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By

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ABSTRACT

TECHNOLOGY USES IN CREATING SECOND LANGUAGE LEARNING ENVIORNMENTS: WHEN LEARNERS ARE CREATORS

By

Gaoming Zhang

From a learner-as-creator perspective, this study investigates how second language learners use technology, especially computers and the Internet, to construct their language learning environments. This study also attempts to identify factors that affected the frequency of technology by second language learners. Participants were 102 Chinese university freshmen who had been learning English as a second language.

Results suggest that in spite of the great potentials of technology in constructing an optimal language learning environment, technology use was not optimal when learners created their own language environments. Second language learners used technology mainly to get language input. Technology was hardly used for opportunities for language use or receiving feedback. Social factors such as the average English proficiency of all the peers in the learner's social network were found to be associated with both the frequency of technology use in second language learning and whether or not a learner used technology to learn English with a certain peer.

Results of this study have both theoretical and practical implications. Results from this study shed light on the gap between the potentials and affordances of technology in second language learning as claimed by a large body of literature and the reality of implementation by learners. The findings of the study indicate the great need to focus more on how learners use technology in their own learning. This study also found that

social network factors such as the average English proficiency of all the peers in the learner's social network influence whether or not the learner used technology to learn English. Specific implications for English learning are provided

DEDICATION

This is dedicated to my family:

My mother, Xiaoling Liu, and sister, Gaoying Zhang,

whose love, support over the years led me to achieve this goal.

My husband, Zhiyi Bao,

for his constant support, encouragement, and love.

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CHAPTER 1

INTRODUCTION

Technology holds great potential for facilitating second language learning. However, the effect of technology in second language learning has not been completely explored and needs to be further examined. This study focused on how students use technology to support their language learning. Specifically this study explored how various technologies, particularly the Internet and computer technologies, were used by second language learners to facilitate their English learning. The study also examined factors that influenced learners' use of technologies in their second language learning.

Statement of the Problem

The broad picture of second and foreign language education seems to be filled with failures. This widespread failure is evidenced by learners' low proficiency of the target language after years of instruction (Collier, 1987; Collier & Thomas, 1988; Cummins, 1981; Jaworski, 1994; Lai, 1994; Wang, 2005). For example, very few language majors in American universities and colleges get even halfway to the level of "minimal professional proficiency" (Diller, 1978). The failure of second language learning seems to be universal. In China, where millions of students are required to learn English as a foreign language since their elementary years, most English language learners have very low language proficiency (Wang, 2005). The task of learning a second or foreign language is widely considered challenging, not only to English, but also to hundreds of languages that are learned as a foreign language across the world.

Recently the need to respond to this widespread failure has become more urgent because the demand for second language education has greatly increased. For example, there are now over one billion people learning English as a second language[1] (ESL) world wide (Economist, 2001). The number of English learning students enrolled in public schools in the U.S. has significantly increased (Capps et al., 2005). According the Census 2000 in the United States, approximately one out of every five children is learning English as a second language.

Having recognized the widespread failure in second and foreign language education, educators and researchers have been working hard to explore different approaches to second language learning. One such approach is to create "optimal" language learning environments (Egbert, Chao, & Hanson-Smith, 1999; Ellis, 1985, 2005). An optimal language learning environment is believed to provide resources and opportunities so as to create three conditions deemed essential for effective language learning: comprehensible and rich language input (Cobb & Stevens, 1996; S. Krashen, 1981; S. Krashen, 1994), ample opportunities for practice (Gass & Selinker, 1994; Lantolf, 2000; Lightbown & Spada, 1999; Pica, 1996; Swain, 1985; Van Lier, 1996), and high quality feedback (Bangert-Drowns, Kulik, Kulik, & Morgan, 1991; Kulik & Kulik, 1988; Lysakowski & Walberg, 1982).

Technology is believed to have great potential for creating optimal language learning environments because it can provide the aforementioned three conditions (Al-Seghayek, 2001; Beauvois, 1997; Bernstein, Najmi, & Ehsani, 1999; Cahill & Catanzaro, 1997; Chun & Plass, 1996; Egan, 1999; Harless, Zier, & Duncan, 1999; Hulstin,

[1] In this paper, the terms foreign language (FL) and second language (L2) are used interchangeably to refer to an unfamiliar language unless specified otherwise specified.

Hollander, & Greidanus, 1996; Kelm, 1998; Knight, 1994; LaRocca, Morgan, & Bellinger, 1999; Laufer & Hill, 2000; Meskill, Mossop, Bates, & 1998; Salaberry, 2001; Stannard, 2006; Wachowicz & Scott, 1999; Warschauer, 1998). For example, tape recorders, films, and television have been used to provide enhanced authentic input. Computer-mediated-communication technologies have been employed to engage the learner in authentic practices. Computers have also been used to improve opportunities for quality feedback.

The potentials of technology for second language learning may also have impact on how an optimal language learning environment can be designed and created. Traditionally, optimal language environments have often been designed by the instructor. This is quite understandable given the fact that until very recently technology resources had been scarce, often only available in formal instructional settings on a very limited basis. In recent years, the rapid spread of the Internet and computer technologies has made it possible for individual learners to have access to a variety of technologies that are even more powerful than what instructors could access previously. For example, foreign language students today can watch authentic TV broadcasts in the target language, interact with native speakers via computer-mediated communication, and use a wide range of software for practices. As a result, individual learners have the potential to design their optimal language learning environment by combining available resources.

In theory, with today's technology, anyone can create their optimal language learning environment and learn a foreign language successfully because they now have access to rich materials for input, a wide range of opportunities to engage in different types of practices, and flexible mechanisms for feedback.

A learner-designed environment is more desirable than that was designed by others for at least two reasons. First, self-designed learning environment provides more opportunities for individualized learning compared with a uniform environment designed by the instructor for all students in one class, a self-designed environment is more likely to serve students' individual needs. The learner can combine his personal interests and learning styles when designing his learning environment. He can also personalize his language learning environment according to his schedules. Second, creating a self-designed environment is an active and constructive process, which may facilitate the learner's self-control capacity. The learner needs to first set goals for his learning, and then attempt to monitor, regulate, and control his cognition and behavior in the whole process. Some researchers have stressed that such self-control capacity is essential for learners to learn effectively in hypermedia environments (Azevedo & Cromley, 2004; Azevedo, Ruthries, & Seibert, 2004; Greene & Land, 2000; Hill & Hannafin, 1997).

However, how learner use technology to create their second language learning environment is understudied. Although there is a large body of literature on affordances of technology in creating the three critical conditions in second language learning, there is little research on how technology is used by second language learners in creating their language learning environments. For example, what technology applications are most/least frequently used by second language learners? When second language learners use technology in their learning, which language conditions are created?

Objectives of the Study

The objective of this study is to understand how learners used technology, especially newer technology (i.e., computers and the Internet technology), to create their

second language learning environments. Participants of the study were college freshmen in a Chinese university. This study also set out to identify factors that affect their technology use in second language learning.

The research questions that are addressed in this study are:

1. How do students use technology in their second language learning?

   The focus of this research question is to report what technology applications were used by ESL learners when creating their language learning environment, i.e., what technology-enhanced resources were selected and used by students. Please note that while this study has a focus on ESL learners' use of newer technology, i.e., computers and the Internet technology, this study doesn't exclude technology that was introduced in second language learning at an earlier time, such as radio and audio-books.

2. What are the factors that influence English language learners' use of technology in their English learning?

   Factors are explored from three aspects. The first aspect relates to factors in individual differences of English learning that have been investigated in traditional learning environments in the literature on second language learning. Factors from this aspect include English learning motivation, English learning strategies. Factors from the second aspect include technology access, technology proficiency, attitudes towards technology uses. The third area involves social networking factors, including social desire, social access, and English proficiency in the network.

Second, what are the factors that influence whether or not a learner uses technology to learn English with a certain person in his social network? According to social networking theories, a learner (i.e., participants in this study) is viewed as the core of his social network and is named as "ego". The persons in the ego-centered network are referred as "alters". Usually the ego is asked to nominate alters in his social network. To understand whether or not an ego used technology to learn English with an alter in his network, variables at two levels were investigated, i.e., the level of the alter and the level of the ego/network. Variables at the level of alters were social access to the alter and social desire to build and maintain friendship with the alter. Variables at the level of ego/network included the average English proficiency of all alters in the learner-centered social network, the ego's English learning strategies and motivation.

Answers to these two questions are of great theoretical and practice significance for a number reasons. Answers to the first question involve how technology is currently used by ESL learners in general. These answers are important for two reasons. First, it is important to know how ESL learners use technology since technology use in second language learning is believed to be a significant factor for learners' language experiences (Al-Seghayek, 2001; Beauvois, 1997; Bernstein et al., 1999; Cahill & Catanzaro, 1997; Chun & Plass, 1996; Egan, 1999; Harless et al., 1999; Hulstin et al., 1996; Kelm, 1998; Knight, 1994; LaRocca et al., 1999; Laufer & Hill, 2000; Meskill et al., 1998; Salaberry, 2001; Stannard, 2006; Wachowicz & Scott, 1999; Warschauer, 1998). Secondly, answers to these two questions could also illustrate and may explain individual differences of technology uses by ESL learners. By looking at individual differences in technology uses

among ESL learners, this study takes a new perspective on technology uses. This new perspective assumes that learners are active agents in selecting and using technology. In other words, learners make their decisions regarding whether to use technology in their English learning, what to use, and how to use them. Here learners are not longer viewed as passive recipients of teachers' decisions about language environments or users of the language learning environment that is traditionally created by instructors. Instead, learners are empowered with the autonomy of selecting language resources and creating their own language learning environment.

Answers to these two questions also have practice significance in that they could provide implications about how to help learners to use technology to optimize their language learning. Specifically, answers to the first question could tell us the least used technology by ESL learners. Teachers could introduce these technology applications to students and maybe demonstrate how these applications could be used in English learning. For the technologies that learners considered technically challenging, additional technology assistance should be provided as well. Answers to the second question would help educators to identify factors that influence ESL learners' technology uses. Teachers could provide assistance and training for those identified factors in order to help learners to facilitate their English learning.

CHAPTER 2

REVIEW OF THE LITERATURE

Although technology holds great potential for facilitating second language (L2) learning, such potentials can only be realized when technology is actually used by learners. To what extent and in what ways language learners use technology ultimately determine the effects of technology. Thus a good understanding of the extent and ways learners use technology is of great significance for both theoretical and practical purposes. This chapter reviews relevant literature on the potential of technology and technology uses in language education.

The Potential of Technology for Creating an Optimal Language Learning Environment (OLLE)

Language educators and researchers have been working on defining optimal language learning environments for a long time. Despite some disagreement about the specifics of an optimal environment, both research and practice suggest that an OLLE consists of at least the following three conditions (Doughty & Long, 2003; Yong Zhao, 2005): 1) high quality language input; 2) opportunities for language use; and 3) high quality feedback. Technology has shown its facilitative role in creating an OLLE since it can provide the three critical conditions in an OLLE. In each of the following subsections, a critical condition in an OLLE is introduced, followed by a review of the contributions that technology can make to create this condition.

Three Conditions in an Optimal Language Learning Environment (OLLE)

Condition 1: Language Input

Successful language learning requires the learner to have access to sufficient high-quality language input. The importance of sufficient high-quality input is now unchallenged across theories on first language (L1) and L2 learning, and across various perspectives on second language learning. In L1 learning, a vast body of literature on emergent literacy has confirmed the critical value of access to language input at home (Bissex, 1980; Heath, 1983; Scollon & Scollon, 1981; Taylor, 1982; Taylor & Dorsey-Gaines, 1988) and in school (Dyson, 1984, 1989; Purcell-Gates & Dahl, 1991). Both the amount and the quality of input that the learner receives are found related to how fast the learner acquires the target language (Ellis & Wells, 1980).

The importance of input is not only validated in early literacy development in L1 learning, but also well recognized in L2 learning. First proposed by Krashen (1981; 1994), the Input Hypothesis stresses the central role of language input in L2 learning. According to Krashen, second languages are acquired "by understanding messages, or by receiving 'comprehensible input' (S. Krashen, 1985, p. 2). Although scholars may have different interpretations of the exact meaning of Krashen's hypothesis (Ellis, 1985; McLaughlin, 1987), few would argue that the learner must be exposed to the target language in order to learn it.

But the input for second language learners must be of high-quality. Comprehensibility and richness are viewed as two main features of high-quality second language input.

Comprehensibility of language input. Krashen defines comprehensible input as language that is heard and/or read and that is slightly above a learner's current language level. Krashen labeled a learner's current language knowledge level as "*i*" and the next stage as *i* +1. Krashen suggests that the most appropriate language input should be at *i* +1 level. Language levels below the level *i* are inappropriate since language at these levels is already known to learners and would serve no purpose of language learning. On the other hand, language containing forms that are far in advance of students' current level cannot become students' intake and therefore does not help students' language learning either.

There are multiple approaches to making language input comprehensible to learners. One approach is to alter or simplify language input. Simplified input usually uses less advanced language mechanisms, such as shorter sentences, slower speech rate (Zhao, 1997), more frequently used words, less advanced sentence structures (Hatch, 1978; D. Larsen-Freeman & Long, 1991) and so on. Another approach to increasing the comprehensibility of language input is providing language assistance such as dictionaries and/or glosses. Watanabe (1997) found that learners with access to marginal glosses of unknown words during their reading achieve a higher word retention rate than their peers who do not have such an access during their reading. Other studies suggest that glosses (i.e., providing meaning of unknown words on paper margins) in multiple modes are effective, such as pictorial glosses (C. Kost, Foss, & Lenzini, 1999), simultaneous presentation of acoustic and visual information (Mayer & Moreno, 1998; Neuman & Koskinen, 1992).

Richness of language input. The importance of the amount of language input is also well recognized. In practice, policy makers have attempted to increase learners'

literacy competency by offering more reading materials and books (Neuman, 1999). Some of the well known national programs are Book Floods and Books Aloud. In the mean time, research literature suggests strong correlations between the amount of a learner' language experience and his language development in general and vocabulary development in particular (Cunningham, 2005; Huttenlocher, Vasilyeva, Cymerman, & Levine, 2001; Naigles & Hoff-Ginsberg, 1995; Pearson, Fernandex, Lewedeg, & Oller, 1997). There are a number of potential explanations for this association. First, when learners are exposed to rich language input, they are more likely to encounter unknown words in a variety of contexts, which may lead to more incidental learning and then a higher word recognition rate (Sternberg, 1987). Another reason for the correlation between the amount of reading and literacy capacity is that voluntary reading may bring more personal interests into reading and may enable readers to reach a higher level of reading competency (Fink, 1995-1996). Without voluntary reading, learners may even lose what they have learned (R. Anderson, Wilson, & Fielding, 1988; Mullis, Campbell, & Farstrup, 1993; Stanovich, 1986).

Lastly, the need for rich language experiences is more urgent in L2 learning due to the limited ESL instruction hours in schools, especially when compared to the instruction hours for L1. For example, children in the typical South Pacific family are exposed to over 40,000 hours of L1 by the end of six years of schooling. In contrast, ESL learners receives less than 3,000 hours of English instruction in a total of six years of schooling (Elley & Mangubhai, 1983).

Condition 2: Opportunity to Use the Language

In addition to high-quality language input, language learners must have sufficient opportunities to use that which they have been exposed to (Gass & Selinker, 1994) and to use the language to interact with others (Lantolf, 2000; Lightbown & Spada, 1999; Pica, 1996; Van Lier, 1996).

The importance of language use in second language learning stems from the findings that learners have trouble attaining native-like fluency even if they were exposed to rich comprehensible language input (Swain, 1985). Swain (1985) studied six-grade students in a French immersion program, who received comprehensive language input in the program but had very limited "comprehensive output." According to the results of the study, these learners achieved performance similar to native speakers on only those aspects of language competence that do not rely heavily on grammar for their realization. Their grammatical performance was, however, not equivalent to those of native speakers. Swain speculates that output in second language acquisition plays a role that is "independent of comprehensive input" (Swain, 1985, p. 248). She refers to the phenomenon that some language learners can perfectly comprehend input (such as what others say to them) but have difficulty in producing language output (i.e., expressing themselves). Swain's proposal of the importance of language use is further supported by more recent studies (DeKeyser & Sokalski, 1996; Nagata, 1998).

Another argument for the importance of language use in second language learning is the Interaction Hypothesis. Around the same time when Swain proposed her hypothesis about output, Long (Long, 1983; 1988) put forward his initial version of Interaction Hypothesis. Long (1983) hypothesized that interaction is facilitative of second language learning. Long's hypothesis came from his observation of the communication between

native speakers (NS) and non-native speakers (NNS), in which students would negotiate for meaning when their communication broke down. Long found that the role of communicative practice was largely underestimated due to the overlook of the role of negotiation of meaning, Negotiation of meaning is a major component in the process of communicative practice. It occurs when learners and their interlocutors attempt to "resolve communication breakdowns and to work toward mutual comprehension (Pica, Holliday, Lewis, & Morgenthaler, 1989). As they negotiate, they work linguistically (e.g., repeating a message verbatim, adjusting its syntax, changing words, modify form, confirmation checks, and requesting for classification (Pica, 1994) until needed comprehensibility is achieved. During this process of negotiation for meaning, learners would have to pay more attention to certain forms and notice the gap between their interlanguage system (i.e., an emerging linguistic system) and the target language (R. W. Schmidt, 1990; Swain, 1985) and then move towards the target language (Gass & Selinker, 1994).

The role of communication and output has its origins in the social-cultural perspective of learning, which views learning as essentially a social activity (Bruner, 1978; Vygotsky, 1978; Wells, 1985). The sociocultural perspective on language learning contends that learners advance their language proficiency by using that language with others in specific situations (Bakhtin, 1981, 1986; Gee, 1992; Vygotsky, 1962, 1978).

Condition 3: Feedback

Feedback is the third critical condition in an OLLE. Feedback has been deemed as essential in learning in multiple learning theories (Cohen, 1985; Fischer & Mandl, 1998). For example, advocates of cognitivism believe that feedback plays a significant role in

learning by informing learners of their mistakes and providing necessary information for them to correct the mistakes and reach their learning objectives. The effect of feedback in learning is also well documented in several meat-analyses (Bangert-Drowns et al., 1991; Kulik & Kulik, 1988; Lysakowski & Walberg, 1982).

Feedback also plays a critical role in second language learning. Constructive feedback can help learners to notice the gap between the target language and their current interlanguage (R. W. Schmidt & Frota, 1986) and then achieve the mastery of the target language (Swain, 1985). Schmidt stresses that noticing is a necessary condition for learning second language (Schimidt, 1993; R. W. Schmidt, 1990, 1994; R. W. Schmidt & Frota, 1986). Feedback has the potentials of making certain language forms more salient and renders higher possibility for learns to notice the gap between the target language and their current interlanguage (R. W. Schmidt & Frota, 1986).

The critical role of feedback in second language acquisition is also well supported by a large body of research studies (Ayoun, 2001; Carroll & Swain, 1993; Doughty & Varela, 1998; Han, 2002; Herron & Tomasello, 1988; Iwashita, 2003; Leeman, 2003; Long, 1996; Long, Inagaki, & Ortega, 1998; Mackey & Philp, 1998; Muranoi, 2000; Nabei & Swain, 2002; W. H. Schmidt et al., 1996). For instance, Herron and Tomasello's study (1988) suggests that feedback produced a greater learning effect than simply modeling to learners. Based on his/her study, Schulz (1996) found that the lack of feedback actually creates problems in second language acquisition and argued that feedback "might be essential for mastery of certain structures for adults and adolescent learners" (p. 344).

Technology Providing Three Conditions in an OLLE

As a large body of literature suggests, technology holds great potentials for creating the three conditions in an optimal language learning environment, i.e., language input, opportunities for language use, and feedback.

Technology and Providing Input

Technology has shown its great potentials in providing comprehensible and rich language input.

Technology and comprehensible input. As it has been discussed above, simplifying language input and providing additional assistance can increase the comprehensibility of language input. Technology has demonstrated its potentials in providing both simplified language input and additional language assistance.

One approach to simplifying language input is to slow down the speech rate. A slowed speech rate has long been proposed as a facilitative factor for second language learning (Derwing, 1990; Henzl, 1973, 1979). The development of technology has made it technically more possible to change the speech rate to better meet individual learners' needs. For example, Zhao (1997) found that language learners improved their listening comprehension when they slowed down the speech rate.

Technology can also provide additional language assistance in second language learning. A large body of evidence suggests that providing definitional information of unknown words results in greater language learning and can facilitate text comprehension (Kame' Enui, Carnine, & Freschi, 1982; Pany & Jenkins, 1978; Stahl, 1983). Technology applications that can provide definitional information of unknown words include computer software with elements such as graphics, photos, animation, sound effects,

music, live action videos, and written/verbal text (Palungtepin, 2005). CD-ROM storybooks are found to be able to facilitate vocabulary learning and reading comprehension (Balajthy, 1994; Discis Knowledge Research, 1990; Martin, 1992). Electronic dictionaries, another popular technology-enhanced language learning tool, have also shown beneficial effects on word retention (Al-Seghayek, 2001; Chun & Plass, 1996; Hulstin et al., 1996; Knight, 1994; Laufer & Hill, 2000).

Technology and rich input. The most recent development of information technology, especially computer-mediated communication, enriches language input in two ways. First, online publishing leads to an explosion of massive information. New language resources includes online dictionaries, reading materials (Brandl, 2002), and E-mails (Biesenbach-Lucas & Weasenforth, 2001), just to name a few. Secondly, the development of computers and the Internet technology breaks the boundaries of time and location, which greatly enriches their language resources. With access to computers and the Internet, language learners can reach and revisit language input at any time at any place in the world, Recently, the development of mobile technologies have further broadened the access to rich language input (Chinnery, 2006).

Technology and Opportunities for Practice

Technology can enhance opportunities for language practice in at least the following three ways.

First, technology, computers and the Internet technology in particular, can allow learners to interact in the formats of synchronous and asynchronous communication. Synchronous communication refers to real-time interactions and asynchronous communication refers to communication that takes place in different real times.

Synchronous and asynchronous communication can enhance communicative language skills (C. R. Kost, 1999) and can provide opportunities to share and collaborate (Hellebrandt, 1999).

Secondly, technology provides multiple modes for language uses. Computer-mediated technologies supports text-based tools (such as electronic dictionaries, electronic mails, bulletin-boards, and instant messages), audio-based communication (such as chat-rooms and voice mails), and audio-visual-based communication (Hampel & Hauck, 2004).

Thirdly, technology may help learners to reach interlocutors that would not be accessible before. With access to computers and the Internet, the learner can not only communicate with classmates after class (Pellettieri, 2000), but also benefit from interacting with native speakers in computer-mediated communication (Dussias, 2006; Kotter, 2003; Lee, 2004, 2006; Stockwell & Harrington, 2003; Tudini, 2003).

Fourthly, learners can interact with computer programs at multiple levels. At the simplest level, computer program can generate a short voice demand or a simple written request that requires language learners to respond. Learners could respond by choosing an answer from multiple choices or type a reply to the request (Hanson-Smith, 1999). In addition, the advancement of speech recognition technologies (Ehsani & Knodt, 1998) allows learners to have virtual but near natural conversations with computer programs on preselected and programmed topics (Bernstein et al., 1999; Egan, 1999; Harless et al., 1999; LaRocca et al., 1999; Wachowicz & Scott, 1999). Furthermore, virtual conversations with virtual characters or computer programs suggest their facilitative role

in promoting language learners' listening and speaking skills (Harless et al., 1999; Holland, Kaplan, & Sabol, 1999) as well as their motivation (Holland et al., 1999).

Technology and Feedback

Technology has shown its capacity in providing feedback mechanism to second language learners in the following five aspects: 1) feedback that was unavailable before; 2) how feedback is delivered; 3) flexibility; 4) who provides the feedback; and 5) convenience and efficacy.

Technology could provide feedback that was not available before. For example, feedback to learners' phonology and oral pronunciation can be greatly enhanced by interactive pronunciation software such as Talk to Me (TTM, 2002) and WinPitchLTL (Neri, Cucchiarini, Strick, & Boves, 2002). Pronunciation software is supported by speech recognition technology. The learner can compare the spectragrams and waveforms between his performance and that of a native speaker of the target language. Another interactive technology is 3D animated representations of the position and movement of the tongue, lip, and teeth of a learner when he speaks (Brown, 2001). These interaction technology applications make more salient the differences between the move of the learner and that of a native speaker and therefore play an assistive role in language learning. Research findings also indicate that automatic speech recognition technology in general can predict reading fluency (Cucchiarini, Strik, & Boves, 1999) .

Technological advancement also has impact on how feedback is delivered. Feedback used to be either written-text-based or spoken language-based. Technology enables feedback to be presented in the new forms of graph and video which can usually provide more detailed information to the learner. Feedback in multi-modality is also

supported by the general hypothesis of effects of multimodality on memory, which argues that multiple modality may lower the cognitive load (Sweller, Chandler, Tierney, & Cooper, 1990) of working memory (Miller, 1956).

Technology also allows great flexibility in sending and receiving feedback. For example, feedback can now be embedded in the task-based learning situations such as games and simulations. Different from feedback in a traditional sense, feedback in these task-based learning situations tend to be less "serious" and more entertaining and can also promote the learner's motivation (Stannard, 2006).

Technology also improves feedback by enabling the learner to receive feedback from a broader audience. As discussed above, computer-mediated communication allows the learner to interact with native speakers. Along with the interaction, the learner gets feedback from native speakers, which may otherwise be unlikely in traditional language classrooms. Furthermore, native speakers tend to use negotiation strategies and recasts to provide feedback to their non-native speaker peers, which may provide assistance for L2 learners (Oliver, 1995).

Lastly, technology brings more convenience and efficacy into feedback. For instance, text-processing software (e.g., Microsoft Word) is embedded with spelling and grammar checks. This type of software is also designed to alert the user when a potential error occurs. Corrections are usually provided. Although such programmed feedback has limitations, it greatly helps learners with less ambiguous linguistic forms and has been widely used.

In summary, a large body of evidence suggests that technology holds great potentials in facilitating second language learning since it can provide the three critical

conditions in an OLLE. But potentials can only translate into effects when the technology is used. The literature suggests that there is a gap between technology potentials and the realization of these potentials.

Realizing Potential of Technology Use: Why Important?

Researchers have argued that there is a gap between the potentials of technology use and the realization of these potentials (B. C. Bruce, 1993). The potentials of technology use usually consist of a set of desirable characteristics of the certain technology. These desirable characteristics, however, can only be achieved when the technology is used in the idealized way that the developer and designer have planned. The realization of technology use, however, may or may not accord to designers' plans or goals. Instead, the realization of technology use is more determined by the practices of individual users than the features of the technology (E. L. Bruce & Rubin, 1993; Kling, 1980). During the process of technology use, users inevitably interpret technology and may recreate it as they adapt it to meet their individual needs, goals, and practice. The importance of the realization process of technology potentials also highlights the role of technology users. According to Bruce, the active agents in the realization process is not the technology itself (i.e., idealization of technology uses, potentials and affordances of technology), but the participants in the setting in which the innovation is placed. Therefore, to understand the realization process, we have to investigate the role of technology users.

The gap between the potentials of technology and the realization of these potentials suggest the importance of studying not only the potentials, but also whether and how the potentials are realized in practice. In this study, the potentials of technology

in second language learning are demonstrated in the accumulative evidence of how technology can provide the three critical conditions in second language learning. If these technologies are used by learners in an idealized context, their great potentials will be realized. However, the idealized picture of technology uses may or may not be true in practice. We have to understand how technology is used by second language learners. The active agents in realizing the potentials of technology in second language learning are learners, not technology applications. In the realization process, learners interpret technologies, make decisions of whether or not to use that technology, and how to use that technology. When learners make decisions of whether and how to use multiple technology applications in their second language learning, they are, in fact, designing and creating their own language learning environment.

So far we have very limited understanding of the realization process of technology uses in second language learning. This study attempts to make contributions in this matter.

Realizing Potential of Technology Use by Learners: Why possible?

So far we have articulated the importance of studying the process of technology use in L2 learning. This section will explain why it is possible for L2 learners to use technology to create an OLLE. The first reason is that the rapid development of computers and technology makes it possible for learners to use technology to create their own OLLE. It is until recently that L2 learners have the empowerment to use technology to create an OLLE. First, the increasingly easy access to technology and relatively low costs of technology use in recent years make it more technically and financially feasible for learners to use technology. The access to the Internet has greatly increased in the last

two decades. In 2005 on average every 3.8 students have access to a computer connected to the Internet in American public schools, compared to 12 students per computer in 1998 (National Center for Education Statistics, 2006). Such a trend is also noted in home Internet access in the United States. According to the most recent Nielsen's national TV panel survey in 2008, four-fifths of all homes in the study have a home computer (Nielsen's National TV network, 2008). Over 90 percent of them, or about three-fourths of all panelist homes have access to the internet in their homes. Among all American homes with access to the Internet, over half of them (57%) now have access to high-speed internet service (Nielsen's National TV network, 2008) .

The increasing access to computers and the Internet is also seen in developing countries. For example, according to the 23rd survey report on the Internet development in China (China Internet Network Information Center, 2009), the number of people who have access to the Internet and use the Internet frequently in their life increased from 88 million in 2007 to 300 million at the end of the year 2008. Among them, about 118 million of people have access to the Internet by mobile phones.

Along with the increasing access to computers and the Internet comes a lower cost for computers and the Internet service. A few hundred dollars nowadays can get you a fairly decent laptop. Besides, the cost of monthly access to the Internet service is about the same as that of TV service.

The rapid development of computers and the Internet access also involves expanded capacity. High-speed computer networks, low-cost storage, increasingly sophisticated search engines, newly developed applications (e.g., blogs, Twittering, Blogging) together enables users to find information on the Internet, share their thoughts

and experiences with others, and seek help from experts. And they can do such things in a more efficient way.

Secondly and more significantly, technology has the potential to increase learner empowerment to create their own learning environments. The concept of learners creating their own environment may sound unfamiliar. However, there are a lot of examples when people learn. By exploring, selecting, and using various learning resources, learners are shaping their learning experiences and creating their own learning environments. And they are doing this every day. Here's an example of how a student in a doctoral program in education may create his learning environment. In addition to course taking, he may go to research talks and seminars that fit his research interests. He could also subscribe to journals and conference newsletters to catch up with the work of others in the field in a timely sense. He can also share his own work with peers and faculty, get feedback from them, and revise his papers. By so doing, he is shaping his own learning experiences in the program and creating his own learning environment.

Although learners had been creating learning environment for a long time before computers were invented, the empowerment for learners to do so has greatly improved since the rapid development of computers and the Internet. To a great degree this is due to the fact that until recently there were limited information and resources for second and foreign language learners to explore on their own outside classroom. Teachers and designers of language programs were the major, if not the sole, sources for learners to get language materials and opportunities for language use. This long-existing situation is recently changed by the development of newer technology. All kinds of technology applications provide a rich variety of tools for "the implementation of self-directed

learning" (Gremmo & Riley, 1995). Now learners have access to a massive amount of information for L2 learning and have a higher degree of empowerment (see an overview by Hannafin & Land, 1997). There are emerging interests in "students as designers" (Harel & Papert, 1991; Reigeluth, 1996). Learners can seek language learning materials and resources that would not be available for them before. They can make decisions about what to use, how to use these resources in their language learning. By so doing, learners are creating a language learning environment for themselves.

The current study intends to make contributions to understanding how learners use technology in L2 learning by answering the following research questions.

1. How do students use technology in their second language learning?
2. What factors affect English language learners' use of technology in their English learning?

CHAPTER 3

ANALYTICAL FRAMEWORK AND METHODOLOGY

This chapter first discusses an analytical framework which was used to identify factors affecting the frequency of technology uses by L2 learners. It then presents an analytical framework to analyze factors affecting whether or not an ego used technology to learn English with an alter. It then describes the methodology of the study.

Analytical Framework for Use Frequency

One of the goals of this study was to identify potential factors influencing how frequently individual ESL learners used technology-enhanced language resources. To achieve this goal, an analytical framework was developed through literature review of three fields, i.e., technology adoption, individual differences in second language learning, and social networks. The assumption of the framework is that factors from these three fields may to some degree be associated with the frequency that the learner adopts and uses technology to learn English, i.e., the outcome and dependent variable in this analysis.

The first group of factors has to do with technology adoption, that is, the extent to which learners adopted technology. These factors were considered since the outcome of this analysis, to what degree learners use technology to learn English, was essentially an issue of technology adoption by learners.

The second group of factors adds to the first group of factors the context of technology use in this study, i.e., English learning. The underlying assumption is that there may be some differences between technology uses in English learning and technology uses for other purposes. In other words, whether and how learners use

technology in English learning may be related to their individual differences in second language learning. Factors in this category include English learning strategies, motivation to learn English, and English proficiency.

The last group of factors pertains to the influence of people in ESL learners' social network. These factors took a close look at learner's *local position* (i.e. the experience that they share with others, see Frank, Muller et al. 2008) and examined whether L2 learners' technology use may be influenced by people in their social network.

Factors Related to Technology Adoption

The literature suggests that technology adoption is affected by a host of factors that include access to technology, attitudes towards technology use, and technology proficiency.

Access to Technology

Access to computers and the Internet has long been considered as a critical condition for technology adoption (Hoffman & Novak, 1998). Access to technology includes access to technology in school, at home, and other spaces (Pelgrum & Plomp, 1996). To put it simply, more access to computers may increase the possibility for more computer use. In a study of the relationship between the access to Internet and the usage over time, Hoffman and Novak (1998) found that white college students were more likely thank African American college students to use computers and the Internet because they have easier access. They concluded that "access translate into usage."

The access to computers and the Internet has been greatly increased in recent years. In 2005 on average there are 3.8 students per computer connected to the Internet in public schools in the United States, compared to 12 students per computer in 1998. Such

a trend is also noted in the increasing access computers and the Internet at home (DeBell & Chapman, 2006) and in public places, such as libraries, cyber-cafes, hotels, airports, and so on.

The sample population in this study, college students in China, also enjoyed increased access to computers and the Internet. In 2008, the number of Internet users in China increased 41.9 percent from the previous year and had reached 298 million by the end of year 2008 (China Internet Network Information Center, 2009). In addition, over 90.6 percent of internet users access the Internet via broadband. The top three places to access to computers and the Internet in China are cyber-cafes, campus, and home. Chinese college students were found to be the most active group of internet users.

Attitudes towards Technology Use

Attitudes and perceptions are considered the filter through which all learning occurs (Marzano, 1992). Attitudes towards technology (e.g., perceived usefulness and perceived ease of use) are widely believed as associated with technology adoption (Davis, Bagozzi, & Warshw, 1989) and have been included in multiple models of technology adoption (e.g., the Technology Acceptance Model by David, 1986). In a more recent study, learners' attitudes to computers and awareness of online resources were found to be strong predictors of how likely the learner adopts technology in their learning (Concannon, Flynn, & Campbell, 2005).

Technology Proficiency

Technology proficiency is another factor that may influence technology adoption. It is well noted in the literature that technology uses are shaped by users' understanding of technologies and technology proficiency (Zhao, Pugh, Sheldon, & Byers, 2002).

Students with higher technology proficiency are more likely to use more advanced technologies and use technologies more frequently.

Factors Related to Second Language Acquisition

Factors related to individual differences in second language acquisition included learners' language learning strategies, their motivation to learn English, and their English proficiency. Originally, studies on individual differences in second language acquisition were to find learners' behaviors, techniques, and skills that can consistently predict their success in second language acquisition (Z. Dornyei & Skehan, 2003; Sawyer & Ranta, 2001). This study assumes that these behaviors, techniques, and skills may also influence the degree to which learners use technology to facilitate their English learning.

Language Learning Strategies

A widely accepted definition of language learning strategies is the specific behaviors or techniques learners use to promote their language development (N. J. Anderson, 1991; Ehrman & Oxford, 1995; Gardner, Tremblay, & Masgoret, 1997; Diane Larsen-Freeman, 1991; D. Larsen-Freeman & Long, 1991; O'Malley, Chamot, Stewner-Manzanares, Russo, & Kupper, 1985; R. Oxford, 2003; R. Oxford & D. Crookall, 1989; R. Oxford & Nyikos, 1989). Both theory and research in second language learning strongly suggest that effective language learners use a variety of strategies to assist in their language development (Ehrman & Oxford, 1990; O'Malley et al., 1985; R. L. Oxford, 1989; R. L. Oxford & D. Crookall, 1989; Skehan, 1989). By including language learning strategies in the analytical framework, it is hypothesized that learners with more advanced language learning strategies are more likely to suse technology to facilitate their English learning.

Motivation

By including motivation as a potential factor, this study assumes that learners' self-directed efforts of using technology in L2 learning may be associated with their motivation to learn the target language. In other words, a learner with higher motivation to learn English is more likely to explore language resources on his own and therefore is more likely to use technology to facilitate his L2 learning.

Although there has been mixed opinions about the direction of the relationship between motivation and autonomous and independent learning (i.e., does motivation lead to autonomy in language learning or the other way around?) in the literature (Dickinson, 1995; Spratt, Humphreys, & Chan, 2002), it is widely accepted that motivation and autonomy in language learning are associated with each other. In a large-scale study of college students, Spratt, Humphreys, and Chan (2002) found that the motivation in English language learning played a key role in developing learners' autonomy and independence in their language learning. In their study, they found that participants' reported level of motivation is positively associated with the frequency of their self-directed language learning engagement.

Factors Related to Social Networks

Factors related to social networks are included in the analytical framework for two reasons. First, it is largely drawn by the framework of social capital. Social capital is defined as the potential to have access to information and resources through social relations (Bourdieu, 1986; Coleman, 1988; Putman, 2000; Woolock, 1998). Social capital has influence on human behavior and decision-making (Dornbusch, 1989) as well as educational decisions (Berndt & Murphy, 2002; Cairns & Cairns, 1994; Chen, Chang, &

He, 2003; Crosnoe, 2000; Dornbusch, 1989; Sizer, 1984). Adolescents' academic performance is influenced by characteristics of their friends. For example, Crosnoe and his colleagues (2003)analyzed data from 9,223 adolescents in the National Longitudinal Study of Adolescent Health and found that students who had friends with positive attitudes towards school or with high academic performance had fewer academic problems than those whose friends were less academically oriented.

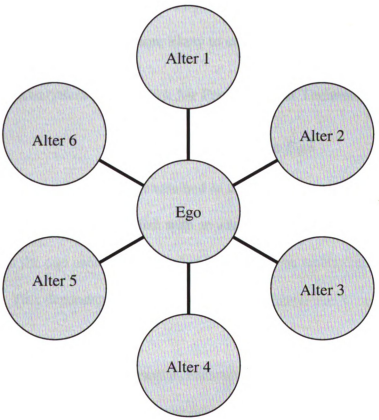
By including factors related to social capital in the analytical framework, this study assumes that how L2 learners use technology may be influenced by people in his social networks. If a learner's friends actively explore technology uses in second language learning, this learner may be more likely to use technology to facilitate his language learning, compared with another learner whose friends do not use technology to learn English at all.

The second reason to include factors related to social networks in the analytical framework has to do with the context of this study, college students in China, who seem to have rich opportunities to interact with peers. College students in China share intensive course-taking activities with peers in their local positions. There are around 270 school days per academic year for college students. On average, the time that Chinese college students spend in course taking is 25 hours per week (Meng, Yang, Lu, Song, & Liu, 2005). College students in China also have a great many of opportunities to interact with their peers enrolled in the same program. Chinese college students can take core courses for their majors as early as in their freshmen year, which provides them rich opportunities to share academic and social experiences with their cohorts in the program.

The social network that was examined in this study was an ego-centric network (Wassmen & Faust, 1994). This type of network centers on a person and investigates the influences of persons in his network. As shown in the following figure, the person in the center of the network is called an ego, surrounded by alters (i.e., persons in his network). The line between the ego and an alter represents the social tie (i.e., social relationship) between the two. In this study, an ego was the learner and alters were persons in the learner's network.

Figure 1

An ego-centric network



Factors related to social networks included social access, social desire, and English proficiency of the whole network.

Social access: the degree of the accessibility for the ego to interact with the alter. The hypothesis is that the accessibility for the ego to interact with the alter is positively related to the odds of their technology use in second language learning.

Social desire: to what degree the ego would like to build and/or maintain friendship with the alter. The hypothesis is that the willingness that the ego would like to make friends with the alter may be associated with the possibility that they use technology in their language learning.

Average English proficiency of all the alters in the socialnetwork: English language proficiency of all the alters as perceived by the ego. The hypothesis is that learners with higher language proficiency are more likely to use technology in their language learning.

Analytical Framework for Probability of Technology Use

Between an Alter and an Ego

Factors at two levels were examined to analyze factors affecting whether or not an ego used technology to learn English with an alter. The dependent variable in this study is whether or not the ego used or discussed about how to use technology to learn English with an alter. This dependent variable is labeled as $Log[ego\ use/1-ego\ use]$ in the models.

Factors at the first level involve characteristics of the alters (i.e., persons in the ego-centric network) and the tie (i.e., the relationship between the ego and the alter). The

following factors were in the first level and were investigated at the level of alters and ties.

- *Social access*: the degree of the accessibility for the ego to interact with the alter. The hypothesis is that the accessibility for the ego to interact with the alter is positively related to the odds of their technology use in second language learning.
- *Willingness to build and/or maintain the friendship with the alter*: to what degree the ego would like to become a friend or continue to be a friend of the alter. The hypothesis is that the willingness that the ego would like to make friends with the alter may be associated with the possibility that they use technology in their language learning. .

The second level of factors was at the level of ego and network. Factors at the second level focus on the characteristics of the ego and that of the network.

- *Average English proficiency of all the alters in the socialnetwork*: English language proficiency of all the alters as perceived by the ego. The hypothesis is that learners whose alters having higher language proficiency are more likely to use technology in their language learning[2].
- *English learning strategies*: The learner's English learning strategies. The hypothesis is that the higher the learner's English learning strategies are, the more likely the learner may use technology to learn English with an alter.

[2] The researcher also constructed a model with the variable of English proficiency of each alter (group-centered at level 1). The regression coefficient was not significant ($\gamma = 0.13, p > 0.05$). Therefore, the variable of English proficiency of a specific alter was not included in the final model.

- *English learning motivation:* The learner's English learning motivation. It is hypothesized that a learner with higher motivation to learn English is more likely to use technology to learn English with an alter.

Based on the hypothesis stated above, the models at the two levels look like this:

Level 1 (tie/ alter level):

$$prob(Y_{ij}) = (1/\beta_j) = \phi_{ij}$$
$$\eta_{ij} = \log[\phi_{ij}/(1-\phi_{ij})]$$
$$Log[ego\ use/1-ego\ use]$$
$$= \beta_{0j} + \beta_{1j}(social\ access) + \beta_{2j}(social\ desire)$$

This model hypothesizes that odds ratios of a learner uses technology with an alter in their language learning i.e., $Log[ego\ tecuse.English/1-ego\ tecuse.English]$, are positively related to the following variables, overall support intercept (β_{0j}), accessibility to the alter, , and the desire that the learner and the alter wants to develop/maintain friendship.

Level 2:

Overall support intercept

$$\beta_{oj} = \gamma_{00} + \gamma_{01}(Network\ English\ proficiency) + \gamma_{02}(Ego\ English\ learning\ strategies) +$$

$$\gamma_{03}(Ego\ English\ motivation) + u_{oj}$$

Social access: $\beta_{1j} = \gamma_{10}$

Social desire: $\beta_{2j} = \gamma_{20}$

This proposed model speculates that the overall support intercept of a learner is characterized by the average English proficiency of all the alters in his network, the ego's English learning strategies, and the ego's English learning motivation[3].

In summary, the analytical framework to investigate factors affecting the frequency of technology use in L2 learning consists of three groups of factors on L2 learners' technology use, i.e., technology adoption, English language learning, and L2 learners' social network. By including these three groups of factors, this study may help us to understand whether L2 learners' technology use is influenced by the degree to which they can adopt technology (i.e., access to technology, attitudes towards technology, and technology proficiency), their individual differences in second language learning (i.e., language learning motivation and strategies), or their social networks. Table 1 lists variables that were examined in this study.

[3] u_{oj} is included in the level 2 model for the variance that can not be explained by the variables in the level 2 model.

Table 1

Variables for the frequency of technology use in L2 learning

	Variables
Technology Adoption	Access to technology Attitudes towards technology uses Technology proficiency
Second Language Acquisition	Language learning strategies Language learning motivation
Social network	Network English proficiency Access to alters in the network Social desire of a network

The framework to investigate whether or not an ego uses technology with an alter include variables at level 1 (i.e., the level of the alter) and level 2 (i.e., the level of the ego and the network). Table 2 lists variables at the two levels.

Table 2

Variables for whether or not an alter used technology to learn English with an alter

	Variables
Alter/tie level	Social access Social desire (Willingness to build and/or maintain the friendship with the alter)
Ego/Network level	Average English proficiency in the network English strategies of the ego English learning motivation of the ego

Methodology

This section describes participants, instruments, data collection, and data analysis for this study.

Participants

Participants of this study were 114 students who were learning English as a foreign language in a public university located at a metropolis of the Northeast China. Among the 102 students, 57 were female students and 55 were male students. The majors of all the participants were not English. However, all of them were taking a 3-credit required *College English* course during the time of the study. Some participants were also taking one or two concurrent English courses.

Participants with such backgrounds were selected for several reasons. First, participants were selected from a non-English speaking country, where English language resources are often relatively limited. As a result, the need for exploring language resources tends to be more pressing and learners are more likely to use technology to facilitate their English learning. Second, the age range was narrowed to college students since they had had some prior experience with both computer uses and second language learning. Therefore, the participants were expected to be able to explore and use technology-enhanced language resources at their own willing. Third, students were selected from the same school so that available technologies and other resources for second language learning would be similar (at least for in-school resources), if not the same. This would help to rule out the extrinsic factors such as school resources when explaining individual differences in using technology to learn English. Fourth, all

participants were selected from the freshmen in this university so that how they learned English would be less affected by the College English Test Band 4, a national English as a foreign language test that the majority of college students would start to prepare in their sophomore year.

Instruments and Data Collection

The primary data source of the study was a student surveys. The participants were asked to complete the survey online. All the participants were recruited from four sessions of *College English*, a required course for all non-English majors in the university. The link to the online survey was first sent to four instructors of the course. The instructors were then asked to announce the link in class and asked for students' voluntary participation. Participants were given two weeks to complete the survey.

All communications with the participants and the survey were in Chinese, the participants' native language. The surveys were first developed in English and then translated into Chinese. Back translation was used to verify the equivalency of the two language versions.

Data Collection: Student Survey

The final student survey (see Appendix 1) included 5 sections, taking approximately 20-30 minutes for completion.

Section 1 includes demographic information, such as grade, and gender, major, English grade in College Entrance Examination, access to computers and the Internet, individual needs of learning English, and general experience with computers and the Internet.

Section 2 focuses on understanding individual language learning environment, including what conditions were present in their individual language learning environment, their access to each listed language resource, and how frequently they used each technology-involved language resource.

The list of technology-involved language resources were drawn from the following three sources. .

The first source was published research findings. Research papers published in two peer-reviewed journals (i.e., *TESOL Quarterly* and *Language Learning and Technology*) were reviewed to identify technology-related language resources that have been studied. These two journals were selected because of their focus on second language learning and their relatively wide circulation in the field. The time period of being reviewed was between 1991 and 2005 for TESOL and between 1997 to 2005 *Language Learning and Technology*[4].

The second source was the researcher's personal experience with learning English as a second language. The researcher had learned English in China and may share some of the language resources with the participants in the study. So the researcher recalled the available resources for L2 learning and added to the list of language resources.

The last step in creating this list was to consider the context of this study (i.e., China). For several language resources that are widely used in the western society, their counterparts in China are added in the list. This may help participants to better understand the survey items and make choices that better represented their practices. For example, for the category of chatting tools, in addition to those that are well known and

[4] The first issue of Language Learning and Technology was in 1997.

widely used in the U.S. (e.g., MSN, Yahoo chatting, Google Talk, etc.), QQ was added, which was a very popular online chatting tool in China.

Section 3 asked about motivation. The items were adapted from a previous study by Noels, Clements, Pelletier (1999). In their study, they investigated learners' motivation on second language acquisition from the following aspects: goals, expectancy, anxiety, and motivation strength. There were altogether 35 items. For each item participants rated the degree to which the statement reflected his/her motivation for language learning by using a 5-Point Likert scale.

Section 4 collected data about language learning strategies. This study used Strategy Inventory for Language Learning (SILL), a well accepted module of language learning strategies constructed by Oxford in 1989. SILL consists of 50 strategy items with subareas of memory, cognitive strategies, compensation, metacognitive strategies, affective aspects, and social strategies. For each described strategy, learners were asked to report how often they used the strategy by choosing from a 5-point Likert scale with 1 for "never or almost never" and 5 for "always or almost always".

Section 5 was composed of three parts and had 33 items altogether. In the first part, participants were asked about their computer knowledge by choosing from a 5-point Likert scale with 1 for "never heard of it" and 5 for "being very familiar with it and knows well how to use it". The second part inquired about participants' attitudes toward computer use, including their perceptions of computer usefulness and intention to use and learn computers. The third part was about participants' perceptions of self-efficacy, liking, usefulness, and intention to use and learn the Web. For all the items in part 2 and part 3, participants were asked to rate their degree of agreement with each statement, with 1

indicating "highly disagree" and 5 indicating "highly agree". The survey items were adapted from the instrument that Liaw (2002) designed in his study.

Data Analysis

Data Cleaning

The survey was delivered to 180 students. Eventually 114 participants completed the survey. The return rate was 63.3 percent. Surveys with missing data for section 2 about how learners use technology to facilitate their language learning were deleted (N= 4). Another eight surveys were excluded because the responses for more than one third of the total survey items were missing. As a result, 102 surveys were considered as valid and were retained for final data analysis.

Data Analysis

This section introduces the data analysis methods employed in this study to answer the two research question, i.e., technology-related language resources used by L2 students, and the factors affecting L2 learners' use of technology.

Technology-related language resources used by L2 students. For each type of technology-related language resource, average numbers of hours of use by all participants were calculated. The total number of hours of technology use in L2 learning for each participant was calculated by adding up the numbers of hours of use for each type of technology-related language resource.

Data were also analyzed by groups of learners. Learners were ranked according to their total number of hours of technology use in L2 learning. They were labeled as non/casual users (the bottom one third of the learners), medium users (the one third in the middle), and frequent users (the top one third of the learners). Numbers of hours of

technology use in L2 learning for each technology-related language resources were reported at the group level. Total numbers of hours of technology use in L2 learning for each group were also reported.

Factors affecting L2 learners' use of technology. Negative binomial and hierarchical linear model were employed to identify factors affecting L2 learners' use of technology.

Negative binomial with log link was conducted to identify the factors that may explain individual students' use of technology in English learning[5]. The final value for each potential factor was the mean of learners' responses (1 to 5 Likert scale) for all the items regarding that factor. For example, for the section of English learning strategies, participants were asked to rate the frequency of their use of 50 English learning strategies on a scale of 1 to 5. Their average scores for the 50 items were then used as the value for the variable of English learning strategies in the analysis.

A forward stepwise method[6] was applied since previous studies can not provide sufficient evidence for a hierarchical regression. In a forward stepwise method, a variable with the largest T-value from a group of independent variables was selected at each stage. The procedure stops admitting independent variables into the model when new variable does not make a contribution that is statistically significant.

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[5] Negative binomial is a type of generalized linear model. It was selected because the dependent variable here (i.e., the total number of hours of learning English with technology) was a count and was over dispersed and that the variance was much larger than the mean (mean=13.7, variance = 151.59).

[6] An alternative approach is to investigating variables that are more driven by theories. For example, since learning is a social activity and how learners use technology may be influenced by alters in their networks, we may want to compare a model with social factors to a model with only technology attitudes and proficiency (i.e., two factors that are often used in technology acceptance models).

A hierarchical linear model with log link was built to identify factors that may influence whether or not the ego used technology with a certain alter. Two datasets were created. One dataset focused on variables at the level of alters. The other dataset included variables at the level of the ego and the network. Then a hierarchical linear model was created to include variables at both levels. Since the dependent variable was dichotomous, a hierarchical linear model with log link was conducted.

CHAPTER 4

RESULTS AND DISCUSSION

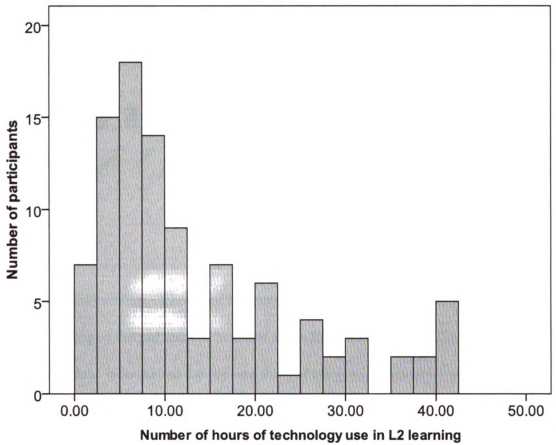
This study set out to answer the following three research questions: 1) how do students use technology in their second language learning? 2) what factors affect how students use technology in their second language learning? This chapter reports and discusses the findings.

Student Uses of Technology for English Learning

The amount of time students spent using technology for learning English varied greatly, ranging from 0.01 hour to 40 hours per week (SD = 11.15 hrs). On average students spent 13.23 hours to use technology in their second language learning. The data regarding technology use reveal that some students use technology a lot, but some do not use technology at all (see figure 2).

Figure 2

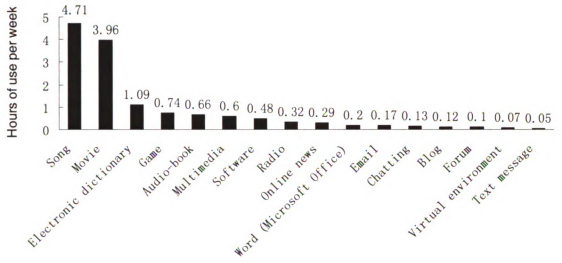
Distribution of numbers of hours of technology use in L2 learning (per week)



Variation was found in the numbers of hours of use across technology applications. As shown in figure 3, the top five most frequently used technology-supported language resources were songs (4.71hrs), movies (3.96hrs), electronic/online dictionaries (1.09hrs), games (0.74hr), and audio books (.66hr). In contrast, online chatting (.13hr), blog (.12hr), online forum (.10hr), virtual environment (.07hr), and text messages (.05hr) were among the least commonly used applications by the participants in this study.

Figure 3

Number of hours of use by technology application



The total numbers of hours of technology use were coded. Participants were ranked according to the numbers of hours of technology use in their L2 learning every week. Participants who ranked the top one third of the group were considered frequent users. Participants from the bottom one third of the group were labeled as non/casual users. Those who fell between these two groups were considered as medium users.

The results indicate great differences of total numbers of hours of technology use across groups. The average numbers of hours of technology use in L2 learning every week for the three groups were 3.72, 9.39, and 26.97 respectively.

Table 3

Average number of hours of use across technology applications by group

Technology application	Non/casual user	Medium user	Frequent user	All users
Song	0.94	2.49	10.88	4.71
Movie	1.75	3.04	7.18	3.96
Electronic dictionary	0.38	1.00	1.91	1.09
Game	0.12	0.65	1.48	0.74
Audio-book	0.16	0.65	1.18	0.66
Multimedia	0.06	0.51	1.26	0.6
Software	0.07	0.25	1.12	0.48
Radio	0.06	0.12	0.80	0.32
Online news	0.04	0.21	0.64	0.29
Word (Microsoft Office)	0.00	0.09	0.52	0.2
Email	0.03	0.10	0.39	0.17
Chatting	0.00	0.07	0.33	0.13
Blog	0.04	0.09	0.24	0.12
Forum	0.03	0.09	0.18	0.1
Virtual environment	0.00	0.00	0.21	0.07
Text message	0.03	0.03	0.09	0.05
Total	3.72	9.39	26.97	13.23

The results bring concerns and arouse interests. First, one of the concerns is that although newer technology, such as online chatting, virtual environment, and mobile technology (e.g., cell-phone text messages), have been proved effective in facilitating L2 learning (Chinnery, 2006; Hanna & Nooy, 2003; Wood, 2001) and have drawn increased attention by researchers, their uses by L2 learners were relatively infrequent. The infrequent use of these newer technologies in second language learning confirms the original concern about the gap between the great potentials of technology in L2 learning and the realization of technology use in practice, which drove this study.

Secondly, when comparing the language learning environments created by participants with the three critical conditions in an optimal language learning environment, it seems that participants used technology mainly to get the first condition, i.e., receiving language input. The top three most frequently used technology applications (i.e. songs, movies, and electronic dictionaries) allow participants to receive language input. However, these applications are limited in providing another two critical conditions in an optimal language learning environment, i.e., opportunities for language use and feedback.

Thirdly, it is noted that songs and movies seem to be favored by L2 learners, as evidenced by the results of this study. Songs and movies were the top two most frequently used technology-related language resources across the groups of frequent-, medium-, and casual-users. Using songs and movies in L2 learning is not something new. Instead, a plethora of studies have documented advantages of using songs and movies to learn L2. Songs offer a number of mnemonic codes (such as repetition, rhyme, and melody) that help the listener's memory (Abrate, 1983; Maley, 1987) and language skills (see reviews by Iudin-Nelson in 1997 and Ray in 1997). Closed captions of movies and

video clips are found useful in improving listening comprehension (Froehlich, 1988; Markham, 1989), vocabulary (Neuman & Koskinen, 1992), and speaking and writing performance (Baltova, 1994; Borras & Lafayette, 1994). More importantly, research has shown some evidence that actual incidental learning takes place from using multimedia materials such as captioning and subtitling of video clips (Gery d'Ydewalle & Van De Poel, 1999; Koolstra & Beentjes, 1999). For example, in the study by Koostra and Beentjes, 246 Dutch children in grade 4 and grade 6 watched an American documentary. In both grade levels, children acquired more English vocabulary when they watched television with subtitling. The evidence of incidental learning of vocabulary from watching subtitled television is also found from studies on adults (G. d'Ydewalle & Pavakanun, 1995; Pavakanun & d'Ydewalle, 1992). Although the current study was not set out to investigate how songs and movies were used by participants, previous evidence of the effects of songs and movies in L2 learning suggest incidental learning may occur while participants listened to songs and watched movies in English.

Fourthly, the numbers of hours of technology use reported by some participants seem too high. For example, the average number of hours of use by frequent users was 26.97 hours per week. This may appear unrealistic at first sight. One possible explanation is when participants reported their technology use, they included the hours when they were multitasking. In other words, they may listen to English songs while they were writing an essay for a science class. Multitasking seems to be embraced by young generation. According to a recent report from the Kaiser Family Foundation, students are multitasking 65 percent of the time (Aratani, 2007). The percentage of "media multitaskers"(defined as using media such as television or computers) among teenagers

increased from 16 percent in 1999 to 26 percent in 2005. Although the consequences of media multitasking have not been fully investigated (Aratani, 2007), there is a long tradition of psychological and media researcher that indicates we tend to underperform when we engage in simultaneous tasks (Fisch, 2000; Lang, 2000).

Factors Affecting the Frequency of Learners' Technology Use in L2 Learning

The dependent variable was the number of hours of technology use in L2 learning every week[7]. The variables that were used in the negative binomial regression included access to technology, attitudes towards technology, technology proficiency, English learning motivation, strategies, English proficiency, average English proficiency of alters in the network, access to the network, and the social desire to alters in the network. The descriptive statistics of these variables are reported in table 4.

[7] Since negative binomial regression analysis requires the outcome to be an integer, the values of the dependent variable here (i.e., the number of hours of technology use in L2 learning every week) were rounded to the nearest integer. However, all values smaller than 1 were rounded up to 1.

Table 4

Descriptive statistics of variables in the regression model

	Variables	Mean	Sd	Minimum	Maximum
English learning	English motivation (n=1~5, N=102)	3.10	.60	1.64	5.00
	English strategies (n=1~5, N=101)	3.18	.63	1.92	5.00
Technology adoption	Technology access (n=1~5, N=102)	3.99	1.03	1	5.00
	Technology attitude (n=1~5, N=102)	3.91	.79	.34	5.00
	Technology proficiency (n=1~5, N=101)	3.93	.836	1.81	5.00
Social network	Network English proficiency (n=1~5, N=97)	3.43	.97	1.00	5.00
	Network access (n=1~5, N=97)	4.58	.70	1.00	5.00
	Network desire (n=1~5, N=97)	3.83	1.00	1.00	5.00

The entry of independent variables for a negative binomial regression with log link was based initially on the variable with the largest zero-order correlation coefficients and then on the part correlations coefficients of the remaining variables. Part correlation coefficients were used to look at the relationship between each independent variable and the dependent variable while "controlling" the effect of other independent variables. Zero-order and part correlation coefficients are reported in table 5.

Table 5

Zero-order and part correlation coefficients with the frequency of technology use in L2 learning

	Correlations		
Model	**Zero-order**	**Part**	**Partial**
(Constant)			
Network English proficiency	.369***	.368***	.398***
Access to networks	.162	.098	.115
Social desire of a network	-.088	-.148	-.172
Technology access	.134	.082	.096
Technology proficiency	.125	-.043	-.051
Technology attitude	.055	.011	.013
Strategies	.268**	.268**	.301**
Motivation	.020*	-.205*	-.235*

*** Correlation is significant at the 0.01 level (2-tailed).
** Correlation is significant at the 0.05 level (2-tailed).
* Correlation is significant at the 0.10 level (2-tailed).

As table 5 shows, English proficiency in the network, English strategies, and motivation seemed to have significant relationship with how frequently a learner used technology in his English learning. A correlation analysis was conducted to see if these three variables were independent of each other.

Table 6

Correlations between variables for the frequency of technology use in L2 learning

	Network English proficiency	Strategies	Motivation
Network English proficiency	1	.147	.152
Strategies	.147	1	.691***
Motivation	.152	.691***	1

*** Correlation is significant at the 0.01 level (2-tailed).

The results of the correlation analysis suggest a large correlation between participants' English learning strategies and motivation ($r = .691, p < .01$). This means, if we include both motivation and strategies as predictors in the negative binomial model with log link, there will be concerns for multicollinearity. Compared with strategies, motivation seemed to be a less useful predictor. The relationship between motivation and the dependent variable, i.e., the number of hours of technology use in L2 learning, needs to be interpreted with caution. It is noted that the signs of the correlation and the *b* regression coefficient for motivation and the number of hours of technology use in L2 learning are opposite (*r* is minus, i.e., -5.435 in appendix 1, *b* is plus, .02 in table 5), indicating suppression (Cramer, 2003). It is also noted that partial correlation between motivation and the number of hours of technology use in L2 learning changes the

direction of the zero-order correlation. This change indicates that when other variables are partialled out, the interpretation of the association between the two variables may be entirely different. In the following step-wise analysis, motivation is not included as an independent variable.

As shown in table 5, average English proficiency of alters in an ego's network had the highest zero-order correlation coefficient (0.369) and part correlation coefficient (0.368). Therefore, average English proficiency of alters in an ego's network was entered as the only variable in step 1. Among the remaining variables, the variable with the greatest part correlation coefficients were English strategies (part correlation coefficient = .268). Therefore, English strategy was entered into the model in step 2. The statistics of part correlation coefficients also suggest that there seemed no obvious cause for concern of collinearity since the VIF values were less than 10 and the tolerance values were above 0.2 (Menard, 1995).

Table 7

Summary of step-wise models

Model	Included variables	Likelihood Ratio Chi-Square of Omnibus Test[8]	Sig.	Goodness of Fit[a]: Akaike's Information Criterion (AIC)
Step 1	(Intercept) Network Eng proficiency	9.658	.002***.	698.772
Step 2	(Intercept) Network Eng proficiency English strategies	10.418	.005***.	694.321

*** Correlation is significant at the 0.01 level (2-tailed).
a Information criteria are in small-is-better form.

Table 8

Parameter estimates for model 1 (Intercept and Network English proficiency)

			Hypothesis Test	
Parameter	B	Std. Error	Wald Chi-Square	Sig.
(Intercept)	1.422	.3981	12.754	.000***
Network English proficiency	.338	.1113	9.233	.002***
(Scale)	1a			
(Negative binomial)	1			

*** Correlation is significant at the 0.01 level (2-tailed).

[8] An Omnibus test compares the fitted model against the intercept-only model.

The final model tested two variables, i.e., average English proficiency of all alters in an ego's network and English strategies. This model was statistically different from the null model (likelihood ratio $X^2 = 10.418$, $p < 0.001$, see table 7) and was therefore accepted. Again average English proficiency of all alters in an ego's network was found to significantly predict numbers of hours of using technology to learn English as the significance values of the Wald statistics for these predictors indicated (6.166, $p < 0.05$). The results, however, did not show the significance of English language learning strategy in predicting the total numbers of hours of technology uses (Wald Chi Square statistic = 2.125, $p > 0.1$, see table 9).

Table 9

Parameter estimates for model 2 (Intercept, Network English proficiency, and English strategy)

			Hypothesis Test	
Parameter	**B**	**Std. Error**	**Wald Chi-Square**	**Sig.**
(Intercept)	.798	.6492	1.509	.219
Average English proficiency of all the alters in the social network	.282	.1134	6.166	.013**
English strategies (Scale)	.258 1a	.1770	2.125	.145

**. Correlation is significant at the 0.05 level (2-tailed).

In short, the average English proficiency of students' close network was identified as a significant predictor of how frequently participants would use technology to learn English. The following sections discuss the finding in the context of previous research on social networking factors, English learning strategies, and technology adoption.

Social Network

As shown in the final model, the average English proficiency of all alters in a participant's ego-centered network was the strongest predictor of the frequency of using technology to learn English. This confirms Coleman's assumption of social capital (1988), i.e., how adolescents behave and interact are influenced by their peers (Crosnoe et al., 2003; Riegle-Crubmb, Farkas, & Muller, 2006; Sizer, 1984; Y. Xu, 2002).

Language Learning Strategies

One of the hypotheses of the study is that English strategy is associated with how intensively learners use technology in their L2 learning. The results of the study, however, do not support this hypothesis. A possible explanation is the mismatch between the definition of English learning strategies and the selected measurement in the study, Strategies Inventories for Language Learning SILL (R. L. Oxford & Burry-Stock, 1995). A well accepted definition of English learning strategies is the specific behaviors or techniques that learners use to develop their language proficiency (N. J. Anderson, 1991; Ehrman & Oxford, 1995; Gardner et al., 1997; Diane Larsen-Freeman, 1991; D. Larsen-Freeman & Long, 1991; O'Malley et al., 1985; R. Oxford, 2003; R. Oxford & D. Crookall, 1989; R. Oxford & Nyikos, 1989). According to this definition of English

learning strategies, using technology to facilitate language learning should be included as a part of English learning strategies since technology has great potentials in L2 learning and using technology in second language is some specific behaviors or techniques to facilitate their L2 learning (Al-Seghayek, 2001; Beauvois, 1997; Bernstein et al., 1999; Cahill & Catanzaro, 1997; Chun & Plass, 1996; Egan, 1999; Harless et al., 1999; Hulstin et al., 1996; Kelm, 1998; Knight, 1994; LaRocca et al., 1999; Laufer & Hill, 2000; Meskill et al., 1998; Salaberry, 2001; Stannard, 2006; Wachowicz & Scott, 1999; Warschauer, 1998). However, the traditional measurements of English strategies (as represented by SILL in this study) do not articulate the specific techniques or skills that learners use technology in their L2 learning. For example, none of the survey questions in SILL focuses on specific techniques or skills that learners may employ to learn English with technology. In addition, technology is not mentioned once in the survey questions on the five sub-skills in SILL (i.e., memory, cognitive, compensation, metacognitive, and affective skills). As a result, participants may limit their answers to their strategies in traditional non-technology settings when answering the survey questions.

Factors Related to Technology Adoption

Although factors related to technology adoption were found to be insignificant in this study. A closer look at these factors may help us to understand the context of the study as well as to learn the relationship between the three groups of factors, i.e., technology adoption, individual differences in second language learning, and social factors.

Access to computers and the Internet. The original concern was that students' use of technology in English learning may be constrained if they had limited access to

computers and the Internet. This concern turned out to be dismissed. Access to computers and the Internet seemed to pose no or small challenges for the majority of the participants in this study. Most participants either used their own laptop or used a desktop in their dorm that they shared all the related expenses with their college friends. Internet services were available for student-owned computers on campus in the university, with a discounted fee of 200 RMB (equivalent to around $30) per semester. For those who did not have their own computers, the top two choices for them to use computers and the Internet were computer labs in the university or Internet cafes located on and off campus, with no or minimal charges (approximately $0.30 per hour). The descriptive statistics of access to computers and the Internet also showed that in general participants had fairly easy access to computer technology. When participants were asked to rate their access to computers and the Internet, the majority of the participants reported that it was fairly easy (34.3%) or very easy (38.2%) for them.

Technology proficiency. The second factor, technology proficiency, was also found not to be significant. This may be related to participants' relatively high technology proficiency (see table 10). They reported that they felt confident and comfortable with most language learning related technologies listed in the survey (the only exception was virtual learning environment, such as Second Life and Worldcraft). This is not the only study in which ESL learners showed relatively high technology proficiency and were not greatly challenged by technical skills. In a study of collaborative email exchange for ESL learning, students in secondary schools also reported that computers were in general easy to use for second language learning (Greenfield, 2003).

Table 10

Descriptive statistics of technology proficiency

Technology proficiency	**Mean**	**Sd**
Online chatting (including both text messages and audio chatting)	4.47	.97
Email	4.42	.95
Search information online	4.39	1.02
Download and install software	4.29	1.11
Online multimedia material (e.g., CNN videos, movie trailers)	4.25	1.16
Electronic dictionaries and online dictionaries	4.18	1.14
Online news	4.17	1.11
Online forum	3.91	1.23
Office software (such as word, excel)	3.90	1.20
Game	3.85	1.21
Blogs	3.80	1.27
Virtual learning environment (such as Worldcraft and Second Life)	2.17	1.31

Attitudes towards computers and the Internet. The third insignificant technology-related variable was participants' attitude towards computers and the Internet. More positive attitude towards computers and the Internet technology did not necessarily lead to more frequent technology uses in English learning. A potential explanation for such a disassociation may be the gap between participants' attitudes and their behaviors. In other

words, even though they believed that computers and the Internet technology could be important in their study and life, they didn't always seek and use technology-related resources. Another possible explanation is the distinction between general technology use (as in study, work, and life) and specific technology uses in second language learning. The focus of the survey on participants' attitudes towards technology uses was participants' value of general technology use in their study, work, and life, rather than to what degree they valued technology uses in English learning in particular. What remains unknown is whether there was a considerable gap between technology uses in general and specific technology uses in second language learning. If such a gap was present, then it became very likely that participants with very positive attitudes towards general technology uses did not hold equally high values of technology uses in second language learning.

Factors Affecting Whether an Ego Used Technology to Learn English with an Alter

The most nominated group of alters were those who had taken at least one English course with their ego. Among 314 alters, 175 of them (i.e., 55.7%) had shared some experiences of English course taking experiences with their ego. Half of the alters were enrolled in the same college program with the ego. High school classmates was the third biggest group, with 121 alters (i.e, 38.5%). Approximately one fifth of the alters were college dorm roommates to their ego. Teachers were also identified as alters to some participants, although the percentage (N=11, 3.5%) was low compared to peer groups.

Table 11

Descriptive statistics of alters

	Frequency	Percent[9]
Person with whom the ego had taken at least one English course together	175	55.6
College classmate	157	49.8
High school classmate	121	38.4
College roommate	68	21.6
Teacher	11	3.5
Total number of alters	314	

The dependent variable of this sub-question was dichotomous i.e., whether or not the ego used technology, discussed, or shared experiences of technology use in L2 learning with a certain alter during the past six months. The independent variables at level 1 (the level of alters) and level 2 (the level of the ego and the ego-centered network) are listed in table 12. Descriptive statistics for variables at the two levels are reported in table 13. Level-1 data indicate that 22 percent of the alters were college roommates of the ego (i.e., roommates=1). Accessibility between an ego and an alter was fairly high, with an average of 4.52 out of 5. Alters' average English proficiency was 3.57. On average the social desire of making friends with the alter was 3.85 out of 5. Overall

[9] Please note that the total percentages do not add up to 100 since categories in this table are not exclusive with each other. For example, alters who were an ego's roommates may be his college classmates and they may have taken at least one English course together.

approximately one third (i.e., 31 percent) of the alters were reported to have used technology to learn English with their egos.

Table 12

Names and labels of level-1 and level-2 variables

Level-1 variables	
Variables	Variable label
Social access	The degree of easy access for the ego to communicate and interact with an alter, being rated between 1-5, with 1 for very difficulty access and 5 for very easy access.
Social desire	The average social desire to befriend an alter, being rated between 1-5, with 1 for very low social desire and 5 for very strong social desire.
Tech.use	This is the dependent variable, i.e., whether or not the ego had used technology in L2 learning with the alter, or had shared his/her experiences of technology uses in L2 with the alter.
Level-2 variables[10]	
Variables	Variable label
English strategies	The ego's overall strategies of English learning. This variable is the average score for all the 50 items on English learning strategies. The range of the value of this variable is one to five.
Average English proficiency of all the alters in the social network	The average English proficiency of all alters in the ego's network, rated between 1-5, with 1 for very low English proficiency and 5 for very high language proficiency.

[10] Ego's motivation to learn English was first included as a level-2 variable. It was removed since there was a large correlation between the variable of ego's motivation and ego's English learning strategies ($r = .660$, $p < .001$).

Table 13

Descriptive statistics for socio-networking factors (level 1 and level 2)

	Level-1 Descriptive Statistics				
Variables	N	Mean	Std. Deviation	Minimum	Maximum
Social access	314	4.52	0.816	1	5
Social desire	314	3.85	0.972	1	5
Tech.Eng	314	0.31	0.461	0	1
Valid N (listwise)	314				
	Level-2 Descriptive Statistics				
Variables	N	Mean	Std. Deviation	Minimum	Maximum
English strategies	94	3.18	.608	1.92	5.00
Average English proficiency of all the alters in the social network	94	3.430	.968	1.00	5.00
Valid N (listwise)	94				

Bivariate correlation was conducted for variables at each level to check if the independent variables were associated with each other. The results suggest no association for the variables at level 1 (i.e., the alter's social access and the alter's social desire, see table 14) and for the variables at level 2 (i.e., the ego's English learning strategies, and the average English proficiency of the network, see table 15).

Table 14
Correlation of variables at level 1

		Social desire
Social access	Pearson Correlation	.001
	Sig. (2-tailed)	.981
	N	310

Table 15
Correlation of variables at level 2

		Network English proficiency
English learning strategies	Pearson Correlation	.146
	Sig. (2-tailed)	.160
	N	94

Unconditional Model

A hierarchical model was created to test factors at the levels of alters and egos & networking factors, with an unconditional model and a conditional model. To gauge the magnitude of variation between egos in learning English with technology with their alters, a model with no predictors at either level was estimated. Given a Bernoulli sampling model and a logit link function, the level-1 model is simply

$$\text{Prob}(Y_{ij}=1|\beta_j) = \phi_j$$

$$\eta_{ij=} \log[\phi_j /(1-\phi_j)] = \beta_{0j}$$

Where the level-2 model is

$$\beta_{0j} = \gamma_{00} + \mu_{0j},\ \mu_{0j} \sim N(0,\ \tau_{00}).$$

Here γ_{00} is the average log-odds of using technology to learn English with alters across egos, while τ_{00} is the variance between egos in ego-average log-odds of using technology to learn English with alters. The results of the unconditional model show that ego networks explain a significant portion of the variance of the likelihood of whether an ego uses technology to learning English with an alter ($P < 0.001$, see table 16). Therefore, a conditional model is needed and analysis should be conducted at the levels of alter and ego/network.

Table 16

Final estimation of variance components in the unconditional model

Random Effect		Standard Deviation	Variance Component	Df	Chi-square	P-value
INTRCPT1,	U0	1.27453	1.62442	92	170.85378	0.000

Conditional Model

The hypothesis is that higher probability for an ego to use technology to learn English with an alter will be associated at level 1 with the alter having higher social desire that the ego want to build/maintain friendship, having higher access to communicate with each other. It is hypothesized a "contextual effect" at level 2 such that the higher average English proficiency of all alters in the ego's network will predict more interaction higher probability of ego using technology to learn English with an alter. The other potential predictor at level 2 is the ego's English learning strategies. The hypothesis is that the higher the ego's English learning strategies are, the more likely the ego uses technology in his/her L2 learning.

Specifically, the level-1 structured model is

$\eta_{ij=} \log[\phi_{ij}/(1-\phi_{ij})] = \beta_{0j} + \beta_{1j}$ (social access$_{ij}$)$+ \beta_{2j}$ (social desire$_{ij}$)

That is Log (ego using technology to learn English/(1 – ego using technology to learn English) = $\beta_{0j} + \beta_{1j}$ (accessibility of the alter to the ego) + β_{2j} (the social desire of making friends with an alter).

Both variables at level 1 were group-mean centered in the model. Group-centered mean helps to explain the within-group variance.

Level 2:

$\beta_{0j} = \gamma_{00} + \gamma_{01}$ (Network English Proficiency) + γ_{02} (English strategies) + μ_{0j},

$\beta_{1j} = \gamma_{10}$

$\beta_{2j} = \gamma_{20}$

Both variables at level 2 were grand-mean centered.

Two factors were found to be associated with a higher possibility of an ego using technology to learn English with an alter. These two factors are: 1) the social access between an ego and an alter; 2) the average English proficiency of all the alters in an ego's network.

Table 17

Estimates of level-1 and level-2 coefficients in the conditional model

	Fixed Effect	Logit Link: Unit-specific model	T-ratio	ρ value (T-ratio)	Confidence Interval of Odds Ratio
Social access slope, β_{1j}	INTRCPT2, γ_{10}	0.979	3.320	0.001***	(1.491,4.756)
Social desire slope, β_{2j}	INTRCPT2, γ_{20}	-0.490	-1.978	0.061	(0.367,1.023)
INTRCPT1, β_{0j}	INTRCPT2, γ_{00}	-.356	-3.802	.0000***	(0.004,0.182)
	Average English proficiency of all the alters in the social network, γ_{01}	0.746	2.893	0.005***	(1.264,3.518)
	English strategies, γ_{02}	0.134	0.445	0.658	(0.629,2.080)

p***< .01, two-tailed

Social access between an Ego and an Alter

An ego's access to an alter was associated with higher chance for them to learn English with technology together, $\gamma_{10} = 0.979$, $t = 3.320$, $\rho < 0.01$. Thus, a unit increase in access to an alter increased the log-odds of an ego and an alter using technology to learn English together by exp s (.979) = .2.66. That is, if we compare two alters differ by one unit in the ego's access to the alter but are similar in other ways, we can expect the odds of ego using technology to learn English with an alter with higher access to be 2.66 times the odds of doing that with an alter that the ego has lower access. When using real numbers to this "one unit social access", the variable of social access had a standard deviation of 0.816 (see table 13). One standard deviation difference in Access was therefore associated with a difference in the log-odds of using technology to learn English of 0.816 * 0.979 = 0.799.

An Ego's Social Desire of Making Friends with an Alter

An ego's desire of making friends with an alter was found not associated with the log-odds of an ego using technology to learn English with an alter, $\gamma_{20} = -0.490$, $t = -1.978$, $\rho > 0.05$. The 95% confidence interval on the odds ratio of the social desire between the alter and the ego overlapped 1, indicating the variable of social desire not a useful predictor. When the odds ratio is 1, a change in the independent variable is not associated with a change in the odds that the dependent variable equals a given value.

Average English Proficiency of all the Alters in an Ego's Network

At level 2, average English proficiency of all alters in an ego's network was a statistically significant predictor, holding other predictors constant, $\gamma_{01} = 0.746$, $t = 2.893$ ($\rho < 0.05$, two tailed). Translating the results into predicted probabilities may further illustrate the findings of the study. If an alter had an average English proficiency

and belonged to a typical ego, the predicted log-odds of using technology to learn English with his/her egos would be -.356, corresponding to a probability of 1/(1+expss = .412. Adding one unit to SN_ENG_0 (the average English proficiency of all the alters that belonged to the same ego) would lead to a predicted log-odds of -.356 + 0.746 = .390, associated with a predicted probability of 0.596. An additional unit increase in SN_ENG_0 would lead to a predicted log-odds of -.356 + (2) * 0.746 = 1.136, corresponding to a predicted probability of .757. As demanded by logic in this Bernoulli model, successive increments to the variable of English proficiency of the network lead to smaller decrements in the predicted probability, instead of linear increments in a linear model.

English strategies

The variable of an ego's English learning strategies was not associated with the log-odds of an ego using technology to learn English with an alter, $\gamma_{02} = 0.134$, $t = 0.445$, $\rho > 0.05$. The 95% confidence interval on the odds ratio of the social desire between the alter and the ego overlapped 1 and suggested it not a useful predictor.

Discussion

In summary, data regarding social factors reveal that the likelihood of an ego uses technology in learning L2 with an alter is associated with social access and the average English proficiency in the ego's network. These findings are congruent with literature on how adolescents' behavior is influenced by people and resources they get from social relationships (Berndt & Murphy, 2002; Cairns & Cairns, 1994; Chen et al., 2003; Crosnoe, 2000; Dornbusch, 1989; Sizer, 1984). In this study, the learner draws on his/her social capital and gets information and help regarding using technology to learn English

that is not formally required. These findings went well with the hypotheses of the study. What was inconsistent with the hypotheses of the study was that social desire to make friends with the alter has no influence. One possible explanation is that using technology to learn English with the alter may be a very specific activity and may not be viewed as much sharing experience as "course-taking" may have provided (Frank et al., 2008). As a result, the experience of using technology to learn English may not satisfy the ego's desire to build or maintain friendship with the alter and is therefore not positively associated.

Summary

Technology use in L2 learning is not as ideal as the great potentials of technology that have been repetitively claimed. Instead, technology use in L2 learning is multi-faceted. Although technology starts to be used by learners in L2 learning, there are variations among the frequency of individual learners' technology use. Variations are also found in learners' technology use by application.

Social network factors play a role in how learners use technology to learn English. Social network factors not only affect how frequently learners use technology in L2 learning, but also influence whether or not a learner uses technology to learn English with a certain alter in his network.

CHAPTER 5

CONCLUSIONS AND IMPLICATIONS

Conclusions

Several conclusions can be tentatively drawn from this study. First, technology use in L2 learning is multi-faceted. On the one hand, technology plays a role in learners' language learning, as evidenced by the decent total numbers of hours of technology use found in this study. On the other hand, newer technology (e.g., instant messenger and blogging), in spite of their great potentials in facilitating L2 learning (Al-Seghayek, 2001; Beauvois, 1997; Bernstein et al., 1999; Cahill & Catanzaro, 1997; Chun & Plass, 1996; Egan, 1999; Harless et al., 1999; Hulstin et al., 1996; Kelm, 1998; Knight, 1994; LaRocca et al., 1999; Laufer & Hill, 2000; Meskill et al., 1998; Salaberry, 2001; Stannard, 2006; Wachowicz & Scott, 1999; Warschauer, 1998), is occasionally used by English language learners. This finding may disappoint those who are advocating the use of computer-based technology in L2 acquisition (Blake, 2000; Chapelle, 1998; Dolog, Henze, Nejdl, & Sintek, 2004; Garret, 1991; Salaberry, 2001; Y. Zhao & Lai, 2007). However, this finding is well connected to previous studies on technology uses in learning in general. First, it supports researchers' doubts about the gap between the potentials of technology in education and the reality of technology uses (B. C. Bruce, 1993). Second, it resonates with researchers' concerns about technology being underused in learning subject areas (Cuban, 2001; Jacobsen, 2002).

A second conclusion that can be drawn from this study is that social factors influence learners' use of technology in L2 learning. As reported earlier, the average English proficiency of alters in their social network is found to be a statistically significant predictor of the frequency of technology use by L2 learners. In addition, social factors (e.g., the average English proficiency of all alters in the learner's network, and social access) are found to be associated to whether an ego used technology to learn English. This result goes well with previous findings on the influence of social factors on teacher technology adoption. For example, research has found that technology adoptions by teachers are associated with social factors such as the access to expertise through help and talk (Yan, 2006).

Implications

This study makes an important contribution to our understanding of computer technology uses in second language learning. First, the finding of second language learners' relatively limited use of newer technology in English learning should concern researchers and educators. As shown in this study, access to technology-supported language resources does not automatically lead to learners' actual uses. The limited use of newer technology makes it unlikely to realize the facilitative role that computer technology could have played in second language learning. This finding has significant implications in that it calls for more awareness of the scarcity of use of newer computer technology by L2 learners. A follow-up need that should be answered is how to promote technology uses by L2 learners. The following sections discuss a few implications of how to help learners use technology to facilitate their English learning.

Conditions other than Input

As observed in this study, technology was used mainly to get only one condition in an optimal language learning environment, i.e., language input. A huge discrepancy was found between the potentials and realization of newer technology in providing the other two conditions, i.e., opportunities for language use and language input. L2 learners may need some assistance with using technology to create these two conditions. Introducing technology-supported language resources that can create these two conditions to L2 learners may be helpful. Teachers can introduce such technology-supported language resources in their English classrooms. Workshops may be another good channel for learners to explore various technology-supported language resources.

Social Factors

Learners' social relationship has been found to significantly influence their use of computer technology in second language learning. As the results of this study show, the average English proficiency in a learner's network influences not only how frequently the learner uses technology in L2 learning, but also influence whether or not the learner uses technology to learn English with his peers. As social factors play a vital role in learners' use of technology in second language learning, means should be sought to help learners to learn second language with computer technology in a socially constructed context. When designing learning activities, teachers should take learners' social factors into consideration. Teachers are expected to design activities that not only encourage students to adopt more technology-supported language resources in their L2 learning, but also highlight the social networks that learners belong to. For example, if a teacher plans to use blogs to teach English writing, in addition to asking students to publish their writing in their blogs, the teacher may encourage students to read each other's writing and give

feedback to each other. Or, the teacher could ask students in the same dormitory to write a group blog instead of each student finishing their individual blog.

Social factors such as social access should also be considered by designers of learning software and virtual learning environments. Opportunities should be provided for learners to communicate and interact with each other when they use the software or when they are in the virtual environment. Designers may consider multiple channels (such as synchronous and asynchronous communication) to meet learners' different needs.

Limitations

Three limitations of this study should be noted. First, the design of ego-centered network in this study includes some clustering of alters. That is, in some cases, an alter in the network of ego X may also be nominated as an alter in the network of ego B. The impact of this limitation is mitigated to some degree, however, by the fact that 77 percent of all alters were nominated only once.

A second and probably more significant limitation of this study is the specificity of the context of the study. The context of the study has to be considered when interpreting findings of this study. The context of this study includes, but is not limited to, personal information such as participants' education background, their age, and their technology proficiency. The contextual factors could also refer to the availability of technology resources as provided for those participants, and their higher education experiences.

A third limitation is that the data of the study come from students' self reports. The validity of the data and the analysis of the data are based on the degree to which participants were telling the truth in the survey.

Directions for Future Research

At a broad level there is a need for further research looking at students' use of computers and the Internet in L2 learning rather than simply focusing on the great potentials of these newer technologies in L2 learning. Most critically, it is important to study a fundamental premise on which calls for greater attention to how learners use technology to create their optimal language learning environment – that greater experience with newer technologies could create critical language conditions that would be otherwise difficult if not impossible for L2 learners.

One area in need of investigation regards how to help learners to use technology to create language learning environments for specific language goals. New studies can focus on how to create technology-enhanced language learning environment to develop specific language skills, such as vocabulary learning, reading comprehension, writing, listening, and so on.

Another area in need of investigation regards language strategies (Zoltan Dornyei, 1994, 2006; Ehrman & Oxford, 1995; Gardner et al., 1997; O'Malley et al., 1985; R. L. Oxford & D. Crookall, 1989) and technology uses. The findings of the study also call for development of new definition and measurements of English learning strategies. New definitions of language learning strategies need to include the techniques and skills to learn English with technology. Accordingly, new measurements of language learning strategies should ask about the strategies that learners use when they learn English with technology.

Thirdly, more studies on the actual effects of using songs and movies in English learning are needed. Although it is well documented that songs and movies may facilitate

students English learning in the experiment settings (i.e., participants in the experimental condition listened to songs or watched movies in the target language and then took tests of certain language skills), it is understudied how substantial students-initiated activities of listening to songs and watching movies may have impacted their language learning. More research along this line is needed. In the mean time, since more and more learners are multitasking nowadays, there is an increased need to study the effect of such activities on language learning when learners multitask.

A fourth area of research needed has to do the methodology of social networking analysis in second language learning. It is well documented in this study that social networking factors have significant influence on how learners use technology to learn English. As a relatively new research method, social networking analysis has been more and more adopted in different disciplines, including English as a second language (D. Xu, Wang, & Li, 2008). The current study suggests an increased need of applying social networking analysis in our future research, especially when research questions may be related to social influences in second language acquisition in general or technology uses in second language acquisition.

Appendix

Appendix A: Zero-order and part correlation coefficients with the frequency of technology use in L2 learning

Model	Unstand-ardized *B*	Std. Error	Standardized *B* Beta	t	Sig.	Collinearity Statistics Tolerance	VIF
(Constant)	-12.377	10.451		-1.184	.240		
Network English proficiency	4.466	1.116	.382	4.001	.000**	.926	1.080
Access to networks	1.912	1.799	.110	1.063	.291	.789	1.267
Social desire of a network	-1.754	1.089	-.155	-1.610	.111	.918	1.090
Technology access	1.058	1.185	.098	.893	.375	.709	1.411
Technology proficiency	-.903	1.928	-.067	-.468	.641	.416	2.402
Motivation	-5.435	2.440	-.282	-2.228	.029*	.529	1.890
Strategies	7.523	2.582	.405	2.914	.005**	.438	2.282
Technology attitude	.238	1.946	.016	.122	.903	.501	1.997

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