject area). This method was used instead of the methods mentioned above because there were multiple data entries in the web log dataset for each participant and this method could account for this repeated person effect.

The relationship between the research questions, the data sources, and the data analysis methods is summarized in Table 3.2.

Table 3.2. Relationship between research questions, data sources, and data analysis methods

Research Questions	Data Sources	Data Analysis Methods
What do pre-service teachers think of technology and English and their abilities to use them?	Questionnaire	Descriptive statistics and frequency analyses on the questions regarding pre-service teachers' preference and self-reported expertise relating to technology and English. Factor analyses on the sets of questions about pre-service teachers' attitude toward technology and English
How and for what purposes do pre-service teachers use technology and English in their daily lives?	Questionnaire and web log	Descriptive and frequency analyses on different aspects of pre-service teachers' daily uses of technology and English (e.g., purposes, languages used, technology tools, and contexts of the events reported)
What, if any, is the relationship between pre-service teachers' technology and English uses?	Questionnaire and web log	Descriptive and frequency analyses on the data in which elements of technology and English were present simultaneously. Correlation analyses on the questions concerning participants' expertise in and attitudes toward technology and English
How do pre-service teachers' uses of technology and English differ depending on personal factors such as gender and subject area?	Questionnaire and web log	General linear regression, and ordinal logistic regression analyses on all questionnaire questions with variables including gender and subject area. Generalized mixed models analyses with variables including gender and subject area on web log events regarding questions about common purposes and technology tools used.

Validity and Reliability

In every stage of the research, several attempts were made to establish the validity and reliability of the study.

Regarding research design, this study employed two research phases, questionnaire and web log, to investigate the issue at hand from multiple angles. This research design allows triangulation of the findings from different research phases and instruments. In other words, by comparing and contrasting the results from various data sources, a researcher can explore multiple complementing aspects of the same phenomenon, verify the results from multiple angles, and search for disconfirming evidence that may need extra examination (Smith, 2006).

Regarding research instruments, I took several steps to develop and verify the correctness and usefulness of the questionnaire and web log. I consulted literature and professionals about important aspects of technology and English and designed questions that address those issues. The questions went through several iterations of revisions based on the suggestions from faculty members and fellow graduate students. The resulting two versions of the questionnaire and web log in two languages, Mandarin Chinese and English, were then tested in a pilot study involving six undergraduate students from a university different from the one in study. Minor changes in format and wording were made based on their feedback.

Regarding data collection, I was able to recruit a sample of pre-service teachers in a size large enough for valid statistical analyses[1]. During the collection of data, I was able to quickly answer questions and resolve confusions on site during the questionnaire phase and via email during the web log phase. In this way, the accuracy of user responses was ensured. In addition, the web log phase requires participants to document their daily activities for a two-week cycle rather than simply a couple of days so that the number of data entries would be large and general patterns could be easier to emerge from the data. Furthermore, I conducted several follow-up interviews with selected participants to verify their responses to the questionnaire and web log.

Regarding data management and analysis, the questionnaire data was coded and entered into the electronic database by a person unrelated to the study. The codes were double checked by me to ensure the accuracy of the data. The web log data, on the other hand, were transferred to the electronic database by me. After I completed necessary management of the data, another person checked the accuracy of randomly-selected data points. In addition, I regularly discussed my quantitative analyses with statistical consultants to make sure that all methods and interpretations were appropriate to the data. All results from statistical analyses were tested by appropriate methods, such as T-test or F-test.

Regarding myself as a researcher, I closely monitored participant's activities relating to the study and made immediate clarifications and adjustments when necessary in order to make sure that all data were valid and usable by the study. I also documented

[1] Given the 95% confidence level and 5% margin of error for valid quantitative analysis, the minimum sample size for the population of 247 students is 151. My sample size of 153 is above this critical number.

all information relating to the study as well as my observations and thoughts throughout the entire study to assist my subsequent analyses and interpretations of the data.

Summary of Chapter 3

In this chapter, I explained the reasons for adopting a two-phase research design and the rationale to use the questionnaire and web log as data collection instruments in this study. I also described the research setting, participants, and data sources as well as the procedures I used to collect and analyze data. Finally, I discussed the issues of validity and reliability in the study. In the chapter that follows, I will present the findings from the analyses on questionnaire and web log data to understand pre-service teachers' perceptions and uses of technology and English.

Chapter 4 : Findings

Overview

In this chapter, I present the major findings regarding 1) how the pre-service teachers in the study perceived and used technology and English in their daily lives, 2) what social connections they were involved in via technology and English, 3) how their digital and English experiences were interconnected, and 4) how personal factors such as gender and subject area had an impact on the ways they used technology and English.

This study found that the pre-service teachers in the study generally had positive attitudes toward technology and English. They saw the importance of technology and English in instructional contexts and expressed their willingness to incorporate these two 21st-century elements in their future teaching. They reported that they were able to use a variety of technology tools and English skills to accomplish various purposes in daily life, and many of their uses of technology and English were closely connected. The more positive attitudes and better abilities they reported having with technology, the more positive attitudes and better abilities they also reported having with English, and vice versa. This positive relationship between technology and English was especially salient in the pre-service teachers' patterns of social connections. They reported that they often used English, mostly accompanied by Mandarin Chinese, to connect with local friends and like-minded people from afar, and such connections usually occurred in digital

contexts. They also reported that they were more likely to coincidentally connect to someone with similar interests when technology and English were used together. In other words, technology and English facilitated connections with people with similar interest. The interconnection between technology and English was also apparent in the differences in technology and English uses among the pre-service teachers. For example, the pre-service teachers who were female and who were in the subject area of Mathematics appeared to be less positive in their perceptions and had less frequent uses of not only technology but also English. In other words, when they lacked certain types of technology use experience, it was very likely that they also lacked English use experience relevant to that technology use.

In the following sections, I describe the results of the data analyses from the questionnaire and web log respectively. Each data source focused on a different dimension of the phenomenon and thus complemented each other.

Questionnaire

In this section, I report the findings of the quantitative analyses from the questionnaire, which explored pre-service teachers' perceptions of and abilities with technology and English. I first provide an overview of the participants' background. Then I present the key findings to answer the following questions: 1) What did the pre-service teachers in the study think about technology and English? 2) What were they able to do with technology and English? 3) What was the relationship between technology and English uses? and 4) What were the differences in the perceptions and uses of technology and English among them? For each question, I first provide a preview of key findings,

followed by discussions of specific topics relating to the question. This section is concluded by a summary of all important findings from the questionnaire.

Participants' Background

There were 153 participants who completed the questionnaire. In general, there were more female (56.9%) than male (43.1%) participants (see Table 4.1). Among the five subject areas, there were more Mathematics (26.8%), Chemistry (22.9%), and History (20.3%) students than Life Sciences (17.0%) and English (13.1%) students. In most subject areas, there were more female than male participants except for Mathematics, which reflected the gender ratio in each subject area (see Table 4.2).

Table 4.1. Participants' background - Questionnaire

		Frequency	*Percentage*
Gender			
	Male	66	43.1
	Female	87	56.9
Subject Area			
	Chemistry	35	22.9
	English	20	13.1
	History	31	20.3
	Life Sciences	26	17.0
	Mathematics	41	26.8
Academic Status			
	Undergraduate	142	92.8
	Graduate	11	7.2
Plan after graduation			
	Teaching practicum	108	70.6
	Master's program in Taiwan	52	34.0
Plan to teach in the future			
	Yes	139	90.8
	No	7	4.6
	Not sure	7	4.6

	Mean	*Standard Deviation*	*Minimum*	*Maximum*
Age	22.37	1.482	21	33

Table 4.2. Numbers of male and female participants in each subject area - Questionnaire

Subject Area	*Male*	*Female*	*Subject Area Total*
Chemistry	15	20	35
English	0	20	20
History	8	23	31
Life Sciences	12	14	26
Mathematics	31	10	41
Gender Total	66	87	153

The majority of the participants were senior undergraduate students (92.8%), and the average of age was 22.37 (see Table 4.1). The 11 graduate students who chose to participate in undergraduate pre-service teacher programs spread evenly across subject areas, with 3 in Chemistry, 3 in History, 2 in Life Sciences, 3 in Mathematics, and none in English. Since the number of graduate students was very small compared to the number of undergraduate students, it did not have a significant influence on the results of subsequent analyses to represent undergraduate pre-service teachers. Regarding their future plans, about 90.8% of the participants planned to become a teacher in the future. About 70.6% of the participants indicated that the first plan they had right after graduation was to participate in a teaching practicum and obtain a teaching certificate afterwards. About 34.0% of the participants either had received an admission or were planning to apply to a master's program in Taiwan. Some of them decided to postpone the admission until they completed the teaching practicum while others planed to pursue an advanced study before starting their teaching career.

Regarding the technology resources that the participants had, the analyses of the questionnaire responses showed that they owned abundant technology resources. All (100%) of them had a cell phone, a computer, and a digital camera, and the majority

(98.7%) had internet access. About a half of the participants also owned a digital music or video player, such as an iPod, (51.0%) and a digital video camcorder (46.4%) (see Table 4.3).

Table 4.3. Technology resources owned

	# of participants	*Percentage of participants*
Cell phone	153	100.0
Computer	153	100.0
Digital camera	153	100.0
Internet connection	151	98.7
Digital music or video player	78	51.0
Digital video camcorder	71	46.4
Video gaming system	56	36.6
Digital audio recorder	52	34.0
Digital reader	8	5.2

In general, pre-service teachers in this study had a high level of access to various types of technology resources. Based on the traditional definition of a "digital divide," which refers to the gap between the people who have access to technology resources and those who do not, these pre-service teachers should be classified as technology "haves" and should have generally equal access to technology. However, does this mean that they all used and thought of technology in the same way? A closer look at these pre-service teachers' perceptions and uses of technology is necessary to understand the phenomenon better.

What did Pre-service Teachers Think about Technology and English?

To answer this question, I provide discussions of three relevant topics: 1) the pre-service teachers' attitudes toward technology and English in general, 2) their views about

individual technology tools and English skills, and 3) the barriers they perceived to learning to use technology and English.

This study found that the pre-service teachers in the study generally had positive attitudes toward technology and English. They thought several technology tools and English skills were valuable for all aspects of their lives. The types of barriers they faced in their learning of using technology and English were different. They believed that the lack of formal training and technical support interfered with their technology learning, and the lack of use opportunities hindered their English learning.

Attitudes toward Technology and English

To understand pre-service teachers' attitudes toward technology and English in general, I asked the questionnaire participants to specify on a scale of 1 (strongly disagree) to 5 (strong agree) the degree to which they agreed with ten statements. The statements include the following:

1. I like to explore new technology tools.
2. I can easily figure out new technology tools.
3. I like to show people how to use new technology tools.
4. I look forward to using new technology tools in my teaching.
5. I will teach my students how to use new technology tools.
6. I like to learn English.
7. I can easily figure out new English words and usages.
8. I like to show people how to use English.
9. I look forward to use English in my teaching.
10. I will teach my students how to use English to complete certain tasks.

Factor analyses, which were performed to detect common patterns underlying these statements, resulted in four factors. Regarding the attitudes toward technology, the first factor described participants' appreciation for technology, which included

Statements #1, #2, and #3 (Cronbach's Alpha = .832). The second factor described the participants' willingness to teach with technology, which included the Statements #4 and #5 (Cronbach's Alpha=.777). Similarly, the attitudes toward English could be described by two factors. The first factor described participants' appreciation for English, which included Statements #6, #7, and #8 (Cronbach's Alpha = .815). The second factor described the participants' willingness to teach with English, which included Statements #9 and #10 (Cronbach's Alpha=.842). To allow a more meaningful interpretation of the four factors, I averaged the ratings of all statements relating to each factor (See Table 4.4).

Table 4.4. Factors regarding the attitudes toward Technology and English

	Mean	*Std. Deviation*
Appreciation for technology	3.60	.785
Willingness to teach with technology	3.85	.676
Appreciation for English	3.00	.905
Willingness to teach with English	3.48	.943

Scale: 1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = strongly agree

The analyses showed that the participants in general appreciated technology and were willing to teach with technology. They had a lower degree of appreciation for English, but they were still willing to teach with English. The average rating of participants' willingness to teach with technology was higher than their appreciation for technology. The same pattern could also be found in participant's attitudes toward English. This revealed that the participants saw the importance of using technology and English in teaching regardless of their degree of appreciation for these two tools.

Views about Individual Technology Tools and English Skills

In addition to investigating the participants' attitudes toward technology and English in general, this study looked further to understand which specific technology tools and English skills the participants thought were important in their lives. I asked the participants to rate the value of a list of technology tools for their social life, academic life, and future career on a scale of 1 (not important at all) to 4 (extremely important). The analyses showed that many technology tools were valuable in different aspects of the pre-service teachers' lives. The participants thought that the technology tools which were the most important for social life were instant or text messaging and email; for academic life and future career were office tools and search engine (see Table 4.5).

Table 4.5. Views about the value of technology tools

	Social Life	*Academic Life*	*Future Career*
Blog	2.95[a] (.849[b])	1.82 (.762)	2.24 (.887)
Discussion group	2.62 (.918)	2.31 (.956)	2.42 (.893)
Electronic transaction	2.02 (.963)	1.48 (.753)	1.88 (.931)
Email	3.61* (.608)	3.59* (.623)	3.58* (.635)
Instant message or text message	3.78* (.503)	3.05* (.869)	3.15* (.809)
Map	2.76 (.983)	2.43 (.974)	2.87 (.889)
Office tools	2.59 (1.127)	3.85* (.426)	3.76* (.500)
Online office collaboration tools	2.10 (.909)	2.44 (.945)	2.50 (.974)
Photo sharing	3.15* (.849)	2.20 (.830)	2.43 (.809)
Podcast	2.57 (.951)	2.24 (.851)	2.36 (.832)
RSS feed	2.09 (.989)	2.37 (1.031)	2.46 (1.064)
Search engine	2.97 (.996)	3.80* (.478)	3.63* (.636)
Social bookmarking	2.05 (.909)	1.99 (.885)	2.05 (.880)
Social networking	3.10* (.981)	1.86 (.790)	2.24 (.849)
Video/online games	2.51 (1.101)	1.37 (.615)	1.59 (.738)
Video sharing	2.93 (.825)	2.35 (.876)	2.46 (.873)
Video/audio conferencing	3.41* (.798)	2.42 (.971)	2.66 (.961)
Virtual community	2.47 (1.076)	1.76 (.767)	1.86 (.838)
Website browsing	3.22* (.945)	3.67* (.583)	3.59* (.653)
Wiki	2.30 (1.027)	3.67* (.548)	3.37* (.751)

Scale: 1=not important at all, 2=somewhat important, 3=important, 4=extremely important
[a] Mean
[b] Standard Deviation
*Mean > 3.00

The participants thought that the technology tools that were valuable for academic life were also important for their future careers, which was not surprising since teacher education programs are supposed to prepare pre-service teachers for future teaching jobs. Although the set of technology tools valuable for the participants' social life was somewhat different from those valuable for academic life and future career, there were several that were thought to be important to all aspects of pre-service teachers' lives. These technology tools and skills include email, instant or text messaging, and website browsing. Given the critical roles these tools play in pre-service teachers' lives, it may be worth the effort to explore the potential of incorporating these tools into teaching.

In addition to technology tools, the participants were asked to rate the importance of English skills, including reading, writing, listening, and speaking, for their social life, academic life, and future career on a scale of 1 (not important at all) to 4 (extremely important). The analyses showed that the participants thought all four English skills were important for their academic life and future career, while listening and speaking skills were somewhat more important than reading and writing for their social life (see Table 4.6).

Table 4.6. Views about the value of English

	Social Life	*Academic Life*	*Future Career*
Reading	2.80[a] (.877[b])	3.64* (.626)	3.61* (.653)
Writing	2.72 (.807)	3.52* (.797)	3.46* (.805)
Listening	3.36* (.792)	3.50* (.781)	3.61* (.728)
Speaking	3.40* (.800)	3.40* (.824)	3.63* (.698)

Scale: 1=not important at all, 2=somewhat important, 3=important, 4=extremely important
[a] Mean
[b] Standard Deviation
*Mean > 3.00

Interestingly, the lower value for social life the participants assigned to the skills of English reading and writing appeared to contradict the findings that several technology tools they thought were important in their social life, such as website browsing and instant or text messaging, require reading and writing skills, and that they often used these tools in English as will be described in the following section. I suspect that this discrepancy in the participants' responses might be because the participants interpreted English "reading" and "writing" as formal skills (e.g., reading an English article or writing an English essay) and did not consider the more informal and colloquial types of English reading and writing activities commonly featured in these technology tools when answering the question.

Barriers to Learning to Use Technology and English

One aspect regarding the pre-service teachers' perceptions about technology and English was the barriers they thought they experienced when they learned to use technology and English. To understand what difficulties they had with technology, I asked the participants to specify the types of obstacles they faced when learning to use technology tools. Table 4.7 shows that more than half of the participants selected the lack of formal training (66.7%), technical support (64.7%), and proper hardware and software (57.5%) as the major obstacles for them to learn technology well. Nearly a half of them (48.4%) also thought that the lack of sufficient English skills impeded their technology learning. The lack of opportunities to use technology (39.2%), the lack of confidence in learning technology (22.2%), and the lack of motivation to learn technology (19.6%) were less of a problem for the pre-service teachers, and only a few of the participants had

the problem of lacking internet connection (13.7%). Some participants explained they liked to learn new technology and constantly explored the technology tools freely available on the web. However, they were also interested in some technology tools that could only be accessed through purchase. They could not afford the cost to learn the tools and thus considered the lack of software and relevant hardware as well as the support and training related to these tools the major barrier to their learning of new technology.

Table 4.7. Barriers to learning to use technology

	# of participants	*% of participants*
Lack of formal training	102	66.7
Lack of technical support	99	64.7
Lack of proper hardware and software	88	57.5
Lack of sufficient English skills	74	48.4
Lack of opportunities to use these technology tools	60	39.2
Lack of confidence in learning new technology in general	34	22.2
Lack of motivation to learn these technology tools	30	19.6
Lack of internet connection	21	13.7

The participants were also asked to specify the types of barriers they faced when learning to use English. Table 4.8 shows the majority of the participants (86.9%) believed that the lack of opportunities to use English hindered their English learning. Besides, more than half of them (59.5%) chose the lack of confidence in learning English as the other primary obstacle to learning English well. They had less difficulty with the lack of motivation to learn English (32.0%) and the lack of formal training (26.1%). Only a few of the participants chose the lack of sufficient technology skills (9.2%) and the lack of dictionaries (3.3%) as the barriers to learning English.

Table 4.8. Barriers to learning to use English

	# of participants	*% of participants*
Lack of opportunities to use English	133	86.9
Lack of confidence in learning English	91	59.5
Lack of motivation to learn English	49	32.0
Lack of formal training	40	26.1
Lack of sufficient technology skills	14	9.2
Lack of dictionaries	5	3.3

Some of the participants explained that they knew the important role English played in many social activities and wanted to develop English use abilities beyond what they learned in school. However, they did not think they had sufficient opportunities to use English in Taiwan and thus lacked the confidence in their ability to learn English well. Although the web log data, which will be presented later in this chapter, suggested that they did use English frequently in daily life, they generally were not satisfied with the quality of their English use (even though they were able to use English to serve various purposes as shown in the web log) and thus desired to be engaged in more intensive English use opportunities. This might be a reflection of the mismatch between the types of English they used every day and what they learned in school. The native-speaker model of English has always been the norm in the Taiwanese education system, and students are constantly tested on their abilities to use English like native speakers do. The pre-service teachers in the study might have developed a habit to evaluate their English use against this native-speaker norm and hence were not satisfied with the opportunities to use English as a lingua franca in Taiwan.

The comparison between the barriers to learning technology and English revealed an interesting pattern. The participants thought they did not lack the opportunities to use technology but were in need of formal training in using new technology. In contrast, they

believed they were not short of formal training in English but needed opportunities to use English. At first glance, it might seem that technology and English played very different roles in the pre-service teachers' lives. However, there was a possibility that the technology tools on which the participants wanted formal training (e.g., specialized tools for professional purposes) might not be the same ones they had many opportunities to use in daily life (e.g., common tools for social purposes). Similarly, the type of English on which the participants received formal training (e.g., academic English) might be different from the type of English they actually had many opportunities to use in daily life (e.g., English for social purposes). In other words, it was likely that there was a mismatch in terms of digital and English practices between what the participants learned, or hope to learn, in school and what they were frequently exposed to in daily life.

If the pre-service teachers had difficulties in learning technology and English, were they still able to develop some abilities in using technology and English to fulfill necessary purposes in daily life? I present the findings relating to this question in the following section.

What were Pre-service Teachers Able to Do with Technology and English?

To answer this question, I discuss what the pre-service teachers reported regarding 1) their expertise in technology and English in general as well as in specific technology tools and English abilities, and 2) their purposes of using technology and English in daily life.

This study discovered that the pre-service teachers in the study generally reported a medium level of expertise in English and a relatively higher expertise in technology. They said they were proficient in using multiple technology tools, especially the ones they believed to be valuable to both the social and academic aspects of their lives. They also reported that they were able to accomplish various tasks in English at least at a basic level, especially the ones that commonly occurred in digital contexts. In addition, they indicated that they had the ability to use technology and English for various social and academic purposes, and there was a similarity in the purposes these two tools served.

Expertise in Technology and English

To understand what the pre-service teachers could do with technology and English, I asked the participants to report their overall expertise in technology and English as well as their proficiency with specific technology tools and English abilities. To begin with, I asked them to indicate on a scale from 1 (poor) to 10 (very advanced) regarding their overall expertise in technology and English. On average, they reported that they had a medium level of expertise in English (5.20) and a higher expertise in technology (6.25). Considering that English is not the primary or official language in Taiwan and that compulsory English classes were no longer offered after the second year of college, it was surprising to find that these pre-service teachers were still able to claim a medium level of expertise in English.

Next, I asked the participants to specify the level of their knowledge and proficiency of using a list of technology tools on a scale of 1 (I don't know what it is) to 5 (I am an expert on it and can teach other people about it). The participants reported a

significant amount of knowledge about many technology tools. They were especially proficient in using instant message or text message, website browsing, email, search engine, office tools, and wiki (see Table 4.9). Note that the three technology tools that the participants claimed to be the most proficient with (i.e., instant or text message, website browsing, and email) were the ones that they believed to be very valuable to all aspects of their lives. The next three tools that they were proficient with (i.e., search engine, office tools, and wiki) were the ones that they thought were useful to their academic life and future careers. Since it was very likely that their views about the technology tools were directly influenced by their experience with these tools in different contexts, the findings imply not only that the school provided an important environment for pre-service teachers to master the use of several technology tools, but also that when a technology tool was useful in both social and academic settings, pre-service teachers were more likely to have opportunities to engage in its use and thus developed substantial knowledge about the tool. At the same time, their increased knowledge of the tool might in turn promote their use of the tool in diverse contexts.

Table 4.9. Knowledge and proficiency of using technology tools

	Mean	*Std. Deviation*
Blog	3.67*	.677
Discussion group	3.54*	.769
Electronic transaction	3.23	.942
Email	4.45*	.537
Instant/text message	4.54*	.525
Map	4.03*	.643
Office tools	4.22*	.503
Online office collaboration tools	2.14	1.901
Photo sharing	3.13	.964
Podcast	2.66	1.089
RSS feed	2.25	1.021
Search engine	4.26*	.657
Social bookmarking	1.88	1.070
Social networking	3.24	.967
Video/online games	3.52*	.940
Video sharing	3.46*	.843
Video/audio conferencing	3.53*	.980
Virtual community	2.39	.912
Website browsing	4.49*	.563
Wiki	4.15*	.636

Scale: 1= I don't know what it is, 2= I know what it is but have never used it,
3= I know a little about how to use it,
4= I know much about how to use it but am not an expert on it,
5= I am an expert on it and can teach other people about it
*Mean > 3.45

In addition to technology tools, I also asked the participants to specify their level of ability to do a list of tasks in English on a scale of 1 (I cannot do this at all) to 5 (very well). The participants reported that they were able to use English to do many tasks at least at a basic level (see Table 4.10). They did not claim a poor ability (mean = 2) in any of the English tasks on the list, which was surprising given that English is not a primary language in Taiwan. On average, the participants said they were the most proficient in using English to listen to music and watch movies, which were usually accomplished via the internet as the participants reported in the web log. They also reported a basic level of ability in using English to browse websites, send instant or text message, post

information on the web, and email, all of which occurred online. The majority of the English tasks the participants said they were better in doing appeared to occur in digital contexts, which implied that the Web has the potential of providing a valuable environment for pre-service teachers to engage in activities involving the use of English.

Table 4.10. Abilities to do tasks in English

	Mean	*Std. Deviation*
Reading newspaper	2.59	.892
Reading novels	2.44	.909
Browsing websites	2.97*	.924
Watching movies	3.02*	.949
Listening to music	3.22*	.875
Having face-to-face conversations	2.67	.924
Conversing on the phone	2.38	.925
Email	2.82*	.914
Writing an essay	2.49	.796
Instant/text messaging	2.95*	.934
Posting information on the web	2.90*	.919

Scale: 1=I cannot do this at all, 2=poor, 3=fair, 4=good, 5=very well
*Mean > 2.80

Purposes of Using Technology and English

In addition to knowing what technology and English abilities the pre-service teachers reported having, it is also important to understand what purposes they thought they were able to serve via the use of technology and English. I asked the participants to estimate their average frequencies of using technology or English for particular purposes in their daily lives on a scale of 1 (never) to 5 (several times a day). The analyses showed that each of the participants reported using technology and English for many types of purposes. Even those who rated themselves as very low in their overall expertise in

technology or English claimed to use these two tools for various purposes in their daily lives.

Table 4.11 shows that the participants generally used technology more often than using English for each of the purposes listed. However, taking the non-official language status of English in Taiwan into consideration, I adopted a lower criterion to interpret the frequency of English use than that of technology use. The table reveals that the most popular purposes for which the participants reported using technology and English were similar, including communicating with others, entertainment, finding information, fulfilling a routine, improving skills, school work, sharing information, and solving a problem. These purposes covered both the social and academic aspects of the participants' lives, which suggests that the pre-service teachers in the study had the ability to use technology and English to serve various purposes in life. The similarity between the common purposes of English and technology use led to my next question: Was there a relationship between technology and English? I attempt to answer this question with the findings presented in the following section.

Table 4.11. Purposes of using technology and English

	Technology	*English*
Collaborating on a task	3.31[a] (.925[b])	2.38 (1.045)
Communicating with others	4.77* (.506)	2.83** (1.152)
Connecting to people I don't already know	2.84 (1.091)	2.11 (1.017)
Entertainment	4.82* (.563)	3.22** (1.182)
Finding information	4.85* (.394)	3.53** (.994)
Fulfilling a routine	4.52* (.629)	2.81** (1.260)
Improving skills	3.59* (.877)	2.97** (1.029)
Purchasing products	2.44 (.959)	1.96 (1.106)
Scheduling or planning	3.44 (1.266)	2.27 (1.231)
School work	4.31* (.654)	3.35** (1.067)
Sharing information	4.39* (.780)	2.92** (1.150)
Social networking	4.55* (.638)	2.66 (1.226)
Solving a problem	4.33* (.715)	2.93** (1.125)

Scale: 1 = never, 2 = a few times a year, 3 = a few times a month, 4 = a few times a week, 5 = several times a day

[a] Mean

[b] Standard Deviation

*Mean > 3.50

**Mean > 2.80

What was the Relationship between Technology and English uses?

To answer this question, I discuss 1) the pre-service teachers' frequencies of using English with technology tools, and 2) direct relations between technology and English in several aspects.

I found that there was a significant interplay between technology and English in terms of the pre-service teachers' perceptions and uses of these two tools. The pre-service teachers in the study reported using English often with the technology tools which they were very proficient in using in social and academic contexts. Besides, there was a positive relationship found between technology and English in terms of the pre-service teachers' attitudes, expertise, and learning difficulties.

Frequencies of Using English with Technology Tools

To understand the relationship between uses of technology and English, I first investigated whether English was often present when pre-service teachers used technology tools. I asked the participants to indicate the frequency they used English with each technology tool on the list on a scale of 1 (never) to 5 (several times a day). Those who had never used a particular technology tool were excluded from the corresponding analysis. The analyses revealed that the technology tools with which the participants reported using English the most often, including website browsing, wiki, search engine, office tools, instant and text message, and email, were also the ones they claimed to have the highest level of proficiency in using, which suggested the important role English played in the participants' digital experience (see Table 4.12). This result brings a new understanding of the earlier finding that the participants thought these technology tools were valuable for their social life, academic life, and future career. The fact that these tools were often used with English showed the importance of using English and technology together for all aspects of the pre-service teachers' lives.

Table 4.12. Frequencies of using English with technology tools

	# of Participants	*Mean*	*Std. Deviation*
Blog	145	2.32	1.005
Discussion group	137	1.97	1.014
Electronic transaction	119	1.65	.962
Email	152	2.63*	1.102
Instant/text message	152	2.71*	1.149
Map	152	2.02	.966
Office tools	151	2.86*	1.166
Online office collaboration tools	59	1.92	1.119
Photo sharing	110	2.13	.968
Podcast	87	2.52	1.088
RSS feed	59	2.02	1.091
Search engine	151	3.36*	1.128
Social bookmarking	40	1.93	1.185
Social networking	116	2.54	1.190
Video/online games	134	2.55	1.205
Video sharing	132	2.65*	1.248
Video/audio conferencing	128	2.38	1.224
Virtual community	59	1.92	1.022
Website browsing	152	3.60*	1.105
Wiki	151	3.38*	1.012

Scale: 1 = never, 2 = a few times a year, 3 = a few times a month, 4 = a few times a week, 5 = several times a day

*Mean > 2.60

Direct Relations between Technology and English

In addition to investigating whether English was often used with technology among the participants, I further examined the direct relations between technology and English in terms of the participants' attitudes, expertise, and learning difficulties. The analyses showed that there was a significant positive relationship between the participants' willingness to teach with technology and with English ($r = .379$, $p < .01$). In other words, as the participants' willingness to teach with technology increased, their willingness to teach with English tended to increase as well, and vice versa. This suggests

that the pre-service teachers who saw the importance of teaching with technology or English were also more likely to see the importance of teaching with the other.

The analyses also discovered a significantly positive relationship between the participants' overall expertise in technology and that in English ($r = .196$, $p < .05$). In other words, as the expertise in technology the pre-service teachers reported increased, the expertise in English they reported increased as well. This implies that the development of the expertise in technology or English may be beneficial to the development of the other expertise among the pre-service teachers.

Moreover, nearly a half of the participants (48.4%) reported that the lack of sufficient English skills was one of the barriers to their learning of technology (see Table 4.7). Some participants explained that they thought technology is dominated by the language of English. Many technology tools are developed in English, and not all of them are also offered in other language versions. To be able to keep up with new technology, the participants believed that improving their English abilities would certainly benefit their learning of many technology tools of the 21st century.

Interestingly, only a few of them (9.2%) thought the lack of sufficient technology skills was one of their barriers to learning English (see Table 4.8). Instead, they believed the lack of opportunities to use English was the major barrier. At first glance, it seemed that the participants' technology abilities were unrelated to their English learning. However, since they used English with many technology tools in daily life, being able to use these technology tools certainly had contributed to increased opportunities for English use among these pre-service teachers. The participants might not realize that they

were actually involved in more English use opportunities via technology and that they could take advantage of their technology abilities to gain more English use experience.

What were the Differences in the Perceptions and Uses of Technology and English among Pre-service Teachers?

To answer this question, I discuss the effect of personal factors, including gender and subject area, on several areas, including 1) pre-service teachers' perceptions about technology and English, 2) their abilities to use technology and English, and 3) the relationship between their uses of technology and English.

This study found that gender was a significant factor that influenced pre-service teachers' perceptions and uses of technology and English. Female participants reported a lower expertise in technology and were less able to use English with a number of technology tools than males. They reported using technology less often than males for many purposes and experiencing more technology difficulties due to the lack of confidence and motivation to learn technology. They appreciated technology less and saw less value of several technology tools for academic life and future career. However, their willingness to teach with technology was not less than males.

Subject area also significantly impacted pre-service teachers' perceptions and uses of technology and English. This study discovered that pre-service teachers of English, as expected, reported that they had a higher expertise in English and used English more often with many technology tools and for multiple purposes than other subject groups. They appreciated English more and saw more value of English skills for

all aspects of their lives. In addition, the Life Sciences group also reported a higher expertise in English and used English more frequently with multiple technology tools and for several purposes than other non-English groups. In contrast, the Mathematics group reported less ability in using English with several technology tools than other subject groups. They perceived less value of English skills for academic life and future career and were less willing to teach with English. They also saw less value of many technology tools for academic life and future career and were less capable of using these tools.

Perceptions about Technology and English

I investigated gender and subject area differences in the pre-service teachers' perceptions about technology and English in the following areas: 1) their attitudes toward technology and English in general, 2) their views about individual technology tools and English skills, and 3) the barriers they perceived to learning to use technology and English.

Regarding the pre-service teachers' attitudes toward technology and English in general, I built four general linear regression models to test whether there were gender and subject area differences. The analyses showed that the participants' appreciation for technology was influenced by their gender, but not their subject area (see Table 4.13). Male participants tended to have a higher degree of appreciation for technology than female ($F = 27.508$, $df = 1$, $p < .001$). However, male and female participants did not differ in their willingness to teach with technology. In other words, even though female participants on average had a lower level of appreciation for technology than males, their willingness to teach with technology was not less than males.

Table 4.13. Factors concerning appreciation for technology

Variable	*B*	*S.E.*	β	*Sig.*
Female	-.709***	.135	-.449	.000
Subject area				.904
(Constant)	3.913	.117		
R^2	.183***			

* p < .05, ** p < .01, *** p < .001

As for the attitudes toward English, the participants' appreciation for English differed depending on their subject area (F = 8.974, df = 4, p < .001) but not gender (see Table 4.14). Pre-service teachers of English, with no surprise, reported a significantly higher degree of appreciation for English. In addition, the participants' willingness to teach with English was also influenced by their subject area (F = 10.761, df = 4, p < .001) but not gender (see Table 4.15). Pre-service teachers of Mathematics reported a significantly lower degree of willingness to teach with English than other subject groups, especially when compared with pre-service teachers of English and Life Sciences. This might be worth further investigation to see if pre-service teachers of Mathematics differed from other subject groups in other aspects of English use.

Table 4.14. Factors concerning appreciation for English

Variable	*B*	*S.E.*	β	*Sig.*
Female	.160	.151	.088	.293
Subject area[a]				.000
Chemistry	.287	.192	.134	.138
English	1.107***	.248	.414	.000
History	- .266	.206	-.118	.200
Life Sciences	.235	.201	.098	.258
(Constant)	2.717	.131		
R^2	.230***			

[a] Mathematics is the reference category.
* p < .05, ** p < .01, *** p < .001

Table 4.15. Factors concerning willingness to teach with English

Variable	*B*	*S.E.*	β	*Sig.*
Female	-.288	.147	-.152	.052
Subject area[a]				.000
Chemistry	.515**	.187	.230	.007
English	1.867***	.242	.669	.000
History	.450*	.201	.193	.026
Life Sciences	.980***	.202	.392	.000
(Constant)	3.022	.128		
R^2	.328***			

[a] Mathematics is the reference category.
* p < .05, ** p < .01, *** p < .001

In addition to investigating the pre-service teachers' attitudes toward technology and English in general, I also used ordinal logistic regression models to find out whether the participants, regardless of their gender and subject area, differed in their views about the value of individual technology tools and English skills. Regarding technology tools, the analyses showed that there was generally no difference in the participants' views about their value for social life. In contrast, the participants' gender and subject area did have an impact on their views about the value of technology tools for academic life and future career. Because the results about academic life and future career were very similar, I present only the results associated with the technology tools that the participants thought were more valuable for academic life. The analyses uncovered that the participants' views differed in several technology tools, such as office tools, search engine, website browsing, and wiki (see Table 4.16). For example, female participants assigned a lower value for academic life than males to these tools except for office tools. Besides, pre-service teachers of Mathematics appeared to be significantly lower in their views about the value of these tools for academic life than all other subject groups, which

might be an indication that they did not have adequate school experience that allowed them to see the benefit of these technology tools for academic life.

Table 4.16. Factors concerning views about the value of technology for academic life

	χ^2	*Female*	*Chemistry*	*English*	*History*	*Life Sciences*
Office tools	13.573*	-1.096[a]	1.815*	2.684*	1.819*	2.637*
Search engine	22.204***	-1.423*	2.888**	2.697**	1.867**	2.456**
Website browsing	30.370***	-1.198*	1.258*	2.704**	2.941***	2.518**
Wiki	26.381***	-1.664**	2.279***	2.502**	2.666***	2.033**

[a] coefficient
Note: Mathematics and male are the reference categories.
* $p < .05$, ** $p < .01$, *** $p < .001$

With regard to English skills, no difference was found about their value for social life among the participants. However, subject area did make a difference in the participant's views for academic life and future career. Because nearly all pre-service teachers of English chose the highest point (4 = extremely important) on the scale regarding the value of all four English skills for academic life and future career, I only present the findings about the participants of other subject areas. The analyses showed that pre-service teachers of Mathematics appeared to see fewer merits of selected English skills for academic life and future career than those of Chemistry and Life Sciences (see Table 4.17). These differences might have resulted from different types of English experience the pre-service teachers had in academic contexts.

Table 4.17. Factors concerning views about the value of English

	χ^2	*Chemistry*	*Life Sciences*
Reading for academic life	20.564***	1.836**	1.846**
Listening for academic life	10.089*	1.112*	1.570**
Reading for future career	13.881**	1.534**	1.218*
Writing for future career	10.331*	1.112*	1.375*

[a] coefficient
Note: Mathematics and male are the reference categories.
* p < .05, ** p < .01, *** p < .001

Finally, I used a series of binary logistic regression models to test the effect of gender and subject area on the barriers the pre-service teachers perceived to learning to use technology and English. The analyses suggested that gender was a significant factor that impacted some of the participants' barriers to learning new technology. Table 4.18 and Table 4.19 revealed that female participants had more difficulties in learning to use technology than males due to their lack of confidence in learning new technology in general ($\chi^2 = 16.723$, df = 5, p < .01) and their lack of motivation to learn technology tools ($\chi^2 = 18.181$, df = 5, p < .01).

Table 4.18. Factors concerning the lack of confidence in learning technology

Variable	*B*	*S.E.*	*Wald*	*df*	*Sig.*	*Exp(B)*
Female	1.795*	.574	9.790	1	.002	6.017
Subject area			.795	4	.939	
(Constant)	-2.424	.546	19.677	1	.000	.089

* p < .05, ** p < .01, *** p < .001

Table 4.19. Factors concerning the lack of motivation to learn technology

Variable	*B*	*S.E.*	*Wald*	*df*	*Sig.*	*Exp(B)*
Female	1.967**	.610	10.413	1	.001	7.148
Subject area			8.211	4	.084	
(Constant)	-1.770	.463	14.590	1	.000	.170

* p < .05, ** p < .01, *** p < .001

Abilities to Use Technology and English

I examined gender and subject area differences regarding the pre-service teachers' abilities to use technology and English in the following areas: 1) their expertise in technology and English, and 2) their purposes of using technology and English.

First of all, I conducted two general linear regression models to test the effect of gender and subject area on participants' overall expertise in technology and English. The analyses showed that gender made a difference in the expertise in technology the participants reported. Male participants generally reported 1.026 points higher on a scale of 1 (poor) to 10 (very advanced) than females ($F = 10.391$, $df = 1$, $p < .01$). Subject area, on the other hand, did not appear to have an effect (see Table 4.20). In contrast, gender did not relate to the expertise in English the participants reported. It was subject area that made a difference ($F = 11.776$, $df = 4$, $p < .001$). Pre-service teachers of English and Life Sciences reported significantly higher points on the scale than other subject groups (see Table 4.21). It was not surprising to see that the pre-service teachers of English claimed a higher expertise in English than other subject groups since English was the subject of their study and teaching. The more interesting finding was that pre-service teachers of Life Sciences also reported a higher expertise of English than other non-English subject groups. This might be related to an ongoing effort of the Life Sciences faculty to stress the importance of English in their program as revealed in my meetings with their faculty members.

Table 4.20. Factors concerning overall expertise in technology

Variable	*B*	*S.E.*	β	*Sig.*
Female	-1.026**	.318	-.292	.002
Subject area				.409
(Constant)	6.640	.277		
R^2	.086*			

* p < .05, ** p < .01, *** p < .001

Table 4.21. Factors concerning overall expertise in English

Variable	*B*	*S.E.*	β	*Sig.*
Female	.259	.299	.069	.388
Subject Area[a]				.000
Chemistry	.696	.380	.159	.069
English	2.664***	.491	.487	.000
History	- .132	.408	-.029	.747
Life Sciences	1.418**	.410	.289	.001
(Constant)	4.327	.260		
R^2	.280***			

[a] Mathematics is the reference category.

* p < .05, ** p < .01, *** p < .001

In addition to looking at the participants' overall expertise in technology and English, I also conducted a series of general linear regression models to evaluate the effect of personal factors on their abilities to use individual technology tools and to use English to complete specific tasks. The analyses about technology tools showed that male participants reported a higher level of knowledge than females in several technology tools (see Table 4.22). Moreover, subject area was also a significant factor. For example, pre-service teachers of English reported higher proficiencies in using several technology tools than other subject groups. In contrast, the Mathematics group reported less knowledge in using a number of technology tools, particularly wiki, than other subject groups. This

suggested that pre-service teachers of Mathematics might not have much experience with the use of wiki in school.

Table 4.22. Significant factors concerning abilities to use technology tools

	R^2	*Female*	*Chemistry*	*English*	*History*	*Life Sciences*
Discussion group	.161***	-.658*** [a]				
Electronic transaction	.143***			.566*	.902***	.675**
Email	.072*			.413*		
Office tools	.095*			.344*	.302*	.449***
Search engine	.083*	-.266*		.629**		.380*
Social networking	.097*			.698*		
Video/online games	.246***	-.882***				
Video sharing	.075*	-.426**				
Virtual community	.080*	-.687**				
Wiki	.115**		346*	.629**	.621***	.390*

[a] unstandardized coefficient
Note: Mathematics and male are the reference categories.
* p < .05, ** p < .01, *** p < .001

Furthermore, the analyses also showed that subject area, but not gender, appeared to be a significant factor that contributed to differences in the participant's abilities to use English to complete tasks (see Table 4.23). For instance, pre-service teachers of English, without surprise, reported a significantly higher level of English abilities in all tasks than other subject groups. In contrast, pre-service teachers of Mathematics were less proficient in using English for several tasks.

Table 4.23. Significant factors concerning abilities to use English to complete tasks

	R^2	*Chemistry*	*English*	*Life Sciences*
Reading newspaper	.270***		1.390*** [a]	.587**
Reading novels	.264***	.495*	1.258***	.614**
Browsing websites	.241***	.551**	1.468***	.788***
Watching movies	.144***		.879**	
Listening to music	.090*		.797**	
Having face-to-face conversations	.267***		1.531***	
Conversing on the phone	.280***		1.556***	
Email	.229***		1.467***	
Writing an essay	.162***		.967***	
Instant/text messaging	.249***	.444*	1.484***	.625**
Posting information on the web	.268***	.674**	1.445***	.734***

[a] unstandardized coefficient
Note: Mathematics and male are the reference categories.
* p < .05, ** p < .01, *** p < .001

In addition to determining in which technology tools and English tasks the pre-service teachers were proficient, I also used a series of general linear regression models to see whether personal factors affected the types of purposes the participants were able to serve via technology. The most prominent pattern revealed in the analyses was that female participants reported significantly lower frequencies in using technology for several purposes than males (see Table 4.24).

Table 4.24. Significant effect of gender on purposes of using technology

	R^2	*Female*
Connecting to people I don't already know	.097**	-.676** [a]
Finding information	.085*	-.173*
Fulfilling a routine	.131**	-.277*
School work	.155***	-.257*
Sharing information	.099**	-.395**

[a] unstandardized coefficient
* p < .05, ** p < .01, *** p < .001

Similarly, I examined the effect of personal factors on the purposes of using English among the pre-service teachers through a series of general linear regression

models. The analyses showed that there was no relationship between the participants' gender and their purposes of using English. However, subject area did appear to have a significant effect. Pre-service teachers of English and Life sciences used English more often for several purposes than other subject groups (see Table 4.25).

Table 4.25. Significant effect of subject area on purposes of using English

	R^2	*English*	*Life Sciences*
Collaborating on a task	.336***	1.542*** [a]	
Communicating with others	.200***	1.119**	
Entertainment	.087*	.881*	
Finding information	.196***	1.219***	.839***
Fulfilling a routine	.161***	1.443***	.608*
School work	.310***	1.683***	
Sharing information	.176***	1.044**	.723**
Social networking	.173***	.989**	
Solving a problem	.212***	1.222***	.924**

[a] unstandardized coefficient
Note: Mathematics and male are the reference categories.
* $p < .05$, ** $p < .01$, *** $p < .001$

The Relationship between Uses of Technology and English

I built a series of general linear regression models to test the effect of personal factors on the participants' frequencies of using English with individual technology tools. Table 4.26 shows that both gender and subject area were significant factors. First of all, male participants reported using English with a number of technology tools more often than females. In addition, pre-service teachers of English and Life Sciences also reported higher frequencies in using English with several technology tools than other subject groups. In contrast, pre-service teachers of Mathematics reported lower frequencies in such uses, especially with wiki, than other subject groups.

Table 4.26. Significant factors concerning frequencies of using English with technology tools

	R^2	*Female*	*Chemistry*	*English*	*History*	*Life Sciences*
Discussion group	.166***	-.704*** [a]		.691*		.610*
Email	.230***		-.504*	.972**		
Office tools	.302***			1.686***		
Search engine	.167***	-.478*	.512*	1.438***		.721**
Social networking	.164**			1.078**		.790*
Virtual community	.223*					1.082**
Website browsing	.252***	-.402*	.520*	1.586***		.927***
Wiki	.244***	-.498**	.768***	1.674***	.492*	1.102***

[a] unstandardized coefficient
Note: Mathematics and male are the reference categories.
* p < .05, ** p < .01, *** p < .001

Summary of Key Findings from Questionnaire

The quantitative analyses from the questionnaire data yielded abundant and interesting results about the pre-service teachers' perceptions and uses of technology and English. The key findings are summarized as follows:

What did pre-service teachers think about technology and English?

In general, the pre-service teachers in the study reported positive attitudes toward technology and English. They appreciated technology and were willing to teach with it. Although they did not appear to appreciate English as much, they were still willing to use it in teaching. In addition, they saw the value of many technology tools and English skills for social life, academic life, and future career. However, they reported that they faced barriers to learning to use technology due to the lack of formal training and technical support and barriers to learning to use English due to the lack of use opportunities.

What were pre-service teachers able to do with technology and English?

On average, the pre-service teachers in the study reported a medium level of expertise in English as well as a more advanced expertise in technology. They reported high proficiencies in using many technology tools, particularly the ones they thought were important to all aspects of their lives. They also reported that they had the abilities to use English to complete many tasks especially in digital environments. They also reported that they were capable of using technology and English for many social and academic purposes. The types of purposes served by technology use and by English use appeared to be similar.

What was the relationship between technology and English?

It was evident that technology and English uses were interconnected in many aspects. First of all, the technology tools with which the pre-service teachers in the study frequently used English were also the ones in which they were the most proficient in using for their social and academic lives. In addition, perceptions and uses of technology and English often supported each other. As the participants' willingness to teach with technology increased, their willingness to teach with English also increased. Similarly, as the expertise in technology they reported increased, the expertise in English they reported tended to increase as well. Furthermore, the participants believed that the lack of sufficient English skills was one major barrier to their learning of technology. Although they thought the major barriers to their learning of English was the lack of opportunities to use English rather than the lack of sufficient technology skills, they might not realize

that they were in fact using English with many technology tools and that their abilities to use these tools certainly had brought them more opportunities of English use.

What were the differences in the perceptions and uses of technology and English among pre-service teachers?

It was evident that gender significantly impacted the perceptions and uses of technology and English among the pre-service teachers. This study discovered that female participants, compared to males, reported a lower level of expertise in technology and were less proficient in using English with several technology tools. They reported using technology less frequently for several purposes than males and more difficulties in learning to use technology due to the lack of confidence and motivation to learn new technology. They also reported a lower degree of appreciation for technology and saw less value of several technology tools for academic life and future career. However, they did not report less willingness than males to teach with technology.

Subject area was also a significant factor that influenced the perceptions and uses of technology and English among the pre-service teachers. This study found that pre-service teachers of English, as expected, reported a higher expertise in English and using English more frequently with several technology tools and for many purposes than other subject groups. They had a higher level of appreciation for English and saw more value of English skills for all aspects of their lives. One interesting finding was that they also reported higher proficiencies in using several technology tools than other subject groups. In addition, pre-service teachers of Life Sciences also reported a higher level of expertise in English and using English more often with several technology tools and for several

purposes than other non-English groups. In contrast, pre-service teachers of Mathematics reported that they were less able to use English to complete several tasks. They saw less value of several English skills for academic life and future career and were less willing to use English in teaching than other subject groups. They also perceived less value of several technology tools for academic life and future career and reported lower levels of proficiency in using these tools. They reported that they were especially less able to use wiki, a tool that was used very frequently with English among other participants.

Web Log

While data from the questionnaire can help us understand pre-service teachers' general thoughts about their technology and English experience, data from the web log can provide more detailed descriptions about what pre-service teachers said they did via technology and English. In this section, I present the findings from the web log, which recorded pre-service teachers' daily events or activities involving the use of technology and English for two weeks. I first give a brief overview of the web log data and the participants' background. Then I describe the key findings to answer the following questions: 1) How were technology and English used in the pre-service teachers' daily lives? 2) What social connections did the pre-service teachers engage in via technology and English? and 3) How did the pre-service teachers' technology and English uses differ depending on personal factors? For each question, I begin by offering an overview of key findings, followed by discussions of specific topics relating to the question. This section is concluded with a summary of all important findings from the web log.

Overview of Data

Of the 153 pre-service teachers who completed the questionnaire, 63 participated in the second phase of the study, in which they filled out a 14-day web log documenting the events or activities in which they participated with the use of technology and/or English. The background of the web log participants was not much different from that of the questionnaire participants, with only slight changes. For instance, there were still more female (54%) than male (46.0%) participants in the web log. The percentage of graduate students (6.3%) was still small, which did not have a significant effect on the results to represent undergraduate pre-service teachers. Among the five subject areas, there were more Chemistry (33.3%) and Mathematics (31.7%) students than History (15.9%), English (11.1%), and Life Sciences (7.9%) students (see Table 4.27). There were more female than male participants in most subject areas except for Mathematics and Life Sciences (see Table 4.28). Compared to the questionnaire participants, in the web log phase the percentages of Chemistry and Mathematics students increased and those of Life Sciences and History students decreased slightly.

Table 4.27. Participants' background - Web Log

		Frequency	*Percentage*
Gender			
	Male	29	46.0
	Female	34	54.0
Subject Area			
	Chemistry	21	33.3
	English	7	11.1
	History	10	15.9
	Life Sciences	5	7.9
	Mathematics	20	31.7
Academic Status			
	Undergraduate	59	93.7
	Graduate	4	6.3

Table 4.28. Numbers of male and female participants in each subject area - Web Log

Subject Area	*Male*	*Female*	*Subject Area Total*
Chemistry	10	11	21
English	0	7	7
History	1	9	10
Life Sciences	4	1	5
Mathematics	14	6	20
Gender Total	29	34	63

The participants submitted 882 web logs in total, with each log representing one day of events or activities for one individual participant. The number of events per log ranged from 0 to 3. There were only 11 logs with no event documented. The total number of events recorded in the 882 web logs was 1954. The average number of total events per participant was 31.02, and the average number of events per day for a participant was 2.22. Furthermore, the events the participants recorded could be related to their use of English or technology or both. Of the 1954 events submitted, 1034 involved the use of English, and 1712 involved the use of a technology platform, such as a computer or cell phone. This revealed that technology played a slightly more important role in the pre-service teachers' lives. There were overlaps between the events involving English use and those involving technology use. Among the events relating to English, the participants used technology much more frequently (76.6%) than without technology (23.4%), meaning that the majority of their English use occurred in digital contexts. In contrast, among the events relating to technology use, the participants used English in slightly less than half (46.3%) of the events. Considering that English is not the primary or official language in Taiwan, I believe this percentage of English use was high.

In order to facilitate meaningful discussions of the findings from the web log data, I categorized the events into three types - 792 (40.5%) events involving the use of both English and technology, 242 (12.4%) events involving the use of English but not technology, and 920 (47.1%) events involving the use of technology but not English. These three types of events will be referred to as English+Technology events, English events, and Technology events respectively.

How were Technology and English Used in Pre-service Teachers' Daily Lives?

To answer this question, I discuss the findings in relation to 1) the pre-service teachers' purposes for using technology and English to participate in the events, 2) the languages they used in the events, and 3) the technology platforms and tools they utilized in the events. This study found that the participants used technology and English, oftentimes together, for a wide range of purposes in their lives. Their uses of English were often embedded in their uses of Mandarin Chinese. When they did use English exclusively, the events usually happened in digital contexts. In addition, most of the participants' technology uses were conducted via computers as the technology platform. The technology tools they commonly used in daily life were of multiple types, and English was frequently involved in their uses of most technology tools.

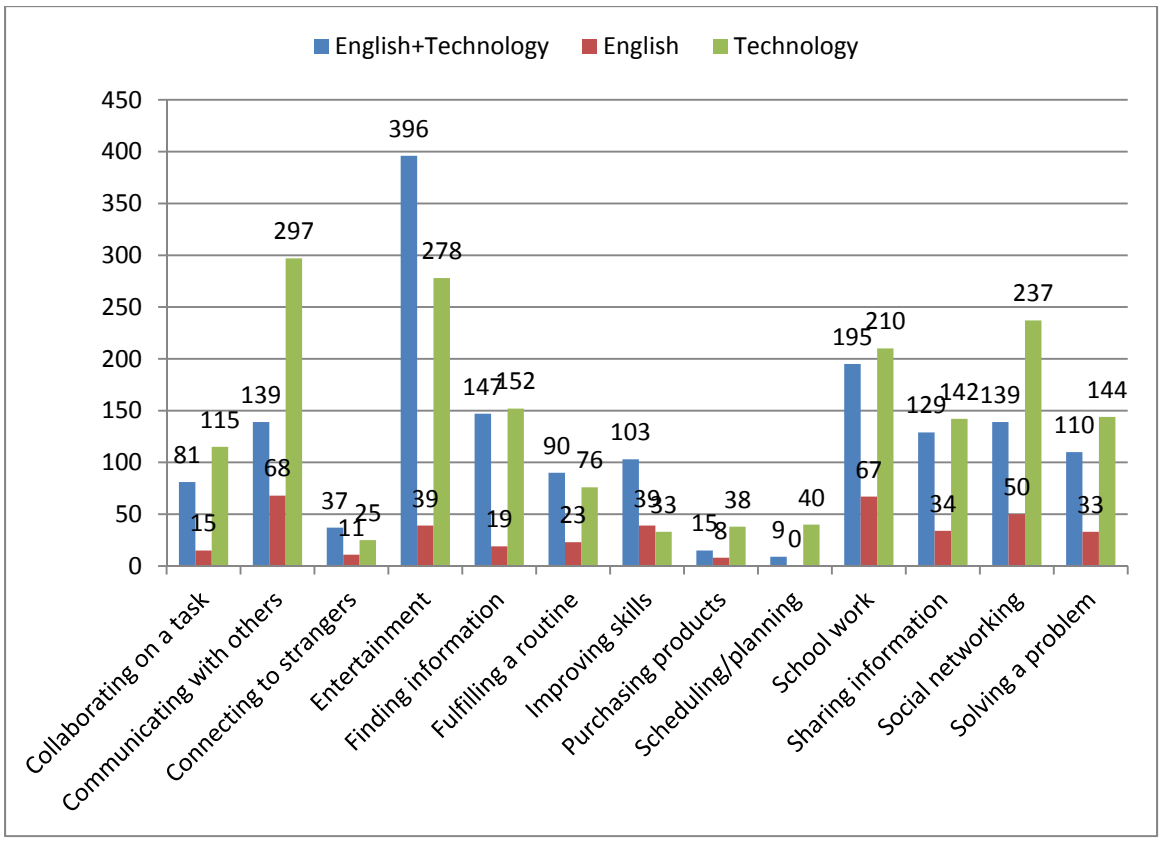
Purposes of the Events

The data revealed that technology and English were tools that could serve multiple purposes simultaneously. The pre-service teachers in the study often participated in an event for more than one reason, which was true in 1066 out of the 1954 events

(54.6%). This should be taken into consideration in the analyses of the data. To address this point, I calculated multiple times for the events associated with more than one purpose, and each time was counted toward every selected purpose. Therefore, the frequencies and percentages of the purposes presented below were independent from each other and should only be interpreted in relation to total events rather than to other purposes. In other words, the percentages of the purposes do not add up to 100%. The same situation was applied to other sections of the web log analyses because most questions in the web log allowed the participants to choose multiple answers.

Figure 4.1 shows that the participants' uses of technology and English covered a wide range of purposes, which proved that they were accustomed to managing many aspects of their lives via these two tools. The comparisons between the frequencies of the English+Technology events and those of the English events uncovered that for every purpose associated with English-related events, the participants used technology much more frequently than without technology. In addition, I expected to see the participants use only Mandarin Chinese, their national language and mother tongue, rather than English in technology-related events. Interestingly, the comparisons between the English+Technology events and the Technology events (the majority of which were conducted in Mandarin Chinese as will be presented in the following section) showed that for most purposes, the frequencies of events involving English use did not differ much from those of events involving no English use. For some purposes, the frequencies of the former even exceeded those of the latter, such as for the purposes of entertainment and improving skills. Therefore, using technology together with English for diverse purposes appeared to be common in the pre-service teachers' lives.

Figure 4.1. Frequencies of web log events for each purpose



Languages Used in the Events

The analyses of the languages used in the web log events showed that English was usually not used alone. In about 68.1% of the English+Technology events and 58.7% of the English events, the participants claimed to use at least one other language in addition to English. As I expected, the participants used English the most frequently with Mandarin Chinese. When another language was involved besides English, about 98.7% of the English+Technology events and 100.0% of the English events involved Mandarin Chinese. In other words, rather than using English exclusively, the participants often embedded English in their use of Mandarin Chinese.

Although English was often used with other languages, the pre-service teachers in the study still had some opportunities to use English exclusively. Of the 353 events in which the participants reported using English alone, 71.7% occurred in a digital context, which suggested that technology provided an important setting for the pre-service teachers to use English exclusively in Taiwan.

Technology Used in the Events

The most common technology platform the participants used was a computer. About 1526 out of the 1712 the technology-related events (89.1%) took place with the use of a computer. This was within my expectation because every participant owned a computer as the questionnaire data revealed. Table 4.29 shows that the majority of the English+Technology and Technology events were conducted on a computer (88.8% and 89.6% respectively), which reflected that computers have become necessary items in the participants' lives. In contrast, cell phone was another technology device that all participants owned besides computer. Because cell phones are more portable than computers and most people carry one around all day long, I would have expected cell phones use among the participants to be even more popular than computer use. However, the participants reported much fewer events involving the use of cell phones than those with computers, and the number of events with the use of English on cell phones was even smaller.

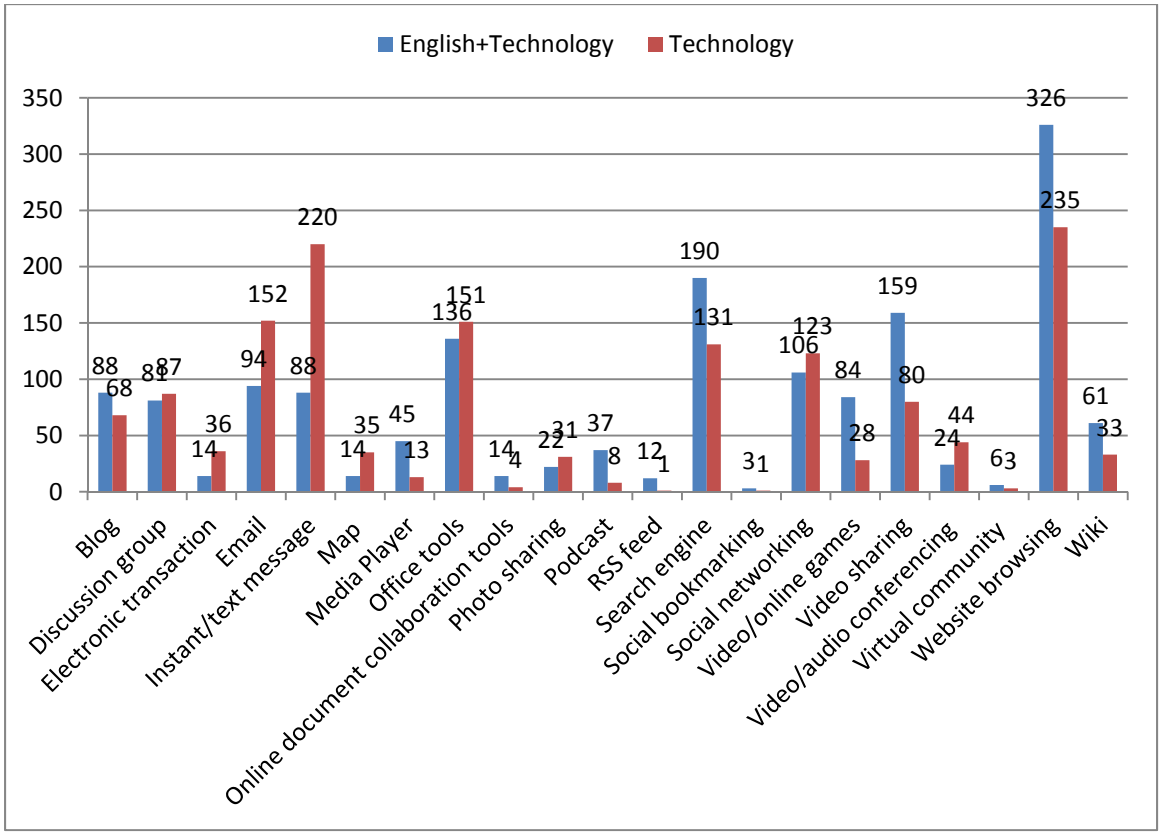
Table 4.29. Frequencies and percentages of web log events for each technology platform

	English+Technology		Technology	
Computer	703	88.8%	824	89.6%
Cell phone	26	3.3%	106	11.5%

One plausible explanation was that the participants were asked to select up to three events that they thought were the most important to report. They might have used cell phones primarily for its traditional function - talking to someone and not for their other newer features, such as sending emails and browsing on the web, and thus might not think such use was worth reporting in the web log. In my research orientation in each teacher education program, I noticed that not many participants had a smart phone containing these new features. When this study was conducted in the spring of 2010, smart phones were still not widespread among the college population because smart phones like iPhones just started to become popular and iPads had not even been launched yet in Taiwan. Most students only used cell phones for the talking and text messaging functions and thus did not feel the need to buy a smart phone that they could not afford.

Regarding technology tools, Figure 4.2 revealed that the participants used various types of tools in the technology-related events, which suggested that they had the ability to use multiple technology tools to serve many purposes in daily life. The comparisons between the English+Technology and the Technology events showed that the frequency of events involving English use for each technology tool generally were not much different from that of events involving no English at all. The participants even conducted some types of technology activities more frequently with English use, such as those involving website browsing, search engine, and video sharing. Although English is not the official language in Taiwan, the pre-service teachers reported using this language very often for most technology tools they used.

Figure 4.2. Frequencies of web log events for each technology tool



What Social Connections did Pre-service Teachers Engage in via Technology and English?

To answer this question, I describe the general patterns of the participants' connections to other people, both intentionally and coincidentally, in the events. This study found that the participants often intended to use technology and English to connect to local people in Taiwan, of whom a large proportion was their friends. English appeared to be commonly used in such connections, particularly when the connections were made in digital contexts. In addition, the participants also often used technology and English together to connect to those who lived remotely and those who they did not know but had

the same interest as theirs. They were also more likely to meet someone coincidentally, especially their online friends and those who shared the same interest as theirs, when technology was used with English. This revealed the potential of the combination of technology and English for transnational connections.

Intentional Connection to People

In the 1954 events recorded in the web log, the participants reported that they wanted to connect to people in 1225 (62.7%) of them, which showed that much of the participants' need for social connection was addressed by uses of technology and English. In the other 729 (37.3%) events in which the participants did not indicate their intention to connect to people, I looked at their answers to the questions closely and found that they actually were in contact with other people or places indirectly through the events. For example, some participants watched YouTube videos posted by others and hence were indirectly connected to them through the videos, which would not have been possible if technology and/or English were not involved. Other examples included listening to music and reading articles posted online by others. Because these participants might have interpreted the word "connect" as direct interaction with people, they reported that they had no plan to connect to others in events such as the above examples. To make the analyses of social connections consistent, these events were excluded from the analyses even though the participants were in fact in contact with people in those events. The analyses in this section thus focused on the participants' awareness of their intention to connect to people.

The majority of the people with whom the participants wanted to connect were friends, especially those who they met in person locally, such as college or high school classmates (see Table 4.30). I expected the participants to use their local languages with these local friends. However, the data showed that in addition to Mandarin Chinese, the participants also often used English with these friends especially when technology was involved (e.g., through emails or via social networking sites). In addition, the participants wanted to connect not only to someone they knew already (e.g., friends, teachers, and family members) but also to someone they did not know but shared the same interest as theirs. They attempted this type of connection more often in technology-related events, particularly when English was also involved. This implies that the combination of English and technology might be the best condition to provide opportunities to connect to like-minded people. The ability to make such connections via technology and English should greatly benefit pre-service teachers because they will have the capability to connect to other teachers or join a professional discussion group when they begin their teaching career.

Table 4.30. Categories of people with whom the participants wanted to connect

	English+Technology		English		Technology	
Friends met in person	276	67.2%	96	71.6%	477	70.1%
Friends met online	96	23.4%	0	0.0%	120	17.6%
University teachers/staff	73	17.8%	27	20.1%	121	17.8%
Family	65	15.8%	10	7.5%	73	10.7%
Others of the same interest	86	20.9%	12	9.0%	67	9.9%
General public	29	7.1%	7	5.2%	58	8.5%

Furthermore, the participants appeared to have a sense of where the people to whom they wanted to connect were most of the time (see Table 4.31). A large proportion of these people resided in Taipei, the city in which the participants lived and studied. The

second largest group of these people resided in other places in Taiwan. It appeared that the people with whom the participants wanted to connect were mostly local people. However, the number of events in which the participants used English with these people was large, especially when the connection was made online. In addition, the participants also wanted to connect to people in other countries through technology-related events. It appeared that this type of connection was mostly conducted when technology was used together with English, which suggests that the combination of technology and English created the greatest opportunities for the participants to engage in transnational connections.

Table 4.31. Locations of people with whom the participants wanted to connect

	English+Technology		English		Technology	
In Taipei	331	80.5%	126	94.0%	550	80.9%
In another city in Taiwan	146	35.5%	18	13.4%	228	33.5%
In another country	105	25.5%	0	0.0%	37	5.4%
Do not know	54	13.1%	2	1.5%	69	10.1%

Moreover, the participants apparently knew how to effectively use English and technology for social connection. In about 94.8% of the events in which they wanted to connect to people, the connections were made successfully. Besides, in about 69.7% of these events, the participants reported that they gained a deeper understanding of new people or places that they did not know well before.

Coincidental Connection to People

The participants reported that they were coincidentally connected to someone they did not expect to be in contact with in about 11.0% of the English+Technology events, 9.9% of the English events, and 9.4% of the Technology events. When English and

technology were used together, they had a slightly greater chance to be in contact with someone unexpectedly. The people to whom they were often coincidentally connected were friends (see Table 4.32). It appeared that when technology was used with English, the participants had increased opportunities to coincidentally meet online friends and people who shared the same interest as theirs, which suggested that the use of technology and English together helped the participants broaden their social network beyond the local level.

Table 4.32. Categories of people with whom the participants were coincidentally connected

	English+Technology		English		Technology	
Friends met in person	24	27.6%	11	44.0%	47	54.7%
Friends met online	37	42.5%	0	0.0%	16	18.6%
University teachers/staff	8	8.0%	1	0.0%	4	7.0%
Family	7	9.2%	0	4.0%	6	4.7%
Others with the same interest	24	27.6%	0	0.0%	8	9.3%
Strangers	8	9.2%	8	32.0%	10	11.6%

How did Pre-service Teachers' Technology and English Uses Differ Depending on Personal Factors?

To answer this question, I conducted a series of generalized linear mixed models to see whether the participants' gender and subject area influenced their likelihood of participating in events that involved uses of English and/or technology tools. The analyses showed that there was no difference among the participants in their possibilities to engage in the English+Technology, English, and Technology events. I conducted further investigation via several generalized linear mixed models and found that the participants did not differ much in terms of their purposes for participating in digital and

English events and the types of technology tools they used in the events. The only two salient patterns I found were that pre-service teachers of English were more likely to use English with office tools ($F = 3.709$, $df1 = 5$, $df2 = 786$, $p < .01$) for school work ($F = 2.445$, $df1 = 5$, $df2 = 786$, $p < .05$) than other subject groups, and that male participants were also more likely to use English and technology together for school work than females (see Table 4.33 and Table 4.34).

Table 4.33. Factors concerning uses of English and technology together for school work

Variable	*B*	*S.E.*	*Sig.*	*Exp(B)*
Female	-.894*	.402	.026	.409
Subject Area[a]			.034	
Chemistry	.595	.433	.170	1.813
English	1.864**	.608	.002	6.451
History	.392	.588	.506	1.479
Life Sciences	.692	.618	.264	1.998
(Intercept)	-1.335	.332	.000	.263

[a] Mathematics is the reference category.
* $p < .05$, ** $p < .01$, *** $p < .001$

Table 4.34. Factors concerning uses of English with office tools

Variable	*B*	*S.E.*	*Sig.*	*Exp(B)*
Female	-.558	.387	.149	.572
Subject Area[a]			.001	
Chemistry	-.151	.420	.719	.860
English	1.661*	.545	.002	5.266
History	.065	.566	.908	1.067
Life Sciences	1.050	.548	.056	2.857
(Intercept)	-1.788	.312	.000	.167

[a] Mathematics is the reference category.
* $p < .05$, ** $p < .01$, *** $p < .001$

It appeared that the more frequent uses of technology and English by the participants who were male and those who were in the subject area of English was

limited to academic settings. However, the questionnaire data suggested that these participants also excelled in other contexts. Although there seemed to be a discrepancy between the findings from both data sources, they did not in fact contradict each other. The differences in the participants' digital and English uses emerged in the web log data were also apparent in the questionnaire data. The reason why other differences in technology and English uses among the participants did not appear in the web log might simply be that the web log documented the participants' uses of technology and English for a restricted time period (two weeks), while the questionnaire asked the participants to summarize all of their digital and English experience. Although the web log might not be lengthy enough in terms of time to allow all use differences among the participants to show at a significant level, its major function was to provide a clear snapshot of the pre-service teachers' uses of technology and English in detail and hence to promote a deeper understanding of the phenomenon.

Summary of Key Findings from Web Log

The analyses of the web log data produced results that fulfilled two purposes. On the one hand, they served as evidence to confirm the findings from the questionnaire. On the other, they expanded our understanding of the per-service teachers' uses of technology and English in new aspects. A summary of the key findings are as follows:

How were technology and English used in pre-service teachers' daily lives?

The pre-service teachers in the study used technology and English for diverse purposes in daily life, and these two 21st-century tools were frequently connected to each

other. The participants often used English with Mandarin Chinese rather than using English alone. In addition, the participants appeared to participate in most technology events via computers. They used various types of technology tools in daily activities, and English was oftentimes the language of use in addition to their mother tongue.

What social connections did pre-service teachers engage in via technology and English?

The pre-service teachers in the study often wanted to connect to local people in Taiwan, particularly their friends, through digital and English events. They appeared to use English for such local connections especially in an online environment. In addition, when these pre-service teachers used technology together with English, they seemed to have more opportunities to connect to people in remote locations as well as to those who shared the same interest as theirs. They were also more likely to be coincidentally in contact with others, many of whom were the friends they met online and people with similar interests. The combination of technology and English appeared to be the best condition for transnational connections.

How did pre-service teachers' technology and English uses differ depending on personal factors?

Pre-service teachers of English appeared to be more likely to use English with office tools for school work than other subject groups. Besides, male teachers in the study tended to use English and technology together for school work more often than females. These patterns were consistent with the findings from the questionnaire data.

Chapter 5 : Discussion and Implications

Overview

The descriptive study sought to understand how pre-service teachers in Taiwan consider and use technology and English in the 21st century. By investigating the digital and English use experience and perceptions of a pre-service teacher sample from one institution, this study was able to learn what these pre-service teachers could and could not do with technology and English, what social connections they were involved in, and how their technology and English uses were related.

In this chapter, I want to argue the following points based on the study findings: 1) the pre-service teachers in the study were digital English natives who were accustomed to using technology with English in daily life; 2) the pre-service teachers were able to use technology and English, oftentimes together, to strengthen their existing local networks and developing new social relations with new people; 3) there was an interplay between technology and English in the pre-service teachers' perceptions and uses, and this interplay should be considered when teacher educators provide support to help pre-service teachers develop critical digital and English abilities for teaching; and 4) the pre-service teachers differed in their perceptions and uses of technology and English depending on gender and subject area, and issues of digital and English participation equity may need to be addressed within this population.

I also discuss implications drawn from the study and suggestions for future research to conclude the chapter.

Pre-service Teachers as Digital English Natives

Past research (e.g., Butler, 2004; C.-H. Chen, 2008; Liang & Tsai, 2008) suggested that many teachers in Taiwan did not consider and use technology and English positively for teaching. They did not develop full digital and English abilities necessary for teaching. This situation leads to one question: *Do teachers lack sufficient digital and English abilities for teaching because 1) they do not know enough about technology and English, or 2) they know technology and English but are not able to apply what they know to teaching.* The former scenario suggests that teachers lack experience with technology and English for both their personal and professional uses, while the latter implies that teachers do have experience in using these two 21st-century tools in their personal lives but for certain reasons they do not, or cannot, transfer relevant knowledge to the contexts of teaching.

This study aims to find out which scenario best described the group of pre-service teachers participating in current research. The findings showed that the second scenario was true. The pre-service teachers in this study appeared to be accustomed to the 21st-century life in which they considered and used technology and English as necessary tools almost every day, which provides evidence that the global diffusion of technology and English has significantly changed the ways people participate in society (Castells, 2004; Crystal, 2003). These pre-service teachers participated in social activities in ways

fundamentally different from the older generation in that uses of technology and English seemed natural to these teachers.

The pre-service teachers in the study are the generation Prensky (2001) called the *digital natives*. The study showed that they had a high level of access to technology resources and used them very frequently for all kinds of purposes. The questionnaire data revealed that they generally had positive attitudes toward technology and believed in the critical role technology will play in their future teaching. They reported having also advanced knowledge and proficiency in using these tools. The analyses on the web log also indicated that these digital natives used a combination of 21st-century technology tools in their everyday lives.

The pre-service teachers' uses of technology appeared to have expanded beyond what the traditional Web 1.0 applications could offer. The more advanced Web 2.0 (Anderson, 2007) provided these pre-service teachers with abundant opportunities to be socially connected. For example, the web log analyses showed that among various technology tools, they reported that they had the highest level of proficiency in using instant or text message, website browsing, email, and search engine. Instant or text message and email allowed pre-service teachers to directly interact with people and thus enable easier social connections. Furthermore, website browsing has been the major user activity associated with the Web since it was in the 1.0 version. However, with the exponential growth of the Web nowadays, the ability of website browsing in the new Web 2.0 era is now more complicated than ever and includes a series of sub-skills one needs (e.g. what information is worth searching for and where is the best place to find it)

to be able to efficiently and effectively navigate through the tremendous cyber space. In addition to website browsing, the use of search engines to seek information stored in various forms, such as text, image, audio, and video, from diverse sources gave the pre-service teachers an even greater power in obtaining comprehensive and reliable information and connecting to others. Technology to these pre-service teachers represented not only a wide array of digital tools necessary for many aspects of their daily lives but also the mindset associated with uses of these tools for meaningful purposes

Perhaps a more surprising finding about the pre-service teachers in the study is that they are not only digital natives but also *digital English natives* because they used English frequently in daily life and much of their English use experience occurred in digital contexts. The questionnaire data showed that in general, these pre-service teachers had positive attitudes toward English. Although they did not always appreciate English, they did see the importance of English in their future teaching. In addition, they were generally more proficient in using English in digital environments. The analyses of the questionnaire showed that regarding the tasks the pre-service teachers usually did with English in daily life, they were generally more proficient in using English to listen to music, watch movie, and browse websites. These tasks were usually accomplished via technology. For instance, they often watched movies on YouTube and listened to the songs they downloaded from the Internet. The web log data also showed that these teachers used English with many technology tools, such as website browsing, search engine, and video sharing, to serve several purposes in life, such as entertainment, school

work, and finding information. This is the evidence that these pre-service teachers had developed the types of English abilities necessary for the 21st century.

One of the characteristics of the *digital English natives* was that they did not often use English exclusively like those who speak the language as their mother tongue do. The pre-service teachers in the study used English only when its use was necessary for participating in certain social activities, and such use was often accompanied by the use of their primary language, Mandarin Chinese, as shown in the web log data. They appeared to be able to switch from one language to the other and to draw upon their knowledge of both languages to express to and understand others. This phenomenon can be best captured by the concept of *plurilingualism*, describing the fact that an individual person "does not keep these languages and cultures in strictly separated mental compartments, but rather builds up a communicative competence to which all knowledge and experience of language contributes and in which languages interrelate and interact. In different situations, a person can call flexibly upon different parts of this competence to achieve effective communication with a particular interlocutor" (Council of Europe, 2001, p. 4).

The sample of pre-service teachers in this study was found to be digital English natives who were capable of using technology and English to accomplish various goals in daily life. Although this study did not follow these same teachers into their teaching career, prior research indicated that this new generation of teachers may nevertheless lack the ability to use technology and English for teaching. If this assumption is true, teacher educators are left with the questions of *why these teachers do not, or cannot, apply what*

they know about technology and English to the contexts of teaching and *how teacher education can best support their development of digital and English abilities for teaching*.

Social Connections Enhanced by Technology and English

In this 21st-century *network society* (Castells, 2000, 2004), the global diffusion of technology and English results in increased opportunities for people to participate in social activities that allow them to connect to people outside of their local contexts and hence to engage in *transnational social networks*; that is, social connections that transcend geographical boundaries. As citizens of contemporary society, the new generation of teachers is also expected to have the ability to make such social connections especially to other teachers and professionals in order to support and improve their teaching.

To see whether the pre-service teachers in the study were able to make transnational connections, this study explored their social connection patterns and found that they mostly used technology and English to connect with those they knew locally. Does this mean that these pre-service teachers' social networks were limited to the local level and that they did not have transnational connections at all? The analyses of the web log data showed that in addition to local connections, these teachers also had many opportunities to connect to people outside of the local contexts via the use of technology and English. In addition, while it might appear that the pre-service teachers often wanted to connect to local people, the web log data suggested that these local connections were conducted in multiple ways that were only made possible by the use of new technology

and English. Therefore, the pre-service teachers in the study were engaged in social connections in the 21st-century ways.

As Beck (2000) suggested, the advance of technology and global spread of English has promoted new relationships, or social connections, among people and places in contemporary society. I argue that these new relationships are of two types. First of all, people have more opportunities to connect to others remotely. With the use of technology and English, people are less bound by their local environment and are more able to participate in social activities with others from afar. Therefore, new relationships can be formed between people from different parts of the world. Secondly, with the use of technology and English, people now have more options to connect to others, including those who live locally and those who they have already known, and thus develop new and improved relations with them. The first type of new relationship represents a change in quantity; that is, the possibility for people to encounter others remotely has increased. In contrast, the second type of new relationships represents a change in quality; that is, the ways people use to connect to others has been enhanced. They now can choose among multiple new methods to contact others. They can make good use of these options enabled by technology and English to develop and strengthen their social relations with others, including those they know locally.

This study showed that the pre-service teachers were able to develop both types of new relationships with others via the use of technology and English. The first type of relationships was evident in their increased ability to connect, both intentionally and coincidentally, to people outside of their local contexts as well as to those who shared

similar interests as theirs especially when they used technology with English. The power of using technology and English for remote social connections was the greatest when these two tools were used together. For example, the web log data showed that when the pre-service teachers used English without technology, they mostly interacted with local people in Taipei. When they used technology without English, they were more capable of connecting to people living in another city in Taiwan. However, when they used technology together with English, their likelihood of being in contact with people in another country significantly increased. In other words, the use of technology and English together contributed to an expansion of the pre-service teachers' social networks.

The second type of new relationships was evident in the pre-service teachers' use of technology and English in multiple ways to connect to local people in order to improve and strength their social networks. Despite the fact that Mandarin Chinese was the local official language, the analyses of the web log showed that these pre-service teachers frequently used English for local connections, particularly in digital contexts. The technology tools they used for these connections were of multiple types, and English was oftentimes the language of use in addition to Mandarin Chinese.

If the pre-service teachers could use technology and English for both types of social connections, it seems reasonable to expect that they will have little difficulty connecting to other teaching professionals or joining teacher groups to support their teaching. However, the young generation's lack of sufficient digital and English abilities for teaching suggested in prior research brings out a related question: *do they also lack adequate abilities to be involved in social connections for professional purposes? If that*

is true, how can pre-service teachers be supported to expand their social networks to cover the professional aspects of their lives?

The Interplay between Uses of Technology and English

The pre-service teachers in the study reported that they used technology and English frequently for similar purposes in daily life. This finding leads to the following questions: *Is there a relationship between technology and English in terms of the pre-service teachers' perceptions and uses? If they are found to be connected, what does this mean for teaching?*

This study discovered that uses of technology and English among the pre-service teachers were indeed interconnected in many ways. To begin with, the analyses of the questionnaire and web log showed that English was oftentimes the language of use with many technology tools, especially the ones that the pre-service teachers believed to be important to their lives and also had the highest proficiency in using. In other words, a large proportion of the pre-service teachers' technology use experience was conducted with the use of English. As mentioned previously, one prominent benefit of using technology and English together was that it enabled transnational social connections. The combination of technology and English had the best potential to provide the pre-service teachers with opportunities not only to connect to people regardless of their physical locations but also to maintain and strength their existing local networks.

The interconnection between technology and English was found not only in that they tended to co-occur but also in that they supported each other in many aspects. For

example, the questionnaire data showed that as the per-service teachers' technology expertise they reported increased, their English expertise also tended to increase. The more positive attitudes the pre-service teachers had toward teaching with technology, the more positive attitudes they had toward teaching with English as well. Although we cannot claim a causal relationship in the abilities and perceptions between technology and English, the development of one appears to benefit the development of the other. It is very likely that when the pre-service teachers used technology more often, they had increased opportunities to encounter English online since English is the language that dominates the Web. Similarly, when they used English more frequently, they were more capable of and confident in using this language with technology to accomplish various tasks.

The pre-service teachers in the study were conscious of the interplay between uses of technology and English. They reported that the lack of sufficient English skills was one major barrier to their learning of technology because English is the dominating language in many technology tools and on the Internet. Although they thought the largest obstacle to their learning of English was the lack of opportunities to use English rather than the lack of sufficient technology skills, these pre-service teachers reported that their major opportunities of English use were through technology. Being able to use technology certainly had benefited their learning of English. In other words, technology and English abilities appeared to support each other.

If uses of technology and English were interconnected in the pre-service teachers' personal lives, it is very likely that this positive relationship between technology and

English will also be carried over to their future teaching settings. The hypothesis is that when they use technology for teaching, they will also often engage in English use, and vice versa. If this important connection between technology and English for teaching is true, teachers will be expected to have the ability to use technology with English to deal with teaching tasks. This gives more reasons for teacher educators to figure out *what digital and English abilities pre-service teachers still lack* and *how to help them develop full abilities in using technology and English for teaching, with an understanding that technology and English are very much interconnected*.

Different Functions of Technology and English for Different Pre-service Teachers

In general, the pre-service teachers in the study reported using technology and English frequently in daily life. However, *are they all using these two tools in the same way? If not, what does this imply for their teaching?* To address this question, this study tried to find out whether there were differences in technology and English uses among the pre-service teachers depending on personal factors such as gender and subject area.

If I used the traditional notion of the *digital divide* and the *English divide* to evaluate the pre-service teachers' access to technology and English, the outcome would have been very misleading. The *digital divide* refers to a gap between the people who have access to technology resources and those who do not (e.g., Guillén & Suárez, 2005; Light, 2001; Lu, 2001; Salpeter, 2006; Tiene, 2002; van Dijk & Hacker, 2003). Based on this definition, all the pre-service teachers in the study were *technology haves* because they indicated in the questionnaire that they possessed abundant technology resources. Each of them owned at least a cell phone, computer, and digital camera, and also

extremely likely internet access as well. Therefore, there should have been no *digital divide* among them. However, does this mean that there is no difference in their use of technology for social participation in daily life? The results of the study suggested that the answer is no. Similarly, the *English divide* refers to a gap between the people who speak English as their mother tongue and those who do not (Rogers, 1998). According to this definition, all the pre-service teachers were *English have-nots* because English is not a primary or official language in Taiwan. However, this study discovered that English actually played an important role in the pre-service teachers' lives and that personal factors like gender and subject area did have an impact on the ways they used English.

Therefore, the notion of a *divide* among people did not work for the pre-service teachers in the study. Their uses of technology and English were diverse and complex and could not simply be viewed from the standpoint of *haves* or *have-nots*. This study tried to understand their technology and English uses from the perspective of the *digital and English participation equity*, which emphasizes fair opportunities to use technology and English for social participation. Because the ability and mindset of using technology and English are often acquired through relevant use in meaningful contexts (Leu, et al., 2004), it is the opportunities of use rather than the mere ownership of resources that is more critical in the development of new digital and English literacies in the new era. There are multiple types of social activities involving uses of technology and English. All pre-service teachers should have the opportunities to participate in the ones they need for both personal and professional purposes and hence develop critical abilities needed in those contexts.

From the perspective of digital and English participation equity, this study looked into the perceptions and uses of technology and English among the pre-service teachers and sought to find out whether some of them lack certain types of technology and English use experience. The data showed significant differences depending on the pre-service teachers' gender and subject area. Regarding gender differences, the questionnaire data suggested that female pre-service teachers reported lower proficiencies in technology and less technology use experience than males. Because technology and English uses were closely connected, female teachers' ability in using English with technology tools was also negatively impacted. Although female pre-service teachers appeared to be disadvantaged in technology use, their desire to use technology in future teaching did not seem to be less than males'. This mismatch between what they could do and what they hoped they will be able do via technology for future teaching poses questions of *whether female pre-service teachers were in need of support to participate in more technology use opportunities* and *whether teacher educators can play a role in providing such support to help them develop critical digital and English abilities for teaching*.

With regard to subject area differences, the analyses of the questionnaire showed that pre-service teachers of English, as expected, reported higher proficiencies in English and more positive attitudes toward English. Further investigations indicated that because English uses were often conducted online, these teachers' abilities to use several technology tools were also better than other subject groups, which is an evidence of the interplay between technology and English uses. This positive relationship is also illustrated in that pre-service teachers of Life Sciences had a higher expertise in English

and used English and technology more frequently than other non-English subject groups. Therefore, more English uses appeared to be associated with more technology uses.

However, the other side of the coin is that fewer English uses also relate to fewer technology uses, which is exemplified in the cases of pre-service teachers of Mathematics. Comparing to all other subject groups, they reported in the questionnaire that they had lower levels of English abilities, less positive attitudes toward English, and thus lower levels of willingness to use English in future teaching. They also tended to see less value of technology tools and were less able to use these tools, particularly wiki. This leads to the following questions: *Does the finding that Mathematics teachers used less English and technology mean that they simply did not need such uses as much as other teachers do or that they were not able to get the opportunities to be involved in those uses? If it is the latter, how can teacher educators help them engage in the technology and English use experience they need for teaching?*

Implications

Teachers play a critical role in educating the next generation. The current body of pre-service teachers is an especially important group because their career trajectory crosses over from the old era to the new globalized context featuring widespread uses of technology and English. They will be educating future students who will likely be immersed in a life that is far more advanced in uses of technology and English. If the younger teachers lack adequate digital and English abilities for teaching, they will not function well in their jobs to teach the next generation and to move the society forward.

The pre-service teachers in the study appeared to have abundant technology and English use opportunities. They reported frequent use of technology and English for diverse purposes, which suggested that they had developed necessary knowledge in technology and English to deal with tasks in daily life. However, whether they will also be able to use technology and English for future teaching remains uncertain. As mentioned previously, many teachers did not appear to have sufficient abilities in technology and English necessary for teaching (e.g., Butler, 2004; C.-H. Chen, 2008). If teachers cannot apply their knowledge of technology and English to the contexts of teaching, *how can this disconnect between their personal and instructional uses of technology and English be bridged? Can teacher education foster successful connections between the two?*

Prior research (e.g., Y.-L. Chen, 2008a, 2008b) suggested that teacher training is a critical factor in promoting teachers' use of technology for teaching. It should also benefit teachers' use of English for teaching since technology and English are interconnected. Although the new generation of teachers appears to be accustomed to technology and English uses in personal life, we cannot simply assume that they are equally capable of using technology and English for teaching. Engaging in the use of technology and English for teaching is an optimal condition for pre-service teachers to develop the 21st-century teaching abilities and mindset, and teacher education can play a key role in supporting and providing opportunities of technology and English uses for pre-service teachers and shape them into well-prepared teaching professionals of the new age.

Although it was not within the scope of the current study to prescribe specific methods or curricula for pre-service teachers regarding this issue, this descriptive study can provide teacher educators with useful implications to consider as follows. Although these implications are geared toward the context of Taiwan, they could potentially be also useful for other countries of similar profiles, such as South Korea and Japan.

Recognize the Roles of Technology and English in Pre-service Teachers' Lives

The pre-service teachers in the study appeared to be already accustomed to digital and English practices in daily life. If they have much knowledge in technology and English but still experience difficulty in using technology and English for school teaching, it is very likely that they do not have sufficient preparation from teacher education programs. The inadequate amount of support for pre-service teachers' development of technology and English abilities for teaching may stem from three possible causes: 1) The important roles of technology and English for future teaching is not recognized; 2) Pre-service teachers' digital and English lives are not acknowledged; and 3) Teacher educators do not use technology and English in the 21st-century ways like the new generation of pre-service teachers do.

If teacher education is to be useful in preparing pre-service teachers for teaching in the new era, the first step to move toward this goal is to recognize that using technology and English has become a trend in contemporary society and will continue to play an important role in education. Technology and English have become a part of pre-service teachers' lives, and it will be unrealistic to expect these teachers to teach in traditional ways without using these two elements of the 21st century. This step is

particularly important with regard to the role of English in the context of Taiwan because this study found that the pre-service teachers did not seem to realize that they did use English frequently in daily life. Therefore, it is imperative to help these teachers recognize the English aspects of their lives and be confident about it. Only when they fully understand their own digital and English lives can they know what abilities they have and can apply to teaching and what is still lacking and needs to be improved in order to be well-prepared for future teaching.

Design Teaching Opportunities that Build on Pre-service Teachers' Existing Digital and English Practices

In addition to recognizing the importance of technology and English in pre-service teachers' lives, a further step to promote uses of technology and English for future teaching among pre-service teachers is to encourage them to think about ways to apply what they know about technology and English to teaching. The pre-service teachers in the study appeared to be capable of using technology and English in multiple ways for diverse purposes and thus should not be viewed as blank slates waiting to be filled with new knowledge about technology and English. A more useful approach is to design opportunities of teaching that build on pre-service teachers' existing digital and English practices. As Minsky (1988) stated in his description of Papert's Principle (which was named after Seymour Papert, one of the pioneers of artificial intelligence), "Some of the most crucial steps in mental growth are based not simply on acquiring new skills, but on acquiring new administrative ways to use what one already knows" (p. 102). Helping pre-service teachers incorporate their personal experience in technology and English into

teaching will not only increase the quantity and quality of their technology and English uses but also connect their digital and English practices between personal and professional contexts.

For example, one crucial finding of this study was that technology and English were often used together in the Taiwanese pre-service teachers' lives and that the use of one supported the use of the other. We also learned that using technology together with English provided the pre-service teachers with increased opportunities to connect to those who lived remotely and who had the same interest as theirs. Abilities to make these types of social connections are particularly important for these teachers because they will need to participate in professional groups and interact with other teachers regardless of their physical locations when they teach in the future. Therefore, teacher educators can design opportunities that allow pre-service teachers to apply their existing knowledge of technology and English for social connections to professional contexts, such as using tools like wiki and discussion group to participate in discussions about teaching with other teachers.

Support Pre-service Teachers' Development of New Abilities of Technology and English for Teaching

The gender and subject area differences found in the uses of technology and English among the pre-service teachers in the study represent the types of digital and English use opportunities individual pre-service teachers were or were not exposed to in daily life. While it is possible that the absence of certain digital and English practices for some teachers means that they did not need these practices in their lives, it may also be

that they lacked the opportunities to participate in those practices that may be useful to their future teaching. Compared to the pre-service teachers in countries like the United States, those in Taiwan are a relatively homogeneous group in terms of their ethnic and language background and the surrounding social environment. Therefore, it is very likely that the lack of some types of technology and English uses (e.g., for pre-service teachers of females and of the subject area of Mathematics) is more of an indication that these pre-service teachers did not have adequate opportunities to be involved in these uses like their peers did and thus were not able to develop relevant abilities.

The new era of globalization requires people to have multiple 21st-century literacies to deal with diverse tasks in life. If we want all pre-service teachers to be able to fully participate in modern society, it will be useful to identify what types of digital and English uses pre-service teachers need but have not had sufficient exposure to and then engage them in those use opportunities especially for teaching purposes. In this way, we can ensure not only that all teachers will acquire necessary abilities of the 21st century but also that these teachers will be able to help their students develop critical abilities for the future. For example, the study found that the pre-service teachers of Mathematics might not have adequate knowledge in using wiki, a tool that is often used with English, for purposes of teaching like their fellow teachers did. By providing them with opportunities to learn about wiki and to experience using this tool for teaching, teacher educators will be able to address the largest barriers the pre-service teachers reported having regarding their learning of technology (i.e., the lack of formal training) and English (i.e., the lack of opportunities to use English) because these pre-service teachers will receive trainings in using wiki while also having opportunities to experience using English with this new tool.

Suggestions for Further Research

This study serves as a good starting point of producing useful knowledge in the fruitful research area of pre-service teachers' uses of technology and English. More research is needed to further extend our understanding of this new generation of teachers and to devise more pedagogical implications to teacher educators. A project relating to this study but with a different scale, method, focus, or setting may shed additional light on this topic.

Different Research Scale

One of the limitations of this study was that the participants were all from the same university. It is arguable that the research findings might only be applicable to this particular school. In order to increase the generalizability of the research findings, the sample size of the study should be expanded to include participants from other universities as well so that the credibility of the research findings can be ensured. In addition, the current study was confined to only five subject areas. There were several other teacher education programs of different subject areas that were excluded from the study. Recruiting participants in more subject areas will help us reach a more profound understanding of all pre-service teachers in Taiwan.

Different Research Method

This study aimed to describe the use of technology and English among pre-service teachers from the quantitative perspective. Large amounts of data were collected and analyzed statistically in order to detect general use patterns among these teachers. While

the quantitative findings provide us with useful information, a study from the qualitative perspective may supplement our understanding of the issue. In other words, to have a deeper knowledge of pre-service teachers' technology and English uses, we need to know not only the quantity but also the quality of such use. A research study with qualitative methods, such as interviews, is particularly useful in capturing findings of this nature.

Different Research Setting

This study was conducted in the context of teacher education programs in a university. The participants were undergraduate students and had not experienced formal teaching as official school teachers. While in this study we found many distinctive patterns in the uses of technology and English among pre-service teachers, further research with a change in research settings from universities to secondary or elementary schools will allow us to find out whether this new generation of teachers follows the same pattern of technology and English uses when they enter the teaching profession after graduation. It will also be interesting to investigate how these teachers use technology and English for school teaching, whether they are able to apply their technology and English use experience in the university to their teaching in secondary or elementary schools, and how they adapt to the fast evolving digital and English practices in the new era of globalization.

Concluding Remarks

Life in the 21st century is fundamentally different from the life of two decades ago. The way we participate in society has been dramatically changed due to the advance of

technology and the global spread of English. We now can easily be involved in transnational connections as well as efficiently obtain critical information and knowledge via the use of technology and English. In order to be full citizens of the 21st century, we need to develop multiple types of new digital and English literacies to deal with various tasks in daily life.

It is particularly important for teachers to adapt to the new form of social participation because they play a crucial role in modeling modern use of technology and English to students. They need to know how to incorporate technology and English into their teaching and how to assist their students in the process of developing 21st century skills. The current body of pre-service teachers is the new generation who are surrounded by constant uses of technology and English. This study looked at a sample of these pre-service teachers and demonstrated that technology and English were central to the lives of these teachers. They were accustomed to using English with multiple technology tools for various purposes in daily life. They were also able to make social connections via technology and English together to strength their local networks and to develop new relationships with people outside of local contexts.

The younger generation of teachers has abundant personal experience using technology and English. However, they may nevertheless need support in developing the digital and English abilities necessary for teaching, and teacher education can play a key role in shaping their teaching experience. It is critical for teacher educators to evaluate these teachers' digital and English abilities and provide them with opportunities to experience using technology and English for teaching. The interplay between technology

and English in terms of perceptions and uses as found in this study suggests that these two tools should be considered together when teacher educators provide support to help pre-service teachers develop 21st-century teaching abilities.

The new generation of pre-service teachers has a great potential to help their students develop appropriate digital and English abilities in the future. Although this study did not follow the pre-service teachers into their classroom teaching, I have confidence in their ability to continue to adapt to the evolving digital and English practices in personal and teaching contexts and to enrich their teaching with technology and English. This study is intended to serve as a first step in understanding the roles of technology and English in teachers' lives in this new era of globalization. Many aspects of the issue still need further investigation. The ultimate goal is to help teachers be better prepared for teaching with the use of technology and English, which in turn would benefit student learning.

Appendices

Appendix A: Questionnaire - Perceptions and Uses of Technology and English

Answer the following questions about your personal background and your thoughts on using technology and English in daily life.

I. Your Profile

1. Name: _____
2. Gender: _____
3. Age: _____
4. Major: _____
5. Academic year: _____

6. Plan after graduation (Check all that apply.):
    a. Participate in a teaching practicum and obtain a teaching certificate afterwards
    b. Be a research assistant
    c. Look for a non-teaching job
    d. Prepare to attend a master's program in Taiwan
    e. Prepare to study abroad
    f. I don't have a plan yet
    g. Other: _____

7. Do you plan to become a teacher in the future?
    a. Yes
    b. No
    c. Not sure

II. Technology Resources and Use

1. Which of the following items do you own or have access to in the place you live? (Check all that apply.)
    - □ Cell phone
    - □ Computer
    - □ Internet connection
    - □ Digital camera

- ☐ Digital music or video player (e.g., MP3 player or iPod)
- ☐ Digital video camcorder
- ☐ Digital audio recorder
- ☐ Digital reader (e.g., Kindle)
- ☐ Video gaming system
- ☐ None of the above

2. How would you rate your overall expertise with technology? (Circle one number.)
(Very poor) 1 2 3 4 5 6 7 8 9 10 (Very advanced)

3. To what extent do you agree with each of the following statements? (Check one box.)

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
a. I like to explore new technology tools.	☐	☐	☐	☐	☐
b. I can easily figure out new technology tools.	☐	☐	☐	☐	☐
c. I like to show people how to use new technology tools.	☐	☐	☐	☐	☐
d. I look forward to using new technology tools in my teaching.	☐	☐	☐	☐	☐
e. I will teach my students how to use new technology tools.	☐	☐	☐	☐	☐

4. How often do you use technology to do the following? (Check one box.)

	Never	A few times a year	A few times a month	A few times a week	Several times a day
Collaborating on a task	☐	☐	☐	☐	☐
Communicating with others	☐	☐	☐	☐	☐
Connecting to people I don't already know	☐	☐	☐	☐	☐
Entertainment or interest	☐	☐	☐	☐	☐
Finding information	☐	☐	☐	☐	☐
Fulfilling a routine	☐	☐	☐	☐	☐
Improving skills or knowledge	☐	☐	☐	☐	☐
Purchasing or returning products	☐	☐	☐	☐	☐
Scheduling or planning	☐	☐	☐	☐	☐
School work	☐	☐	☐	☐	☐

Sharing information or thoughts	☐	☐	☐	☐	☐
Social networking	☐	☐	☐	☐	☐
Solving a problem	☐	☐	☐	☐	☐

5. How well can you use the following technology tools? (Check one box.)

	I don't know what it is	I know what it is but have never used it	I know a little about how to use it	I know much about how to use it but am still not an expert on it	I am an expert on it and can teach other people about it
Blog	☐	☐	☐	☐	☐
Discussion group	☐	☐	☐	☐	☐
Electronic transaction	☐	☐	☐	☐	☐
Email	☐	☐	☐	☐	☐
Instant message or text message	☐	☐	☐	☐	☐
Map	☐	☐	☐	☐	☐
Office tools	☐	☐	☐	☐	☐
Online office collaboration tools (e.g., Google Docs)	☐	☐	☐	☐	☐
Photo sharing (e.g., Flickr)	☐	☐	☐	☐	☐
Podcast	☐	☐	☐	☐	☐
RSS feed	☐	☐	☐	☐	☐
Search engine	☐	☐	☐	☐	☐
Social bookmarking (e.g., delicious)	☐	☐	☐	☐	☐
Social networking	☐	☐	☐	☐	☐
Video/online games	☐	☐	☐	☐	☐
Video sharing	☐	☐	☐	☐	☐
Video/audio conferencing (e.g., Skype)	☐	☐	☐	☐	☐
Virtual community (e.g., Second Life)	☐	☐	☐	☐	☐
Website browsing	☐	☐	☐	☐	☐
Wiki	☐	☐	☐	☐	☐

6. Which of the following technology tools do you think is valuable in your social life (e.g., this tool promotes my relationship with friends), academic life (e.g., this tool enhances my performance in school), and future career (e.g., this tool will enrich my teaching)?
(Circle one number: 1=not important at all, 2=somewhat important, 3=important, 4=extremely important):

	Social life	Academic life	Future Career
Blog	1 2 3 4	1 2 3 4	1 2 3 4
Discussion group	1 2 3 4	1 2 3 4	1 2 3 4
Electronic transaction	1 2 3 4	1 2 3 4	1 2 3 4
Email	1 2 3 4	1 2 3 4	1 2 3 4
Instant message or text message	1 2 3 4	1 2 3 4	1 2 3 4
Map	1 2 3 4	1 2 3 4	1 2 3 4
Office tools	1 2 3 4	1 2 3 4	1 2 3 4
Online office collaboration tools	1 2 3 4	1 2 3 4	1 2 3 4
Photo sharing	1 2 3 4	1 2 3 4	1 2 3 4
Podcast	1 2 3 4	1 2 3 4	1 2 3 4
RSS feed	1 2 3 4	1 2 3 4	1 2 3 4
Search engine	1 2 3 4	1 2 3 4	1 2 3 4
Social bookmark	1 2 3 4	1 2 3 4	1 2 3 4
Social networking	1 2 3 4	1 2 3 4	1 2 3 4
Video games	1 2 3 4	1 2 3 4	1 2 3 4
Video sharing	1 2 3 4	1 2 3 4	1 2 3 4
Video/audio conferencing	1 2 3 4	1 2 3 4	1 2 3 4
Virtual community	1 2 3 4	1 2 3 4	1 2 3 4
Website browsing	1 2 3 4	1 2 3 4	1 2 3 4
Wiki	1 2 3 4	1 2 3 4	1 2 3 4

7. What are the barriers for you to learn how to use some technology tools well? (Check all that apply.)
   - ☐ Lack of confidence in learning new technology in general
   - ☐ Lack of motivation to learn these technology tools
   - ☐ Lack of opportunities to use these technology tools
   - ☐ Lack of formal training
   - ☐ Lack of proper hardware and software
   - ☐ Lack of sufficient English skills
   - ☐ Lack of internet connection
   - ☐ Lack of technical support
   - ☐ Other: _____

III. English Resources and Use

1. How would you rate your overall expertise with English? (Circle one number.)
   (Very poor) 1 2 3 4 5 6 7 8 9 10 (Very advanced)

2. To what extent do you agree with each of the following statements? (Check one box.)

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
a. I like to learn English.	☐	☐	☐	☐	☐
b. I can easily figure out new English words and usages.	☐	☐	☐	☐	☐
c. I like to show people how to use English.	☐	☐	☐	☐	☐
d. I look forward to use English in my teaching.	☐	☐	☐	☐	☐
e. I will teach my students how to use English to complete certain tasks.	☐	☐	☐	☐	☐

3. How often do you use English to do the following? (Check one box.)

	Never	A few times a year	A few times a month	A few times a week	Several times a day
Collaborating on a task	☐	☐	☐	☐	☐
Communicating with others	☐	☐	☐	☐	☐
Connecting to people I don't already know	☐	☐	☐	☐	☐
Entertainment or interest	☐	☐	☐	☐	☐
Finding information	☐	☐	☐	☐	☐
Fulfilling a routine	☐	☐	☐	☐	☐
Improving skills or knowledge	☐	☐	☐	☐	☐
Purchasing or returning products	☐	☐	☐	☐	☐
Scheduling or planning	☐	☐	☐	☐	☐
School work	☐	☐	☐	☐	☐
Sharing information or thoughts	☐	☐	☐	☐	☐
Social networking	☐	☐	☐	☐	☐
Solving a problem	☐	☐	☐	☐	☐

4. How well can you do the following tasks in English? (Check one box: 1=I cannot do this at all, 2=poor, 3=fair, 4=good, 5=very well):

	I cannot do this at all	Poor	Fair	Good	Very well
Reading newspaper	☐	☐	☐	☐	☐
Reading novels	☐	☐	☐	☐	☐
Browsing websites	☐	☐	☐	☐	☐
Watching movies	☐	☐	☐	☐	☐
Listening to music	☐	☐	☐	☐	☐
Having face-to-face conversations	☐	☐	☐	☐	☐
Conversing on the phone	☐	☐	☐	☐	☐
Email	☐	☐	☐	☐	☐
Writing an essay	☐	☐	☐	☐	☐
Instant messaging or Text messaging	☐	☐	☐	☐	☐
Posting information on the web	☐	☐	☐	☐	☐

5. How often do you use ***English*** with the following technology tools?

	I don't use this tool at all	Never use it in English	A few times a year	A few times a month	A few times a week	Several times a day
Blog	☐	☐	☐	☐	☐	☐
Discussion group	☐	☐	☐	☐	☐	☐
Electronic transaction	☐	☐	☐	☐	☐	☐
Email	☐	☐	☐	☐	☐	☐
Instant message or text message	☐	☐	☐	☐	☐	☐
Map	☐	☐	☐	☐	☐	☐
Office tools	☐	☐	☐	☐	☐	☐
Online office collaboration tools	☐	☐	☐	☐	☐	☐
Photo sharing	☐	☐	☐	☐	☐	☐
Podcast	☐	☐	☐	☐	☐	☐
RSS feed	☐	☐	☐	☐	☐	☐
Search engine	☐	☐	☐	☐	☐	☐
Social bookmarking	☐	☐	☐	☐	☐	☐
Social networking	☐	☐	☐	☐	☐	☐
Video/online games	☐	☐	☐	☐	☐	☐

Video sharing	□	□	□	□	□	□
Video/audio conferencing	□	□	□	□	□	□
Virtual community	□	□	□	□	□	□
Website browsing	□	□	□	□	□	□
Wiki	□	□	□	□	□	□

6. Which of the following English skills do you think is valuable in your social life (e.g., this skill promotes my relationship with friends), academic life (e.g., this skill enhances my performance in school), and future career (e.g., this skill will enrich my teaching)?
   (Circle one number: 1=not important at all, 2=somewhat important, 3=important, 4=extremely important):

	Social life				Academic life				Future career			
Reading	1	2	3	4	1	2	3	4	1	2	3	4
Writing	1	2	3	4	1	2	3	4	1	2	3	4
Listening	1	2	3	4	1	2	3	4	1	2	3	4
Speaking	1	2	3	4	1	2	3	4	1	2	3	4

7. What are the barriers for you to learn English well? (Check all that apply.)
   - □ Lack of confidence in learning English
   - □ Lack of motivation to learn English
   - □ Lack of opportunities to use English
   - □ Lack of dictionaries
   - □ Lack of formal training
   - □ Lack of sufficient technology skills
   - □ Other: _____

Appendix B: Web Log - Daily Uses of Technology and English

This web log is available online at https://docs.google.com/spreadsheet/viewform?formkey=dDZ5ZzRDb0lvcE5fdkxBdUhabXF6Vnc6MA

This is a log of your daily activities using technology and English. Before starting the log, review all the events/activities you were involved in using technology and/or English today. Choose THREE events related to technology and/or English that you think were the most important to you and that the use of technology and/or English were vital in the events. Answer questions about those events in the following pages. (Note that you should not include events that are directly related to this research study, e.g., receiving emails about this study.)

Click "Continue" to go to the next page, and remember to click "submit" at the end of the last page to complete the log. You will then see a page that confirms your log submission.

Please make sure that the information you fill in the log is accurate and clear.

Your Profile

Answer the following questions about your background.

1. What is your name? _____

2. What is your email address? _____

3. What is your subject area? (Check one box.)
   - Chemistry
   - English
   - History
   - Life Sciences
   - Mathematics
   - Other: _____

4. What is the date of the events/activities you are recording now? (e.g., 5/23, Sunday) _____

Event One

Think about one event/activity related to technology that you feel was the most important to you today. (If you do not have any event related to technology to report, you can skip Event One.)

1. Give this event a short title (e.g. Online shopping, Chatting with a friend, etc.)
   _____

2. What did you do? (Describe briefly.)
   _____

3. What was your major reason? (If more than one, check all that apply.)
   - o Collaborating on a task
   - o Communicating with others
   - o Connecting to people I don't already know
   - o Entertainment
   - o Finding information
   - o Fulfilling a routine
   - o Improving skills
   - o Purchasing products
   - o Scheduling or planning
   - o School work
   - o Sharing information
   - o Social networking
   - o Solving a problem
   - o Other: _____

4. What language(s) did you use? (If more than one, check all that apply.)
   - o English
   - o Mandarin Chinese
   - o Taiwanese
   - o Other: _____

5. How did you use the language? By…(Check all that apply)
   - o Reading
   - o Writing
   - o Listening
   - o Speaking

6. What technology tool(s) did you use in this event? (Check all that apply.)
    - o Blog
    - o Discussion group
    - o Electronic transaction
    - o Email
    - o Instant message or text message
    - o Map (e.g., Google Maps)
    - o Office tools
    - o Online document collaboration tools (e.g., Google Docs)
    - o Photo sharing (e.g., Flickr)
    - o Podcast
    - o RSS feed
    - o Search engine
    - o Social bookmarking (e.g., delicious)
    - o Social networking
    - o Video/online games
    - o Video sharing (e.g., YouTube)
    - o Video/audio conferencing (e.g., Skype)
    - o Virtual community (e.g., Second Life)
    - o Website browsing
    - o Wiki (e.g., Wikipedia)
    - o Other: _____

7. What technology platform did you use in this event? (Check all that apply.)
    - o Cell phone
    - o Computer
    - o Digital audio recorder
    - o Digital music or video player (e.g., MP3 player or iPod)
    - o Digital reader (e.g., Kindle)
    - o Digital video camcorder
    - o Video gaming system
    - o Other: _____

8. Where did you do this activity?
    - o Book store
    - o Coffee/tea shop
    - o Shopping mall
    - o Home
    - o Library
    - o On the street
    - o School
    - o Other: _____

9. When did you do this activity?
    - o In class
    - o At work
    - o At free time
    - o Other: _____

10. Who did you want to connect to? (Check all that apply.)
    - o Family
    - o Teachers or staff in my university
    - o Friends I met in person (e.g. college or high school friends)
    - o Friends I met online
    - o Anyone who have the same interest as mine
    - o The general public
    - o No one other than myself (Skip to Q14)
    - o Other: _____

11. Where are the people you wanted to connect to?
    - o In Taipei
    - o In another city in Taiwan
    - o In another country
    - o I don't know

12. Did you successfully connect to the people you wanted to connect to?
    - o Yes
    - o No

13. If your answer to the previous question is "no", explain why. _____

14. Were you coincidentally connected to someone you did not expect to be in contact with?
    - o Yes. (Answer the following two questions.)
    - o No. (Skip the next two questions.)

15. Who were you coincidentally connected to?
    - o Family
    - o Teachers or staff in my university
    - o Friends I met in person (e.g. college or high school friends)
    - o Friends I met online
    - o Anyone who have the same interest as mine
    - o The general public
    - o Other: _____

16. Where are the people you were coincidentally connected to?
    - o In Taipei
    - o In another city in Taiwan
    - o In another country
    - o I don't know

17. Did this event help you reach a deeper understanding of new people or places that you did not know well before?
    - o Yes
    - o No

18. Is there anything else that you want to share regarding this event?
    _____

Event Two

Think about one event/activity related to English that you feel was the most important to you today. You can report any event in which you read or write or listen or speak English (even for a brief moment) for purposes meaningful to you. You can use more than one language in an event. (If you do not have any event related to English to report, you can skip Event Two.)

1. Give this event a short title (e.g. Online shopping, Chatting with a friend, etc.)
   _____

2. What did you do? (Describe briefly.)
   _____

3. What was your major reason? (If more than one, check all that apply.)
   - o Collaborating on a task
   - o Communicating with others
   - o Connecting to people I don't already know
   - o Entertainment
   - o Finding information
   - o Fulfilling a routine
   - o Improving skills
   - o Purchasing products
   - o Scheduling or planning
   - o School work
   - o Sharing information
   - o Social networking
   - o Solving a problem
   - o Other: _____

4. What language(s) did you use? (If more than one, check all that apply.)
    - o English
    - o Mandarin Chinese
    - o Taiwanese
    - o Other: _____

5. How did you use the language? By…(Check all that apply)
    - o Reading
    - o Writing
    - o Listening
    - o Speaking

6. What technology tool(s) did you use in this event? (Check all that apply.)
    - o Blog
    - o Discussion group
    - o Electronic transaction
    - o Email
    - o Instant message or text message
    - o Map (e.g., Google Maps)
    - o Office tools
    - o Online document collaboration tools (e.g., Google Docs)
    - o Photo sharing (e.g., Flickr)
    - o Podcast
    - o RSS feed
    - o Search engine
    - o Social bookmarking (e.g., delicious)
    - o Social networking
    - o Video/online games
    - o Video sharing (e.g., YouTube)
    - o Video/audio conferencing (e.g., Skype)
    - o Virtual community (e.g., Second Life)
    - o Website browsing
    - o Wiki (e.g., Wikipedia)
    - o Other: _____

7. What technology platform did you use in this event? (Check all that apply.)
    - o Cell phone
    - o Computer
    - o Digital audio recorder
    - o Digital music or video player (e.g., MP3 player or iPod)
    - o Digital reader (e.g., Kindle)
    - o Digital video camcorder
    - o Video gaming system
    - o Other: _____

8. Where did you do this activity?
    - o Book store
    - o Coffee/tea shop
    - o Shopping mall
    - o Home
    - o Library
    - o On the street
    - o School
    - o Other: _____

9. When did you do this activity?
    - o In class
    - o At work
    - o At free time
    - o Other: _____

10. Who did you want to connect to? (Check all that apply.)
    - o Family
    - o Teachers or staff in my university
    - o Friends I met in person (e.g. college or high school friends)
    - o Friends I met online
    - o Anyone who have the same interest as mine
    - o The general public
    - o No one other than myself (Skip to Q14)
    - o Other: _____

11. Where are the people you wanted to connect to?
    - o In Taipei
    - o In another city in Taiwan
    - o In another country
    - o I don't know

12. Did you successfully connect to the people you wanted to connect to?
    - o Yes
    - o No

13. If your answer to the previous question is "no", explain why. _____

14. Were you coincidentally connected to someone you did not expect to be in contact with?
    - o Yes. (Answer the following two questions.)
    - o No. (Skip the next two questions.)

15. Who were you coincidentally connected to?
    - o Family
    - o Teachers or staff in my university
    - o Friends I met in person (e.g. college or high school friends)
    - o Friends I met online
    - o Anyone who have the same interest as mine
    - o The general public
    - o Other: _____

16. Where are the people you were coincidentally connected to?
    - o In Taipei
    - o In another city in Taiwan
    - o In another country
    - o I don't know

17. Did this event help you reach a deeper understanding of new people or places that you did not know well before?
    - o Yes
    - o No

18. Is there anything else that you want to share regarding this event?
    _____

Event Three

Think about one event/activity related to technology and/or English that is different from Event One or Two. (If you do not have any event related to technology or English to report, you can skip Event Three.)

1. Give this event a short title (e.g. Online shopping, Chatting with a friend, etc.)
   _____

2. What did you do? (Describe briefly.)
   _____

3. What was your major reason? (If more than one, check all that apply.)
    - o Collaborating on a task
    - o Communicating with others
    - o Connecting to people I don't already know
    - o Entertainment
    - o Finding information
    - o Fulfilling a routine
    - o Improving skills
    - o Purchasing products
    - o Scheduling or planning
    - o School work
    - o Sharing information
    - o Social networking
    - o Solving a problem
    - o Other: _____

4. What language(s) did you use? (If more than one, check all that apply.)
    - o English
    - o Mandarin Chinese
    - o Taiwanese
    - o Other: _____

5. How did you use the language? By…(Check all that apply)
    - o Reading
    - o Writing
    - o Listening
    - o Speaking

6. What technology tool(s) did you use in this event? (Check all that apply.)
    - o Blog
    - o Discussion group
    - o Electronic transaction
    - o Email
    - o Instant message or text message
    - o Map (e.g., Google Maps)
    - o Office tools
    - o Online document collaboration tools (e.g., Google Docs)
    - o Photo sharing (e.g., Flickr)
    - o Podcast
    - o RSS feed
    - o Search engine
    - o Social bookmarking (e.g., delicious)
    - o Social networking
    - o Video/online games
    - o Video sharing (e.g., YouTube)
    - o Video/audio conferencing (e.g., Skype)

- o Virtual community (e.g., Second Life)
- o Website browsing
- o Wiki (e.g., Wikipedia)
- o Other: _____

7. What technology platform did you use in this event? (Check all that apply.)
   - o Cell phone
   - o Computer
   - o Digital audio recorder
   - o Digital music or video player (e.g., MP3 player or iPod)
   - o Digital reader (e.g., Kindle)
   - o Digital video camcorder
   - o Video gaming system
   - o Other: _____

8. Where did you do this activity?
   - o Book store
   - o Coffee/tea shop
   - o Shopping mall
   - o Home
   - o Library
   - o On the street
   - o School
   - o Other: _____

9. When did you do this activity?
   - o In class
   - o At work
   - o At free time
   - o Other: _____

10. Who did you want to connect to? (Check all that apply.)
    - o Family
    - o Teachers or staff in my university
    - o Friends I met in person (e.g. college or high school friends)
    - o Friends I met online
    - o Anyone who have the same interest as mine
    - o The general public
    - o No one other than myself (Skip to Q14)
    - o Other: _____

11. Where are the people you wanted to connect to?
    - o In Taipei
    - o In another city in Taiwan
    - o In another country
    - o I don't know

12. Did you successfully connect to the people you wanted to connect to?
    - o Yes
    - o No

13. If your answer to the previous question is "no", explain why. _____

14. Were you coincidentally connected to someone you did not expect to be in contact with?
    - o Yes. (Answer the following two questions.)
    - o No. (Skip the next two questions.)

15. Who were you coincidentally connected to?
    - o Family
    - o Teachers or staff in my university
    - o Friends I met in person (e.g. college or high school friends)
    - o Friends I met online
    - o Anyone who have the same interest as mine
    - o The general public
    - o Other: _____

16. Where are the people you were coincidentally connected to?
    - o In Taipei
    - o In another city in Taiwan
    - o In another country
    - o I don't know

17. Did this event help you reach a deeper understanding of new people or places that you did not know well before?
    - o Yes
    - o No

18. Is there anything else that you want to share regarding this event?
    _____

Appendix C: Consent to Participate in the Dissertation Study

Life in the 21st Century:
A Study of Pre-service Teachers' Uses of Technology and English

Principal Investigator: Yung-Hui Chien, Ph.D. Candidate, School of Education, University of Michigan

Faculty Advisor: Donald Freeman, Associate Professor, School of Education, University of Michigan

You are invited to participate in a research study that looks at the ways pre-service teachers in Taiwan use technology and English in their daily lives. The purpose of this study is to understand how the new generation of pre-service teachers uses technology and English for social and educational purposes in the age of globalization. The research results will be used to derive useful implications for teacher education design.

If you agree to be part of the research study, you will be asked to fill out a questionnaire and complete a two-week web log of your daily activities related to technology and English uses.

You will directly benefit from being in this study because the study will raise your awareness of your technology and English abilities, which will be very useful to you when you apply for a job after graduation. There will be minimal risk associated with this study because the topic is not sensitive.

Participating in this study is completely voluntary. Even if you decide to participate now, you may change your mind and stop at any time.

If you have questions about this research study, you may contact Yung-Hui Chien (yhchien@umich.edu), University of Michigan, School of Education, 610 E. University Ave., Rm 1228, Ann Arbor, MI 48109.

By signing this document, you are agreeing to be in the study. You will be given a copy of this document for your records and one copy will be kept with the study records. Be sure that questions you have about the study have been answered and that you understand what you are being asked to do. You may contact the researcher if you think of a question later.

I agree to participate in the first phase of the study - ***Questionnaire***.

_____ _____

Signature Date

I agree to participate in the second phase of the study - ***Web Log***.

_____ _____

Signature Date

Primary email: _____

(Send the web log link to this email account.)

Secondary email: _____

(Send the web log link here if the primary one fails.)

Cell phone: _____

(Text the web log link to this number if all emails fail.)

Bibliography

104 Corporation (2008). 上班族英文破！ Retrieved March 8, 2012, from http://www.104.com.tw/cfdocs/2000/pressroom/104news970723_2.htm

Anderson, P. (2007). *What is Web 2.0? Ideas, technologies and implications for education*. Bristol, England: Joint Information Systems Committee.

Baker, S., Resch, I., Carlisle, K., & Schmidt, K. A. (2001). The great English divide. *Bloomberg Businessweek*. Retrieved from http://www.businessweek.com/magazine/content/01_33/b3745009.htm

Beck, U. (2000). *What is globalization?* Malden, MA: Blackwell Publishers Inc.

Berends, M. (2006). Survey methods in educational research. In J. L. Green, G. Camilli & P. B. Elmore (Eds.), *Handbook of complementary methods in educaiton research* (pp. 623-640). Mahwah, New Jersey: Lawrence Erlbaum Associates, Inc.

Birchler, U., & Bütler, M. (2007). *Information economics*. New York, NY: Routledge.

Butler, Y. G. (2004). What level of English proficiency do elementary school teachers need to attain to teach EFL? Case studies from Korea, Taiwan, and Japan. *TESOL Quarterly, 38*(2), 245-278.

Castells, M. (2000). *The rise of the network society*. Oxford ; Malden, MA: Blackwell Publishers.

Castells, M. (2004). Informationalism, networks, and the network society: a theoretical blueprint. In M. Castells (Ed.), *The network society: a cross-cultural perspective* (pp. 3-45). Cheltenham, UK / Northampton, MA: Edward Elgar Publishing.

Castells, M. (2006). The network society: from knowledge to policy. In M. Castells & G. Cardoso (Eds.), *The network society: From knowledge to policy* (pp. 3-21). Washington, DC: Center for Transatlantic Relations, Johns Hopkins University.

Chen, C.-C. (2005, June 23-29). *Going digital: Taiwan experiences.* Paper presented at the American Library Association Annual Conference, Chicago, IL.

Chen, C.-H. (2008). Why do teachers not practice what they believe regarding technology integration? *The Journal of Educational Research, 102*(1), 65-75.

Chen, Y.-L. (2008a). A mixed-method study of EFL teachers' internet use in language instruction. *Teaching and Teacher Education: An International Journal of Research and Studies, 24*(4), 1015-1028.

Chen, Y.-L. (2008b). Modeling the determinants of internet use. *Computers & Education, 51*(2), 545-558.

Council for Economic Planning and Development (2002). *Challenge 2008--National development plan: English summary*. Taipei: Executive Yuan.

Council of Europe (2001). *Common European framework of reference for languages: Learning, teaching and assessment*. Cambridge: Cambridge University Press.

Creswell, J. W. (2009). *Research design: Qualitative, quantitative, and mixed methods approaches* (3rd ed.). Thousand Oask, California: SAGE Publications, Inc.

Crystal, D. (2003). *English as a global language* (2nd ed.). Cambridge: Cambridge University Press.
Crystal, D. (2006). English worldwide. In R. Hogg & D. Denison (Eds.), *A history of the English language* (pp. 420-439). Cambridge: Cambridge University Press.
Cullen, R. (2001, August 16-25). *Addressing the digital divide.* Paper presented at the 67th IFLA Council and General Conference, Boston, MA.
de Segovia, L. P., & Hardison, D. M. (2009). Implementing education reform: EFL teachers' perspectives. *ELT Journal, 63*(2), 154-162.
Educational Testing Service (2012). The TOEFL test: Your passport to study abroad. Retrieved March 28, 2012, from http://www.ets.org/toefl
Gan, Z. (2009). IELTS preparation course and student IELTS performance: A case study in Hong Kong. *RELC Journal: A Journal of Language Teaching and Research, 40*(1), 23-41.
Gee, J. P. (1986). Orality and literacy: From the savage mind to ways with words. *TESOL Quarterly, 20*(4), 719-746.
Gee, J. P. (2001). A sociocultural perspective on early literacy development. In S. B. Neuman & D. Dickinson (Eds.), *Handbook of early literacy research* (Vol. 1, pp. 30-42). New York: Guilford.
Giddens, A. (1990). *The consequences of modernity*. Cambridge: Polity Press.
Giddens, A. (2000). *Runaway world: how globalization is reshaping our lives* (2nd ed.). New York, NY: Routledge.
Goody, J. (1977). *The domestication of the savage mind*. Cambridge: Cambridge University Press.
Graddol, D. (1997). *The future of English?* London: British Council.
Graddol, D. (2006). *English next*. London: British Council.
Graves, K. (2008). The language curriculum: A social contextual perspective. *Language Teaching, 41*(02), 147-181.
Guillén, M. F., & Suárez, S. L. (2005). Explaining the global digital divide: Economic, political and sociological drivers of cross-national Internet use. *Social Forces, 84*(2), 681-708.
Hargittai, E. (2010). Digital na(t)ives? Variation in internet skills and uses among members of the ‘‘net generation’’. *Sociological Inquiry, 80*(1), 92-113.
Hargittai, E., & Hinnant, A. (2008). Digital inequality : Differences in young adults' use of the internet. *Communication Research, 35*(5), 602-621.
Harper, V. (2003). The digital divide (DD): A reconceptualization for educators. *Educational Technology Review, 11*(1).
Havelock, E. A. (1963). *Preface to plato*. MA: Harvard University Press.
Hole-in-the-Wall Education Limited (2011). Hole-in-the-wall: Lighting the spark of learning. Retrieved April 10, 2012, from http://www.hole-in-the-wall.com/
Hu, G., & McKay, S. L. (2012). English language education in East Asia: Some recent developments. *Journal of Multilingual and Multicultural Development*, 1-18. doi:10.1080/01434632.2012.661434
IELTS (2012). IELTS: The world speaks IELTS. Retrieved March 28, 2012, from http://www.ielts.org/default.aspx
Jenkins, J. (2006). Current perspectives on teaching world Englishes and English as a lingua franca. *TESOL Quarterly, 40*(1), 157-181.

Kachru, B. (1985). Standards, codification and sociolinguistic realism: the English language in the outer circle. In R. Quirk & H. G. Widdowson (Eds.), *English in the world: Teaching and learning the language and literatures* (pp. 11-30). Cambridge: Cambridge University Press.

Kang, H.-k. (2008). New administration struggling to tackle English divide. *The Korea Times*. Retrieved from http://www.koreatimes.co.kr/www/news/nation/2012/03/113_17811.html

Ku, H., & Zussman, A. (2010). Lingua franca: The role of English in international trade. *Journal of Economic Behavior & Organization, 75*(2), 250-260.

Larsen-Freeman, D. (2010). Having and doing: Learning from a complexity theory perspective. In P. Seedhouse, S. Walsh & C. Jenks (Eds.), *Conceptualising learning in applied linguistics* (pp. 52-68). Hampshire, England: Palgrave Macmillan.

Larsen-Freeman, D., & Cameron, L. (2008). *Complex systems and applied linguistics*. Oxford: Oxford University Press.

Larsen-Freeman, D., & Freeman, D. (2008). Language moves: The place of "foreign" languages in classroom teaching and learning. *Review of Research in Education, 32*(1), 147-186.

Lei, J. (2009). Digital natives as preservice teachers: What technology preparation is needed? *Journal of Computing in Teacher Education, 25*(3), 87-97.

Leu, D. J., & Kinzer, C. K. (2000). The convergence of literacy instruction with networked technologies. *Reading Research Quarterly, 35*, 108-127.

Leu, D. J., Kinzer, C. K., Coiro, J. L., & Cammack, D. W. (2004). Toward a theory of new literacies emerging from the internet and other information and communication technologies. In R. B. Ruddell & N. J. Unrau (Eds.), *Theoretical models and processes of reading* (5th ed., pp. 1570-1613). Neward, DE: International Reading Association.

Liang, J.-C., & Tsai, C.-C. (2008). Internet self-efficacy and preferences toward constructivist Internet-based learning environments: A study of pre-school teachers in Taiwan. *Educational Technology & Society, 11*(1), 226-237.

Lievrouw, L. A., & Farb, S. E. (2003). Information and equity. *Annual Review of Information Science and Technology (ARIST), 37*, 499-540.

Light, J. S. (2001). Rethinking the digital divide. *Harvard Educational Review, 71*(4), 709-733.

Lu, M.-T. (2001). Digital divide in developing countries. *Journal of Global Information Technology Management, 4*(3), 1-4.

Luke, A., & Luke, C. (2000). A situated perspective on cultural globalization. In N. Burbules & C. Torres (Eds.), *Globalization and education: Critical perspectives* (pp. 275-297). New York: Routledge.

Mathews, J. A., & Cho, D.-S. (2007). *Tiger Technology: The Creation of a Semiconductor Industry in East Asia*. Cambridge, UK: Cambridge University Press.

Mathison, S. (1988). Why triangulate? *Educational Researcher, 17*(2), 13-17.

Miniwatts Marketing Group (2012). Internet world stats: Usage and population statistics. Retrieved May 11, 2012, from http://www.internetworldstats.com/

Minsky, M. (1988). *The society of mind*. New York, NY: Simon & Schuster.

National Education Examinations Authority (2012). Public English test system (PETS). Retrieved March 28, 2012, from http://sk.neea.edu.cn/yydjks/index.jsp
National Taiwan Normal Univeristy Office of the Secretariat (2012). About NTNU. Retrieved May 16, 2012, from http://www.ntnu.edu.tw/scr/about.html
National Telecommunications and Information Administration (1995). *Falling through the net: A survey of the "have nots" in rural and urban America*. Washington, DC: U.S. Department of Commerce.
National Telecommunications and Information Administration (1998). *Falling through the net II: New data on the digital divide*. Washington, DC: U.S. Department of Commerce.
National Telecommunications and Information Administration (1999). *Falling through the net: Defining the digital divide. A report on the telecommunications and information technology gap in America. Revised*. Washington, DC: U.S. Department of Commerce.
National Telecommunications and Information Administration (2000). *Falling through the net: Toward digital inclusion. A report on Americans' access to technology tools*. Washington, DC: U.S. Department of Commerce.
New London Group (1996). A pedagogy of multiliteracies: Designing social futures. *Harvard Educational Review, 66*, 60-92.
Nunan, D. (2003). The impact of English as a global language on educational policies and practices in the Asia-Pacific region *TESOL Quarterly, 73*(4), 589-613.
O'Neill, E. T., Lavoie, B. F., & Bennett, R. (2003). Trends in the evolution of the public web: 1998-2002. *D-Lib Magazine, 9*(4). Retrieved from http://www.dlib.org/dlib/april03/lavoie/04lavoie.html
OLPC Foundation (2012). One laptop per child. Retrieved April 10, 2012, from http://laptop.org/en/index.shtml
Palincsar, A. S., & Dalton, B. (2005). Speaking literacy and learning to technology; Speaking technology to literacy and learning. In B. Maloch, J. Hoffman, D. Schallert, C. Fairbanks & J. Worthy (Eds.), *Invited annual research address, 54th Yearbook of the National Reading Conference* (pp. 83-102). Oak Creek, WI: National Reading Conference, Inc.
Palincsar, A. S., & Ladewski, B. G. (2006). Literacy and the learning sciences. In K. Sawyer (Ed.), *Handbook of the learning sciences* (pp. 299-317). New York: Cambridge University Press.
Pan, Y.-C. (2009). Test impact: English certification exit requirements in Taiwan. *TEFLIN Journal, 20*(2), 119-139.
Prensky, M. (2001). Digital natives, digital immigrants. *On the Horizon, 9*(5), 1-6.
Punch, K. F. (2005). *Introduction to social research: Quantitative and qualitative approaches* (2nd ed.). Thousand Oaks, California: SAGE Publications Ltd.
Reese, W. (2005). *America's public schools: from the common school ot "No Child Left Behind"*. Baltimore: The John Hopkins University Press.
Rogers, P. S. (1998). National agendas and the English divide. *Business Communication Quarterly, 61*(3), 79-85.
Rowan, B., & Correnti, R. (2009). Studying reading instruction with teacher logs: Lessons from the study of instructional improvement. *Educational Researcher, 38*, 120-131.

Salpeter, J. (2006). Inside the divide: Despite progress, it's still a tale of missed connections. *Technology & Learning, 26*(8), 22.

Schleppegrell, M. J. (2004). *The language of schooling*. Mahwah, NJ: Lawrence Erlbaum.

Seidlhofer, B. (2004). Research perspectives on teaching English as a lingua franca. *Annual Review of Applied Linguistics, 24*, 209-239.

Seidlhofer, B. (2005). Key concepts in ELT: English as a lingua franca. *ELT Journal, 59*(4), 339-341.

Sfard, A. (1998). On two metaphors for learning and the dangers of choosing just one. *Educational Researcher, 27*(2), 4-13.

Sirgy, M. J., Lee, D.-J., Miller, C., & Littlefield, J. E. (2004). The impact of globalization on a country's quality of life: Toward an integrated model. *Social Indicators Research, 68*(3), 251.

Sirgy, M. J., Lee, D.-J., Miller, C., Littlefield, J. E., & Atay, E. G. (2007). The impact of imports and exports on a country's quality of life. *Social Indicators Research, 83*(2), 245-281.

Smith, M. L. (2006). Multiple methodology in education research. In J. L. Green, G. Camilli & P. B. Elmore (Eds.), *Handbook of complementary methods in educaiton research* (pp. 457-475). Mahwah, New Jersey: Lawrence Erlbaum Associates, Inc.

Taiwan Ministry of Education (2012a). 教育部全球資訊網. Retrieved May 11, 2012, from http://www.edu.tw/index.aspx

Taiwan Ministry of Education (2012b). 教育部高級中等以下學校及幼稚園教師資格檢定考試網站. Retrieved January 26, 2012, from http://tqa.ntue.edu.tw/

The Language Training and Testing Center (2012). GEPT: The general English proficiency test. Retrieved March 28, 2012, from http://www.lttc.ntu.edu.tw/E_LTTC/E_GEPT.htm

The Society for Testing English Proficiency (2012). EIKEN: Test in practical English proficiency. Retrieved March 28, 2012, from http://stepeiken.org/

Tiene, D. (2002). Addressing the global digital divide and its impact on educational opportunity. *Educational Media International, 39*(3-4), 211-222.

Tiene, D. (2004). Bridging the digital divide in the schools of developing countries. *International Journal of Instructional Media, 31*(1), 89.

Tsai, Y., & Tsou, C.-H. (2009). A standardised English language proficiency test as the graduation benchmark: Student perspectives on its application in higher education. *Assessment in Education: Principles, Policy & Practice, 16*(3), 319-330.

United Nations Development Programme (2001). *Human development report 2001: Making new technologies work for human development*. New York, NY: United Nations.

van Dijk, J., & Hacker, K. (2003). The digital divide as a complex and dynamic phenomenon. *The Information Society, 19*(4), 315-326.

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.

Warschauer, M. (2000). The changing global economy and the future of English teaching. *TESOL Quarterly, 34*(3), 511-535.

Warschauer, M. (2003). Dissecting the "digital divide": A case study in Egypt. *Information Society, 19*(4), 297-304.
Warschauer, M. (in press). A literacy approach to the digital divide. In M. A. Pereyra (Ed.), *Las mulialfabetizaciones en el espacio digital* Malaga, Spain: Ediciones Aljibe.
Wertsch, J. V. (1995). The need for action in sociocultural research. In J. V. Wertsch, P. d. Rio & A. Alvarez (Eds.), *Sociocultural studies of mind* (pp. 56-74). Cambridge ; New York, NY, USA: Cambridge University Press.
Widdowson, H. G. (1997). EIL, ESL, EFL: Global issues and local interests. *World Englishes, 16*(1), 135-146.
Wright, K. B. (2005). Researching internet-based populations: Advantages and disadvantages of online survey research, online questionnaire authoring software packages, and web survey services. *Journal of Computer-Mediated Communication, 10*(3), 00.
Wright, P. S., Horn, S. P., & Sanders, W. L. (1997). Teacher and classroom context effects on student achievement: Implications for teacher evaluation. *Journal of Personnel Evaluation in Education, 11*, 57-67.
Yusuf, S. (2003). *Innovative East Asia: The future of growth*. Washington, DC: The World Bank.
Zheng, Y., & Cheng, L. (2008). College English test (CET) in China. *Language Testing, 25*(3), 408-417.