THE ROLE OF TASKS IN THE INTERNET HEALTH INFORMATION SEARCHING OF CHINESE GRADUATE STUDENTS

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The purpose of the study was to examine the relationships between types of health information tasks and the Internet information search processes of Chinese graduate students at the University of North Texas. The participants' Internet information search processes were examined by looking at the source used to start the search, language selection, use of online translation tools, and time spent. In a computer classroom, 45 Chinese graduate students searched the Internet and completed three health information search tasks: factual task, interpretative task, and exploratory task. Data of the Chinese graduate students' health information search processes were gathered from Web browser history files, answer sheets, and questionnaires. Parametric and non-parametric statistical analyses were conducted to test the relationships between the types of tasks and variables identified in the search process. Results showed that task types only had a statistically significant impact on the time spent. For the three tasks, the majority of Chinese graduate students used search engines as major sources for the search starting point, utilized English as the primary language, and did not use online translation tools. The participants also reported difficulties in locating relevant answers and recommended ways to be assisted in the future when searching the Internet for health information. The study provided an understanding of Chinese graduate students' health information seeking behavior with an aim to enrich health information user studies. The results of this study contribute to the areas of academic library services, multilingual health information system design, and task-based health information searching.

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CHAPTER 1

INTRODUCTION

Purpose of Study

The purpose of this study was to examine the relationships between types of health information tasks and the Internet information search processes of Chinese graduate students at the University of North Texas (UNT). The search process was analyzed by looking at the source used to start the search, language selection, use of online translation tools, and time spent.

Background

In the United States (U.S.), looking for health information online is one of the most popular online activities, and more than 80% Internet users and 59% of all adults have searched health information (Fox, 2011). Internet health information covers a variety of health topics, and the content varies in the level of depth. Searching for health or medical information is one of the most common online activities next to email and product or service research (Fox & Fallows, 2003). The top three health topics searched are a specific disease or medical problem, certain medical treatment or procedure, and exercise or fitness (Fox & Jones, 2009). At the same time, Internet health information has impacted users' utilization of health information. About 60% of Internet health information seekers report that information found on the Internet assists them in making medical decisions, maintaining health, and having discussions with their doctors (Fox & Jones, 2009). The Internet has become increasingly important as a source of health information (Cohen & Stussman, 2010).

The popularity of searching Internet health information and its health-related impact has generated research studies. Researchers are interested in users' health information needs and information behaviors (e.g., Dutta-Bergman, 2004; Graham, Tse, & Keselman, 2006). Numerous studies of Internet health information seeking have focused on who searches for health information online, why they choose Internet as their medium, what kind of information sources they use, and how they search (e.g., Eysenbach & Köhler, 2002; Morahan-Martin, 2004). User studies have been conducted on groups of health professionals, patients, women, seniors, college students, or people of low literacy (Beverley, Bath, & Barber, 2007; Casebeer, Bennett, Kristofco, Carillo, & Centor, 2002; Flynn, Smith, & Freese, 2006; Ivanitskaya, O'Boyle, & Casey, 2006; Murray et al., 2006; Sillence, Briggs, Harris, & Fishwicka, 2007). Attention has also been paid to digitally divided minorities, such as Hispanics, Africa Americans, and Asians (e.g., Cleveland et al., 2008; Pena-Purcell, 2008). The barriers of language, medical terminology, culture and social economic levels have been identified in Internet health information searching (Edejer, 2000; Morahan-Martin, 2004). Through the analysis of multilingual search logs, users from different backgrounds behave differently and have identifiable patterns in their searches (Ghorab, Leveling, Zhou, Jones, & Wade, 2010). The cross-cultural Internet health information searching is complicated in searching patterns, types of sites visited, and usage of online information (Harris, 2002).

Health information searches usually start from an inquiry comprising of either internal personal health concerns or external needs for others. In the area of information science, query, query formulation, and query analysis are often discussed in relation to information retrieval systems. The term, *task*, has been mentioned often in the context of information seeking

process. Vakkari (2003) defined *task* as an activity to be performed in order to accomplish a goal. Users need to accomplish search tasks through a series of actions with information resources on the Internet.

English and Chinese are the most widely used languages on the Internet. Multilingual users in multilingual environments are able to take advantage of various information resources written in multiple languages. However, multilingual searching on the Internet has not been well explored (Rieh & Rieh, 2005). There are research gaps in information seeking in the multilingual world (Zhou, 2006).

Chinese students are the largest group of international students in the United States (Institute of International Education, 2011). The U.S. continues to be the top destination for Chinese students seeking higher education overseas. In 2011, there were 157,558 Chinese students studying in the U.S. and the rate of change increased to 23.5% (Institute of International Education, 2011). At the UNT Denton campus, a total of 332 Chinese students were enrolled in Fall 2011, which is almost four times larger than the enrollment number of 85 in Fall 2006 (University of North Texas, 2006, 2011).

Problem Statement

Although Chinese students represent a significant demographic group in the U.S., there is limited knowledge of their Internet health information search processes. No study had been conducted on factors that may influence the Internet health information search processes of Chinese students in the U.S. This is the problem addressed in this dissertation. This study examined how these Chinese graduate students conducted Internet information searches to complete different types of search tasks.

Designing health information systems for diverse populations has been hindered by a lack of knowledge about the information seeking behavior of different cultures. This dissertation is specifically concerned about the impact of types of health information search tasks, in regards to the Internet information search processes of Chinese students. How do different types of health information tasks influence their Internet information search processes?

Significance of Study

Research on the factors that influence Chinese students' Internet health information searching not only helps information professionals to understand Chinese individual's health information seeking behavior, but also enriches health information user studies in general. Understanding how Chinese students search for health information can assist in information systems design and library services geared toward underserved minorities.

There is a need for information systems design to focus on constructing language and culture sensitive health information sources for minorities (Cleveland et al., 2009). The experiences of Chinese students' Internet health information search processes provide first-hand data to understand how they seek information. How people search information is a major aspect of database interface design and functions modeling. The study can assist system developers in gaining a greater understanding of the searching practices of Chinese students.

Regarding library services toward underserved minorities, this study may be useful for libraries to design instructional training tools to help minorities to efficiently access online health information sources.

Definitions

Chinese graduate students: International graduate students from China enrolled in the University of North Texas, Denton Campus.

Exploratory task: A task which can broader a searcher's knowledge of a topic.

Factual task: A task which asks a searcher for specific data.

Information search process: A progressive series of activities that begin with a question and culminate in the identification of sources and information that aim to address the question. In this study the activities investigated are (a) sources used to start the search, (b) the selection of the language used in the search, (c) the use of online translation tools, and (d) the search time spent.

Internet health information: Any health related information available on the Internet, regardless of the origin or format.

Interpretive task: A task that requires a searcher to think and to configure an answer.

Task: An activity to be performed in order to accomplish a goal (Vakkari, 2003).

Task types: There are three types of tasks which are adopted from Kim's study (2009), factual task, interpretive task, and exploratory task.

Online translation tools: Online bilingual dictionaries or any online assistant tools which can help the term translation from one language to another language.

Research Questions

The global research question of this study was: Do the types of tasks have any effect on the Internet search processes of Chinese graduate students looking for health information?

The following research questions and hypotheses were addressed in this study:

R1. Do Chinese graduate students vary in the selection of sources used to start their search depending upon the types of health information tasks?

H_0. There is no significant difference in the selection of sources used to start their search among the types of health information tasks.

R2. Do Chinese graduate students vary in their language selection depending upon the types of health information tasks?

H_0. There is no significant difference in their language selection among the types of health information tasks.

R3. Do Chinese graduate students vary in their use of online translation tools depending upon the types of health information tasks?

H_0. There is no significant difference in their use of using online translation tools among the types of health information tasks.

R4. Do Chinese graduate students vary in the time spent depending upon the types of health information tasks?

H_0. There is no significant difference in the time spent among the types of health information tasks.

Assumptions and Limitations of Study

It was assumed that Chinese graduate students were proficient in both the English and Chinese languages. Graduate students were assumed to have experience searching the Internet. Also, it was assumed that participants in the study would answer the questionnaires truthfully.

This study was limited to Chinese graduate students at the University of North Texas. Forty-five Chinese graduate students participated in the study. This selected group of Chinese students was not representative of the whole Chinese population in the U.S.

This was a within-group experimental study. It focused on the types of health information tasks and did not cover other factors which influence the Internet health information search process, such as, cognitive styles and health conditions. The time spent was

estimated and not absolutely quantified, due to the nature of the logging function in the Web browser used.

Summary

Searching Internet health information is one of most popular online activities. Internet health information has impacted on Internet users. To design health information systems or sources for diverse populations requires a good understanding of their information seeking behaviors. There is little known about Internet health information search processes of Chinese graduate students. There is a need for research to address this issue and support the information services and system design which aim to help Chinese students efficiently access health information.

This chapter provided a brief introduction to the study. The specific purpose of the study was to examine the relationships between types of health information tasks and the Internet search processes of Chinese students. Chapter 2 presents theoretical perspectives of health information seeking behavior, and discusses studies on search tasks, Web search behavior, multilingual information searching, and Internet health information.

CHAPTER 2

LITERATURE REVIEW

Introduction

The purpose of this chapter is to establish the existing theoretical and practice framework in which the research is situated. This chapter presents information behavior theories and models, characteristics of users, search tasks, Web search behavior, multilingual information searching, and Internet health information. In information science, the user is the center of information behavior theories, and the characteristics of users are associated with the behaviors in their information search processes. With the development of the Internet, online behavior has become a new branch of behavior studies. A task can lead to an information search, and is often used in experimental research to analyze users' behaviors. Research on the area of multilingual information searching is needed. Studies of Internet health information provide a better understanding of users' search for this type of information on the Internet.

Information Behavior Theories and Models

Information behavior is a fundamental branch in information science. In the last three decades, information seeking behaviors have been conceptualized and studied (Case, 2002). Fisher, Erdelez, and McKechnie (2005) identified 70 theories which had been used in information behavior research since 1978. The most discussed important information seeking behavior theories and models in the field of health information research include Dervin's sense making (1992), Granovetter's strength of weak ties (1973), Johnson and Meischike's comprehensive model of information seeking (1993), and Kuhlthau's information search

process model (1993). These major theories or models are presented in this section, including an overview, applications in health information research, and how they are related to this study.

Sense Making

Dervin's sense making theory focuses on an individual in a situation, who faces a gap and builds a bridge over the gap using different sense making strategies and assesses the outcome in order to move to the next stage of information seeking. Dervin added emotional, physical, and spiritual feeling as ways of gap-bridging along with ideas. Dervin (1992, 1999) developed sense making methodology as a process or dialog oriented approach of defining research questions, interviewing informants, analyzing data, and drawing conclusions. The core of sense making theory is a gap, and a need to solve a problem. Dervin's theory of sense making has set new directions in understanding dynamic, personal, and context-laden nature of information behavior (Case, 2002). The major contribution of sense making is emphasizing the view of information services from a user-centered view rather than a system-centered view, and using effective communication methods to identify what is on an individual's mind and what he or she is looking for in order to bridge the gaps (MacCall, 1999). The applications of sense making can be found in the studies of information needs and barriers, reference librarians' interactions, information design, and knowledge management systems (Dervin & Dewdney, 1986).

Health is a big area of sense making applications (Baker & Pettigrew, 1999; Dervin, Harping, & Foreman-Wernet, 1999; Dervin, Jacobson, & Nilan, 1982; Dervin, Nilan, Krenz, & Wittet, 1982; Frenette, 1999; Nelissen, van Eden, & Maas, 1999). Dervin (1982) and others found that cancer patients' most important questions were the ones they received least help

with. Cardillo (1999) studied health communications and adolescent illness using sense making. Frenette (1999) examined information needs of people when they cease smoking. Using sense making methodology, Nelisese et al. (1999) investigated the quality of information services to cancer patients in the hospitals. Dervin et al. (1999) conducted sense-making interviews with drug-addicted pregnant mothers who wanted to be listened to and supported in their real material lives. Dervin (2005) worked with the National Library of Medicine (NLM) and came up with 25 guidelines for health information outreach to vulnerable populations.

For the studies mentioned above, sense making has been well used in identifying health information needs, information services evaluation, and health information outreach. For studies on health information searching on the Internet, sense making can help the design of health information tasks which should reflect targeted users' information needs. Sense making can help to understand users' Web movements from one step to another step by modifying search terms and uses of information tools, which brings them closer to locating the answers to health questions. In the design of health information systems, sense making can contribute to a better understanding of users' needs and to creating useful information tools to assist their search processes.

Strength of Weak Ties (SWT)

Granovetter (1973, 1983) proposed a theory of SWT on how people look for a job through their social networks. SWT is derived from sociology and has been adopted in information science. SWT explains the information flow in a social network among different types of connections. SWT helps to identify channels of information communication and from where and whom individuals can get useful information. Morey (2007) found that surveyed

African Americans depended most on health professionals (weak ties) for health information, and the Internet was an important media for health information.

Though, few studies have been conducted on health information seeking behavior, SWT has still been considered as a potential method in this area, and can be applied in information direction, information use, and information origin (Baker & Pettigrew, 1999).

SWT provides a social network view of information flow and explains the social channels where users can obtain useful information. Many websites of diseases-based support communities are open for patients and their family members to share health information and their own experiences living with diseases. These online social communities are sources of health information.

Comprehensive Model of Information Seeking (CMIS)

Johnson and Meischike (1993) developed a comprehensive model of information seeking (CMIS) exploring the characteristics of health information sources. CMIS is considered the most extensive model of the health information-seeking process (Rice & Katz, 2001). CMIS integrates three theoretical perspectives pertaining to health behaviors and media use: (a) the health belief model; (b) uses and gratifications research; and (c) a model of media exposure and appraisal. In CMIS, four health-related factors (demographics, direct experience, salience, and beliefs) determine two information carrier factors (perception of information carrier characteristics and utility), through all of which information-seeking actions are determined (Johnson & Meischke, 1993).

In CMIS, demographic factors such as socioeconomic status are associated with health behaviors, which influence source selection. An individual's direct experience with a health

condition or disease can be a significant factor contributing to information seeking (Johnson & Meischke, 1993). Salience refers to how an individual feels about the health treatment he or she received. Beliefs are an individual's perception of the future prevention and the control of health conditions. These four factors are taken together to determine information carrier characteristics and utility of information sources. Information carrier characteristics involve a direct evaluation by an individual of a particular medium. Specific information carrier characteristics investigate editorial tone, understandability, and communication potential. Utility refers to whether the information is important and relevant to an individual's specific needs. Information seeking actions mean the activities carried out, choosing the search methods to narrow the scope and increasing the depth of search.

CMIS has been often used in the studies of cancer information seeking. Johnson and Meiscke (1993) studied the use of magazines among cancer patients to test this model, and found that health related factors contributed little to information seeking and information factors had more power. Based on CMIS, an intervention framework is created to help people with their genetic information seeking skills (Johnson, Andrews, & Allard, 2001). According to the patients' characteristics, patterns of online cancer information seeking differ (Han et al., 2008).

CMIS identifies the components in individuals' health information seeking. CMIS connects health-related factors with health information selection. For studies on Internet health information searching, it is important to understand users' characteristics and their search experiences with health topics.

Model of the Stages of Information Search Process

In the 1980s and1990s, Kuhlthau conducted multiple studies to investigate the affective aspects (cognitive and physical) in the process of information seeking. From these studies, Kuhlthau (1993) developed an information search process (ISP) model. The ISP model describes users' experience in a six-stage process of information seeking as a series of thoughts, feelings, and actions. The six stages include (a) task initiation, (b) topic selection, (c) prefocus exploration, (d) focus formulation, (e) information collection, and (f) search closure. The ISP model considers information seeking as a process of construction and learning, and uncertainty in early stages of the process. The principle of uncertainty is central to ISP, because it connects cognitive thoughts and affective feelings in the information search process, and it indicates a zone of intervention, as well as information needs, or the gap, where users may need external assistance. Kuhlthau's (2008) information search process model is useful in analyzing user behavior. The ISP model presents users' information searching processes in work and daily life, their problems, and uncertainties. Warner and Procaccino (2004) examined how women sought health information using the ISP model.

As stated in the ISP model, the information search process is a process of learning. Internet health information users gain the knowledge about health issues they search. Usually, users only have little knowledge about health issues when they start to search the Internet for health information. With further searches, the more they know, the closer they locate accurate answers. The ISP model identifies six stages which can analyze users' search steps during their online information seeking, especially when they cannot locate a direct answer by a quick search.

The four information behavior theories and models discussed above provided information about different approaches to understanding information seeking. These theories and models provided a framework for this study in order to understand why Internet users look for health information, how they search for information, where they can obtain information, and how they select information sources. Though this study did not apply any specific theory or model to address the research questions, they aided in understanding users and their information search processes. The following section focuses on characteristics of users.

Characteristics of Users

Since the 1970s, user centered studies have increased in information science and much of the research has focused on human factors (Cotten & Gupta, 2004). Case (2002, 2006) reviewed the categories of information seekers by occupation, roles, demographics, and theories and methods used to study information seekers. Fisher & Julien (2009) categorized information behavior studies into the following: academics, scientists, students, occupational groups, people and everyday life, and people and health contexts.

Users' characteristics and user factors involve understanding users' demographics, information skills, individuals' personalities, cognitive styles, and psychological factors. A user's demographical make-up include age, gender, race, culture, language, education, domain knowledge, social economics, income, and social status, all of which can have an impact on the information search process.

Types of information behaviors exist with different levels of information skills and Web experiences. Marchionini, Dwiggins, Katz, and Lin (1993) suggested that individual searcher characteristics were one of four factors in browsing, and these characteristics included

experience and knowledge about the object sought, motivation, purpose, learning pattern and cognitive style. Studies on Internet users also discuss cognition, psychological factors, and personalities.

Demographics

Demographic characteristics are the baseline to understand users. In online health information research, demographical variables are often used to compare the use of online information among different age groups and races.

The 2002 Pew Internet Health Report stated that the groups most likely to go online for health information were women, Internet users younger than 65, college graduates, those with more online experience, and those with broadband access (Fox & Rainie, 2002). Women were more likely than men to use the Internet to obtain health information (Kaselman, Browne & Kaufman, 2008). Among senior citizens, more years of education and high cognitive scores increased the odds of online information seeking (Flynn et al., 2006). Age, income, and education were the key factors to discriminate online and offline health information seekers (Cotten & Gupta, 2004).

In the studies of health information seeking behaviors, special attention has been given to health care providers, such as physicians and nurses; to health information heavy users, such as patients with cancer or other chronic diseases; to women who are care givers; and to lay individuals and vulnerable groups who have limited abilities to access to Internet health information, such as minorities, seniors, and people with low literacy. Health status is another important term used in health information research. Research shows that less healthy people are more apt to use the Internet to find information relating to physical and mental health

issues, compared to those who report better health status (Houston & Allison, 2002; Fox et al., 2000).

Culture and language also need to be considered, as well as social status and income, since these are a major cause of the digitally divided. For the study of cancer patients' health information behavior, Kakai et al. (2003) mentioned the importance of recognizing their culturally developed world views. Dervin (2001) stated that cultural identity applied to how people make sense of the world, though there were no relationships between cultural identity and health information seeking in many studies.

Traditional health beliefs and health practices are part of Chinese culture. Chinese have rooted cultural health beliefs even though they experience modern medicine (Lim, Schwarz, & Lo, 1994). Ma's study (1999a, b) found that Chinese participants were more likely to self-determine the severity of a condition/disease, and thought that diseases could be treated through the use of nonprescription drugs. Poor competency in English could hinder communication, affecting health seeking behaviors and decisions making.

Web Experiences, Search Skills, and Domain Knowledge

Web experience and domain knowledge affect information behaviors. Internet skills mean the ability to use the Internet efficiently, which promise a successful search. Poor Web experiences increase errors and cause longer interaction (Wang et al., 2000). Domain knowledge provides an advantage to locating the right sources, evaluating search results, and making good decisions.

Hölscher and Strube (2000) found that successful search performance required the combination of Web experience and domain knowledge. Differential and combined effects can

be identified through specific strategies directly related to Web experience and domain knowledge. Internet professionals used advanced search strategies if no relevant documents were found, including reformatting of existing queries, changing search engines, and requesting additional result pages, as well as going back to earlier result pages or queries. Internet users' difficulties in formulating and evaluating medical hypotheses are rooted in their domain knowledge (Kaselman et al., 2008).

Cognition, Psychological Factors, and Personalities

On the user's side, the cognitive factor is considered the most important element. The cognitive factors affecting cognitive style are likely to affect the search process. Goldstein and Blackman (1978) investigated how cognitive abilities, cognitive style, and problem solving style were related to search performance. For health information seeking, Dervin and Frenette (2001) concluded that cognitive involvement is a more fundamental and explanatory predictor than the characteristics of information source, channel, message, and receiver. Among different cognitive styles, Witkin's field dependence/field independence is one of the most extensively researched approaches (Kim, 2009). Field dependent individuals and field independent individuals differ in their structuring and analytic skill abilities; the field independent individuals are more engaged in structuring and analytic activity, which field dependent individuals are less good at (Ford, Wilson, Foster, Ellis, & Spink, 2002; Clewley, Chen, & Liu, 2010). These individuals with strong field-dependence tendencies are likely to have greater difficult in the Web environment and are more easily confused than those who are strongly field independent (Wang, Hawk, & Tenopir, 2000). The field dependent individuals spend more time than the field independent individuals on Web search (Kim, 2009).

Zhang (2008) explored effects of undergraduate students' mental models of the Web on their online searching behaviors. In her study, students with a different mental model showed different performance and feelings during interactions with the Web. All of the students with a good understanding of the Web spent most of their time on search tasks and performed the best search. When the students felt that the tasks were difficult, they were less satisfied with their performance.

In the study of the influences of personalities and psychological factors on students' searching behaviors, Heinström (2005) identified three information seeking patterns of fast surfing, broad scanning, and deep diving. He found that these patterns were significantly related to students' study approaches. Fast searching connects a surface approach and emotionality, low openness to experience and low conscientiousness. Broad scanning has a relationship to extraversion, openness, and competitiveness. Deep diving is associated to analytical students who have a deep and strategic study approach. Heinström (2006) observed that an energetic personality, high motivation, and positive emotionality could increase likelihood for incidental acquisition, while low motivation, stress, and insecurity reduce receptivity. Also, affective and physical factors can support or hinder a search interaction. Positive and negative feelings can be affected by the search process and results. A positive feeling often comes after a successful action, but a negative feeling can result in quitting. However, these factors have not often been studied in the area of Internet health information searching.

These users' factors discussed above explain various information search patterns. This study collected data on users' demographics, Web experiences, search skills, and domain

knowledge, but did not measure factors of cognitive styles, psychology, and personality because they were not within the scope of this study.

Search Tasks

Tasks can lead to the information search process and have an impact on information seeking behavior. This section reviews the roles of search tasks, the attributions and their association with information searching, as well as task types.

The Roles of Tasks

Vakkari (2003) defined a task as "an activity to be performed in order to accomplish a goal" (p.416). He viewed a task from two perspectives: 1) from a construction perspective, tasks can be complicated by multiple subtasks, and 2) from a functional perspective, task performance can include physical and cognitive actions which lead to a meaningful use. In information science, the task is regarded as one of the most important factors in determining information seeking behaviors as related to information needs. Tasks can initiate information searching, and task studies usually focus on information searching in electronic environments. Tasks are often linked to information search and search tactics, such as term selection, relevance judgment, and information system use. Also, Vakkari (2003) stated that "it is sufficient to characterize the tasks in a way that helps to identify for the purpose of analysis" (p.417).

Tasks' Attributes and their Associations with Information Search

The attributes of tasks can be viewed by their structure, content, and difficulty/ complicity. The structure of a task can be classified into the categories of open or closed, ill-defined or well-defined. The expression of tasks can be worded in the questions of who, what,

when, where, why, how, pros, and cons. The content of tasks is mostly related to the information topics and knowledge domains. Tasks can also be divided into either generic or specific topics. Toms, Freund, Kopak, and Bartlett (2003) observed that participants searched Google for search tasks from four domains (consumer health, shopping, travel and general research), and the results indicated significant differences by the domain. Many researchers use other specific tasks characteristics to explain information seeking activities. Task complexity and difficulty of task are often addressed.

One important characteristic of tasks, task complexity, is often used to differentiate tasks in domains such as information studies. Campbell (1988) pointed out that task complexity increases information load, diversity, or rate of changes. Input, performance, process, and output of a task can be also predicted by task complexity (Byström, 2002; Byström & Jarvelin, 1995; Tiamiyu, 1992). Byström and Jarvelin (1995) used task complexity to explain variation in the types of information, information channels, and sources. Gwizdka and Spence (2006) found that task difficulty was related to Web search performance. The task complexity is correlated with the Web search interaction (Kim, 2006). In the previous studies, task complexity is subjective and measured by users (Campbell, 1988; Kim, 2006). Subjective task difficulty was found to be influenced by an individual's search effort, cognitive difference and mental effort (Gwizdka, 2008). When having difficulty finding information, users used more queries and spent more time on search results pages (Aula, Khan, & Guan, 2010).

These studies on tasks' attributes and their influence on users' information behavior provided a better understanding of the concept of the task, and also helped the researcher recognize the importance of using tasks on information studies.

Task Types

Researchers have discussed various task attributes, have characterized a task along a number of attributes, and have classified tasks into types of tasks (Kim, 2006; Thatcher, 2008; Terai et al, 2008). Kim (2006) summarized task attributes into structure, goal, topic, expected information and expected outcome, and developed three types of tasks: factual task, interpretive task, and exploratory task. The three types of tasks are different, with regards to information needs, outcome, format of question and form of action. Kim (2006) further investigated the way different types of tasks were related to different searching behaviors and significant differences in information searching interaction and searching strategies were found between types of tasks.

Types of tasks can be simply defined by purposes/goals or actions. In a study of the influence of Web experience and task type on Web search strategies, Thatcher (2008) used researcher-defined and participant-defined tasks, each of which included a directed search task and a general-purpose browsing task. For each task, Thatcher discussed the patterns of use and difference, though there was not a statistically significant relationship with the distribution of search strategies by Web experience. Toms et al. (2007) considered fact finding (to find specific information), information gathering (to collect information on a topic), and decision making (to select a course of action from multiple sources) as common types of tasks which included the levels of search goals. Terai et al. (2008) examined the performance of an informational task (a basic information-gathering task) and a transactional task (an interactive search task characterizing typical activity) in online information seeking, and identified the difference in numbers of Web pages visited and the reading time for each page. Visiting information gained

from a focus group, Kellar, Watters, and Shepherd (2007) defined five task categories: fact finding, browsing, information gathering, transactions, and others. Browsing was defined as visiting webpages without any specific goal. Their study found differences in how participants used Web browsers, and information gathering tasks were the most complex.

Other task types are discussed by their structure, such as single session and multi-session tasks; simple, hierarchical, and parallel tasks; or primary task and secondary task (Liu, Gwizdka, Liu, Xu, & Belkin, 2010; Gwizdka, 2009). Gwizdka (2009) studied three categories of task structures: simple, hierarchical, and parallel. Different from a single session task, the relationships between multiple subtasks can be parallel or dependent, and Liu and Belkin (2010) applied multi-session tasks to predict the usefulness of retrieved documents. In addition, Gwizdka (2009) conducted a dual-task approach to assess cognitive load on Web search tasks, including a primary and a secondary task. He designed six tasks, combining the tasks of fact finding, information gathering, simple task (need of a single piece of information), hierarchical task (a depth search), and parallel task (a breadth).

For different types of tasks, users may apply different search strategies, which differs their search processes. The types of tasks defined in the studies of Thatcher (2008) and Terai et al. (2008) cannot represent health information tasks; because health information tasks may all fall into just one of their categories: a directed search task or an informational task. The types of tasks in the study by Kellar et al. (2007) are based on online search activities or actions, and searching for health information can experience all these activities. The classification of Toms et al. (2007) reflects health information seekers' search purpose or goal. However, it is hard to differ in the design of health information tasks. After comparing to other types of tasks, three

types of tasks were adopted for this study from Kim (2009), because: 1) they were clearly defined with comprehensive descriptions, which is helpful in designing task scenarios, 2) they had clearly distinct differences for the tasks in the field of health information, and 3) these tasks could become good tactics to lead an individual's information search process for health information.

Web Search Behavior

As the Internet becomes more widely used, Web search behavior is more frequently studied. Web search behavior research has become an important part of information behavior, which concentrates on the users' screen movements, users' interaction with the Internet, and users' Web browser actions. Many of these studies come from the areas such as information retrieval (IR), online searching, system evaluation, and human-computer interaction (HCI). The researchers come from different disciplines, which indicate the interdisciplinary nature of the research related to Web search (Hsieh-Yee, 2001).

Many studies used mathematical models to predict Web search behavior. Lau and Horvitz (1999) constructed Bayesian networks to infer users' search behaviors with a focus on query refinement. Zukerman, Albrecht, and Nicholson (1999) proposed the use of Markov models to predict a Web user's next action based on the timing and locations of past requests. However, these studies did not address personal characteristics of the users nor their Web experience.

Users' characteristics and search tasks are important factors in Web information seeking. Choo, Detlor, and Turnbull (1998) developed a behavior model of information seeking on the Web connecting search motivations with the Web movements. Wang, Hawk, and Tenopir (2000)

developed a multidimensional model of user-Web interaction in IR with three components, including the user, the interface and the Web. Navarro-Prieto, Scaife, and Rogers (1999) investigated the impacts of search tasks and search experience on search strategies. The observed Web experiences can be integrated into behavior based information seeking models. Table 2-1 summarizes the previous studies of Web search which combine the factors of users, search tasks, and Web browsing.

Table 2-1

Selected Studies on Web Search Behavior

Year	Author(s)	Title	Methods	Participants	Factors/Relationship
1999	Choo, Detlor, & Turnbull	Information seeking on the Web - An integrated model of browsing and searching	Log-file analysis, survey, and interview	34	Web movements and search motivation
2000	Hölscher & Strube	Web search behavior of Internet experts and newbies	Log-file analysis and interviews	24	Search engine interaction sequence and technical experts
2000	Wang, Hawk, & Tenopir	Users' interaction with World Wide Web resources: An exploratory study using a holistic approach	Log-file analysis with transcripts of video and audio data	24	User-Web interactions and users' cognitive style and affective feelings
2006	Kim	Task as a predictable indicator for information seeking behavior on the web		30	Information searching interaction and information searching strategies between task types
2008	Gwizdka	Revisiting Search Task Difficulty: Behavioral and individual difference measure	Web-based information search	48	Subjective task difficulty and the searcher's effort
2011	Du & Evans	Academic users' information searching on research topics: Characteristics of research tasks and search strategies	Transcribed think-aloud utterance and search logs	11	The processes of information searching were complex and challenging as research tasks

Hybrid Information Seeking Model

Choo et al. (1998) developed a behavior model of information seeking on the Web. In the model, four main modes of information seeking were defined as un-directing viewing, conditional viewing, informal search, and formal search, which were defined by the search purposes. According to Ellis (1989), certain Web moves or activities are associated with each mode, which are categorized in six characteristics: staring, chaining, browsing, differentiating, monitoring, and extracting. For example, during a formal search, the dominating activities on the Web are monitoring and extracting, as Web users spend more time in searching and using Web tools to keep up with the desired information. Choo et al. (1998) measured real tasks by the proxy server installed on the client's computer. The log file contained data and time of each access, the Uniform Resource Locator (URL) and its length. The log and the observed protocol were put together for categorizing users' actions in terms of the process model developed.

This model connects information needs and search motivations or purposes with Web movements. The model was tested under a natural setting with real tasks. However, it has not been tested for a specific domain, such as health information. Usually, health information searching may belong to the formal search mode, and users are more likely to monitor often and extract information from the Web.

Multidimensional Model

In general, there is a co-existence between cognitive information processing and affective information behaviors. Wang et al. (2000) developed a multidimensional model of user-Web interaction in information retrieval consisting of three components: user, interface and the Web. In their experimental study, users' cognition, affective states and physical

behaviors were observed during their online information search processes for two search questions. User-Web interactions were monitored by a process tracing technique. Transcripts of video and audio data on interactions were integrated with URLs in log files to describe search process. The statistical significance of correlation was tested between the variables of time spent, URLs visited, users' cognitive styles, and affective feelings before or after the study.

This multidimensional model draws upon the major components of Web search behavior: user, interface, and the Web, and considers the effects of cognitive styles and affective states on Web search behavior. The Web is a difficult environment for developing correct user mental models because of heterogeneous objects, poor interfaces, and diverse Web organization (Wang et al., 2000).

Expert Process Model of Information Seeking Using a Search Engine

After interviewing technical experts and observing their online searching practice, Hölscher and Strube (2000) derived a global level of the process model of information seeking, using a close-up of direction interaction with a search engine. In this process model, the search sequences start with information needs, followed by direct access to the search engine and to documents, or a known website, and then browsing the website. The result of browsing was either success or failure. The transition probabilities between all steps of the model were computed for an analysis of interaction sequences. The search engine interaction sequence included selecting the search engine, generating/formulating search terms, submitting query/getting results, examining results, and selecting document from results.

This process model of information seeking using search engines explore the search engine interaction sequence in general. The sequence is helpful to understand users' search

processes when they use search engines to start health information searching.

Task -based Information Searching

Users' individual differences and tasks are factors that influence the use of information systems. Many studies discussed in the section of search task in this dissertation use task-based approaches (Kellar et al., 2007; Kim, 2006; Gwizdka, 2008; Du & Evans, 2011). Research has been conducted on differences of search behaviors among tasks or specific task attributes, such as types, or difficulty. Further, some studies connected individuals' Web experiences, topic familiarity, cognitive abilities and styles, or mental effort with tasks to fully investigate individuals' search behaviors. The task-based methods start from designing tasks, recruiting participants to work on search tasks in a control setting, collecting data on participants' search process or search behaviors, and comparing the differences among the tasks, behaviors, and other factors.

In summary previous studies on Web search behavior provide a foundation for this dissertation. These experimental studies apply multiple methods of data collection, including questionnaires or interviews to collect users' background information and using logs to record Web activities.

Multilingual Search

The Internet is multilingual (Danet & Herring, 2003). According to the Internet World Stats May 2011 updates (Internet World Stats, 2011), which provides statistical information about Internet usage and users population, English, Chinese, Spanish, Japanese, Portuguese, German, Arabic, French, Russian, and Korean are the top ten languages used on the Web. Information written in non-English languages increased dramatically in the most recent decade.

From 2000 to 2011, three languages' growth rates on the Internet were over 1,000%, including Arabic (2,501.2%), Russian (1,825.8%), and Chinese (1,478.7%).

Cross language information retrieval (CLIR) attempts to make information accessible across languages and reduce language barriers. Most CLIR research (Chen, 2006; Wang, 2005) focused on query translation, which was to translate the user's query in one language into another language in which search results will be presented. The common translation techniques used in CLIR include machine translation, dictionary based translation, statistics approach, and information mapping.

Some of current search engines provide multilingual support. The search engines offer a variety of language aids, such as language limits, machine translation, translated search results with multiple interface languages. However, with limited content in non-English languages, many search engines which were mainly designed for the English language, could not meet information needs of non-English speaking population (Zhou, 2006).

Large and Moukdad (2000) studied multilingual access to Web resources, especially problems of multilingual access and their solutions. Petrelli et al. (2004) reported that individuals tended to choose the most appropriate language for their task, which was not necessarily their native language. Rieh and Rieh (2005) believed that bilingual users took advantage of various multilingual information resources on the Web. In their study of Korean bilingual academic users' behaviors, perceptions, and preferences while using the Internet in a multilingual environment, these users used both Korean and English information resources on the Web, but did not conduct multilingual searches across all kinds of information task or use search engines for a multilingual search. For their own research, the academic users were more

interested in foreign documents and using foreign search engines. For their personal information needs, they used Korean search engines for information written in Korean. Hansen and Karlgren (2005) conducted a study to investigate how users assess relevance of documents in English compared with Swedish, the users' first language, and found that relevance assessment took longer in English than in Swedish.

The area of multilingual searching on the Web is not well explored yet (Rieh & Rieh, 2005). It is important to enhance the understanding of multilingual Web searching from the user's perspective. It is worthwhile to conduct research in a controlled environment setting for the purpose of observing how the selection of language is related to the effectiveness of search results and users' perception of search success. Research on interactions between bilingual/multilingual users and their language selection during online information search process is limited, especially, since few have been done in the domain of medicine.

Language Selection

Internet users have access to more information in various languages. Language selection is the key in multilingual information search. Some individuals know more than one language, and they can search and read information in multiple languages. More multilingual speakers would have access to websites in their native languages and in English (Nelson, 2003). At the same time, those users who speak more than one language face the problem of language selection in the search (Durham, 2003; Rieh & Rieh, 2005). Each individual has his/her strategies when conducting multilingual information searching, and the search strategies depend on the individual's competency, preference, and information needs.

Considering language competency, if one is proficient in more than two languages,

he/she will have more choices in language usage. With regard to information search tasks, one makes a choice about the language which provides useful information, or compares different sources in different languages for a better result, or the person may just use one of his/her favorite languages to search.

For those who know two languages, but are not equally competent in the languages, they may like to search using their first language to locate information written in another language. This was one assumption in CLIR researchers' minds (Chen, 2006; Wang, 2005), who concentrated their efforts on query translations and developing systems to help the translations.

For most users, regardless of their language competency, they can use search engines and online dictionaries to translate information. For example, Google enables user to search information in multiple languages. On Google's main page, one can type a query in one's own language, and set language preference to display Web pages in other languages. However, the quality of the translation is questionable, especially for those languages which are not familiar in the Western world, like Chinese and Arabic.

Research on how users interact with multilingual sources on the Web is limited. How users use information tools, online dictionaries and search engines for efficient search is not well known.

Search Engines

Current search engines can offer multilingual support. Search engines offer a variety of language aids, such as language limits, machine translation, translated search and multiple interface languages.

In the U.S., Google, Bing, and Yahoo are the most popular search engines (eBizMBA, 2012). In Google, individuals can set their language preferences to start searching information written in all the languages, or specific languages from a pool of 45 languages. Zhang and Lin (2007) studied 21 search engines which support multiple language searches, in terms of the number of supported languages, visibility of language support, translation ability, result presentation, and interface design. They found that Google provided the best multiple language support. Bing is using new index-serving technology to provide fast and relevant search results for users. Yahoo is the first human indexed directory-based search engine, and it offers search results with directory category links that have been reviewed by human experts.

Major Chinese search engines include Baidu, Sina, and Yahoo China. Baidu is the biggest Chinese search engine. Baidu has indexed 740 million Web pages and is the backend search provider for a large number of Chinese Web sites or portals. Baidu supports Chinese character encoding conversion and enables users to type Chinese in pinyin without inputting Chinese characters, which is convenient for users whose computers support Chinese characters inputting.

In the domain of medicine, Zhou, Qin, and Chen (2006) compared English and Chinese search engines, and found their gap was greater than that of general-purpose search engines, because English search engines had incorporated many features such as meta-search, medical thesaurus, and document clustering, while, Chinese search engines provided few of these features.

Online Translation Tools

Google Translation Tools (GLT) present language support services at the top of its home

page. Individuals can type in a search query in the search box, choose the language of query, select the language in which they want to search, and click on “Translate and Search.” GLT presents the search results in both languages, providing the title, a short summary, and the URL of the page. As of February 2012, GLT supported multi-languages search for 63 languages. Chen and Bao (2009) examined the functions and performances of GLT and concluded that GLT was a useful tool for Web users.

Yahoo! Babel Fish supports text translation and Web page translation between 38 pairs of 12 languages. Individuals need to input the text needed to be translated into the text box, and select the translation pair. However there is a limit of 150 words or less. For Web page translation, individuals need to paste the URL in the text box and select the language pair.

Bing Translator provides online text translation of 36 languages and automatically detects the input language. Users need to select the language translated to, when they set the language translated from auto-detected, and type the text or the URLs in the space provided for translation.

This section reviewed multilingual search, language selection, search engines, and the use of online translation tools. Online dictionaries are also useful tools for translation and definition including medical dictionaries. This study observed language selection and the uses of online translation tools in Internet health information searching.

Health Information

Internet Health Information

Internet health information covers a variety of health topics, with different levels of depth in content. The top three health topics searched include a specific disease or medical

problem, certain medical treatment or procedure, and exercise or fitness.

Internet health information searching is one of the most common and popular online activities (Harris, 2002; Fox, 2006; Fox & Jones, 2009; Fox, 2011). People with health questions believe that they can find information on the Internet even though they may not know much about the health topic (Fox, 2011). The popularity of searching the Internet for health information and how the information impacts users has proven to be a challenge to researchers. Studies on the use of Internet health information have been well documented (see Table 2-2), and researchers have focused on users' information needs and information behaviors. Numerous studies of Internet health information seeking have inquired as to who searches for health information online, why they choose the Internet, what kind of information sources they use, and how they search. User studies have been conducted among various groups, including health professionals, patients, women, seniors, college students, and lay people. Digitally divided minority groups also have gained special attention, and barriers of language, medical terminology, culture and social economic factors have been identified. The relationship between patients and physicians were discussed in some of the studies on using Internet health information.

Researchers have focused on students' searching for online health information (Escoffery et al., 2005; Ivanitskaya, O'Boyle, & Casey, 2006; Kim, Park, & Bozeman, 2011). Their general findings were that students depended too much on search engines; used a trial-by-error approach and did not evaluate the information found. Ivanitskaya (2006) concluded that many students lack important competencies that may limit their ability to make health decisions. A study about Chinese college students and their online activities for sex education

and Human Immunodeficiency Virus (HIV) prevention investigated the relationship of Internet use and HIV knowledge and susceptibility; and the relationship of online risk behavior with sexual status (Hong, Li, Mao, & Staton, 2007). Hong et al. (2007) found that there was a significant difference between gender and academic level in the Internet use. HIV knowledge did not differ by Internet use.

The 2002 Harris Interactive Health Care News reported the different levels of Internet use for health purposes among the U.S., Japan, Germany, and France. The cross-cultural differences can be found in online searching patterns, the types of sites visited, as well as online information used. Fogel (2003) pointed out that only limited empirical research was available focusing on the use of the Internet for health information among racial/ethnic populations, and he made recommendations related to content, research, and outcomes for future study.

Half of all online health inquiries (52%) are on behalf of someone other than the person conducting the search (Fox & Jones, 2009). The physicians and patients' relationship is often discussed in the use of online health information. Murray et al. (2003) examined the use of the Internet to look for health information as well as the timing of the search in relation to visiting a physician. A positive physician-patient relationship was more likely to be when the physicians have good communication skills and they do not feel be challenged by the patient who brought the information.

According to Hekelman, Kelly, and Grundner (1990), the most commonly mentioned reason for the use of online health information system is that the individuals do not want to bother their physician. Other common reasons include the desire for a speedy response, the factor that the individuals do not understand their physicians' answers or are too embarrassed

to ask a physician in person. Ferguson (1997) noted that individuals highly value the degree to which Internet information meet their particular concerns and having the information in an understandable form. These results suggested that anonymity, interactivity, timeliness, and clarity could be an important evaluation criteria driving Internet use for health information.

When facing a health question, many people turn to a health professional, friend, or family member, and the Internet plays a supplemental role. Posting comments, reviews, or other health content on the Internet are not yet mainstream online activities. Experts remain vital to health-search and decision-making process; Wireless connection are associated with deeper engagement in social media and an accelerated pace of information exchange (Fox & Jones, 2009). The younger generation is more likely to participate in social technologies related to health. The users engaged in health related Second Life may potentially impact real-life health behaviors (Beard, Wilson, Morra, & Keelan, 2009).

Health information seekers not only benefit from flexibility and richness of information sources, but also deal with navigational difficulties and quality problems (Cline & Haynes, 2001). Eysenbach and Köhler (2002) reported a concern of quality with Internet health information. Misunderstanding or misuse of health information content can have negative impacts on human health and lives. Lack of health information competencies limits individuals' abilities to conduct efficient search, to locate accurate information, and to make a good medical decision (Cline & Haynes, 2001; Ivanitskaya, O'Boyle & Casey 2006).

Table 2-2

Selected Studies on Internet Health Information

Year	Author(s)	Title	Purpose(s)	Participants	Methods	Instruments	Results
2002	Eysenbach & Köhler	How do consumers search for and appraise health information on the World Wide Web? Qualitative study using focus groups, usability tests, and in-depth interviews	To describe techniques for retrieval and appraisal used by consumers when they search for health information on the internet	People who had already searched for health information on the Web	Focus group, observation (usability test), interview	Health questions	Internet users successfully found health information to answer questions in an average of 5 minutes 42 seconds, but very few participants had noticed and remembered which websites they had retrieved information from.
2004	Cotten & Gupta	Characteristics of online and offline health information seekers and factors that discriminate between them	To understand factors that discriminate between those who seek online vs. offline health information	2817 non-institutionalized adults	Survey, interview	2000 general social survey	Internet health information seekers were healthier than the non-Internet health information seekers. Age was a key factor that discriminated between online and offline health information seeking.
2004	Birru, Monaco, Charles, Drew, Njie, Bierria, Detlefsen, & Steinman	Internet usage by low-literacy adults seeking health information: An observational analysis	To determine how low-literacy adults independently access and evaluate health information on the Internet, and to identify challenges and areas of proficiency in the Internet-searching skills of low-literacy adults	Low-literacy adults	3 health questions	Observation	Search engine usage, ability to answer questions, information accessed, attitude and self-reporting the literacy level did appear to inhibit information-seeking efforts of low-literacy adults in health information searching. Future research may help to illuminate the factors that contribute to the inconsistencies between subjects' perceived unwillingness to explore the Internet's health resources and their positive feedback about navigating through these resources.
2006	Ivanitskaya, O'Boyle, & Casey	Health information literacy and competencies of information age students: Results from the interactive Online Research Readiness Self-Assessment (RRSA)	To identify approaches to building information age students competencies of young health consumers	Young students	Online assessment	RRSA to measure basic research skills	The study obtained direct measurement of skills and knowledge rather than self-reports by health information consumers. RRSA findings suggested that college students' health information competencies were limited.

(table continues)

Table 2-2 *(continued)*.

Year	Author(s)	Title	Purpose(s)	Participants	Methods	Instruments	Results
2007	Beverley, Bath, & Barber	Can two established information models explain the information behavior of visually impaired people seeking health and social care information?	To determine the extent to which two existing models of information behavior could explain the information behavior of visually impaired people seeking health and social care information	31 visually impaired people	Semi-structured interview	Qualitative research, holistic-inductive framework	The study found that several factors may affect a visually impaired people, which related to health conditions, understanding of information, interactions with information providers, the degree of independence, the support from family and friends, acceptance of their own impaired, registration status, the willingness and ability to pay for aids, adaptations and equipment.
2008	Yoo & Robbins	Understanding middle-aged women's health information seeking on the Web: A theoretical approach	To investigate how and why middle-aged women use health-related Web sites based on an integrated model drawn from two theories	354 middle age women	Survey	Survey	Middle-aged women were more likely to go to the websites if they have positive attitude, stronger motivations, and confidence.
2008	Keselman, Browne, & Kaufman	Consumer health information seeking as hypothesis testing	To understand information seeking difficulties by drawing on hypothesis testing explanatory framework, to address the role of use competencies and their interaction with resources	20 participants	Thinking aloud, semi-structured interview, audio recording	Online searching-MedlinePlus	Online search skills enhanced search efficiency, but did not eliminate the difficulties. The difficulties may be related to formulating and evaluating information.
2009	Pak, Price, & Thatcher	Age-sensitive design of online health information: Comparative usability study	To examine if two designed interfaces (hierarchical vs. tag-based) can affect older adults' use of a health information website	50 younger adults, and 50 older adults	Website navigation, experimental task, 2x2 factorial design	Abilities tests; task based search	Older adults performed worse than younger adults in the hierarchical condition, but performed as well as younger adults in the tag-based condition. The results indicated that the web design which considers the age-related changes in cognition can enhance older adults' access to health information.

(table continues)

Table 2-2 *(continued)*.

Year	Author(s)	Title	Purpose(s)	Participants	Methods	Instruments	Results
2010	Wen, Kreps, Zhu, & Miller	Consumers' perceptions about and use of the Internet for personal health records and health information exchange: Analysis of the 2007 Health Information National Trends Survey	To examine consumer attitudes toward PHRs and their health care providers' use of HIE, as well as to evaluate consumer use of the Internet for tracking PHRs	data from the 2007 iteration of the Health Information National Trends Study	Survey; Multivariate logistic regression to identify predictors	Survey	Internet use for tracking PHRs is still uncommon.
2011	Powell, Inglis, Ronnie, & Large	The characteristics and motivations of online health information seekers: Cross-sectional survey and qualitative interview study	To identify the characteristics and motivations of online health information seekers accessing the NHS Direct website, and to examine the benefits and challenges of the health Internet	792 respondents	An online questionnaire survey	An online questionnaire survey	Individuals seek information to help their health decision-making and confirm what they learned. The seeking of reassurance was found one of the primary motivations.
2012	Zhang, Wang, Heaton, & Winkler	Health information searching behavior in MedlinePlus and the impact of tasks	To explore consumer health information searching behavior in MedlinePlus	19 undergraduate students	Test and questionnaire ; 3 search tasks; video captured software; interview	Questionnaire, and ETS VZ-2 paper test	Most participants accessed results through the links and a few limited their search; participants used both searching and browsing strategies during the interaction with MedlinePlus; For more complex task, browsing was more likely to be used.

The Impact of Internet Health Information

Internet health information has impacted Internet users' health behavior. A total of 60% of Internet health information seekers reported that they or someone they knew had been helped by medical advice or health information found on the Internet, in making medical decisions, maintaining health, and discussing with doctors (Fox & Jones, 2009).

From Fox's (2008) report on e-patients, about 1 in 10 online health information inquiries had a major impact on someone's health care or the way they care for someone else. Among 57% of participants who mentioned that their most recent search had an impact on their health decisions, either major or minor, 60% said that information found online does affect their decision on how to treat an illness or condition; 56% said that it has changed their overall approach to maintaining their health or the health of someone they help take care. Over 50% of respondents said that online health searches led them to ask a doctor new questions, or to get a second opinion from another doctor. 42% adults said that they or someone they knew had been helped by online health advice.

Looking online for health information is a mainstream activity, but few people are engaged daily or even weekly with online health resources. Eighty-one percent of Internet users go online and do things related to health less often than once a week (Fox, 2006).

Regarding the social life of health information, Fox and Jones (2009) stated that the Internet only played a supplemental roles for individuals having a health question; posting comments and reviewing health content were not main stream online activities. Health care professionals reminded important in health searching and decision making process. About the use of social technologies, the younger generation (ages of 18-49) is more likely to engage in

social technologies related to health, and wireless connection are associated with deeper engagement in social media and speed up information exchange (Fox & Jones, 2009).

Health Information Portals

In the U.S., one major consumer health information portal is MedlinePlus. MedlinePlus is a database of authoritative, up-to-date, and extensive consumer health information compiled by the National Library of Medicine (NLM). It provides links to online health information from the National Institute of Health (NIH) and many other health-related organizations. It also provides drug information, health news, patient tutorials, and an illustrated medical encyclopedia. MedlinePlus serves general health consumers and health professionals for patient education.

In China, the major Chinese medical portals have wide content ranging from general health to drugs, industry, and research conferences. For example, 39.net provides health information services for the public, including health information resources, interaction with health professionals and experts, and concerns about consumer health.

However, few of Chinese medical portals support the search function. Most of these portals maintain a small collection of fewer than 10,000 pages and provide only a Chinese version for their geographical regions.

Health Information and Chinese Students

Chinese students have relied on the Internet for information and social networking. Melkote and Liu (2000) found that Chinese students and scholars often engaged in online discussions within their group to understand their new environment and find about events in

their native country. Chen (2004) identified that Chinese students in the U.S. were heavy Internet users.

In 2006, the survey (Cleveland et al., 2008) of Dallas/Fort Worth Chinese health information needs showed that 65% Chinese participants looked for health information online. Those participants that were of the age of 25-34 showed an interest in exercise and diet information. This group of participants was interested in learning about updates on medical developments. Most participants identified their health information needs in various ways, such as when health problems arise, searching for specific medical information in order for a better understanding and decision-making. Also, it was found that the participants searched the Internet health information when their family members or friends requested information about health issues.

Seventy percent of Internet health information available is in English (Kaicker et al., 2010). Chinese students are able to use both Chinese and English on the Internet. The advantage of bilingualism enables them to retrieve online information cross languages between Chinese and English. Though, they may have limited proficiency in English, and are not familiar with English as well as Chinese, their native language. English proficiency is positively related to English-language Internet usage (Ye, 2005).

Some Chinese students have difficulties with medical terminology, except those who major in medical sciences or related fields. The difficulties in language proficiency and lack knowledge of medical terminology in English, as well as unfamiliarity with US health care system may limit their abilities to obtain accurate health information and access health services.

The searching strategies Chinese students apply to cope with these difficulties are not well observed and identified in the U.S.

Summary

This chapter presented the literature review which covered the areas of information behavior theories, characteristics of users, search task, Web search behavior, multilingual environment, and health information. Searching the Internet for health information is one of the most popular online activities. The use of online health information impacts people's life. Theories and models on information behaviors focus on characteristics of users, and provided a foundation to study users' information behaviors. Task-based information searching connects searchers' goals or information needs with their information search process and patterns. Methods used in the studies of Web search can also apply to online health information research.

This study investigated the effects that different types of tasks (independent variables) had on the search process of Chinese graduate students when searching for health information on the Internet. The dependent variables were the source used to start the search, language selection, use of online translation tools, and time spent. The next chapter covers the methodology used in the study.

CHAPTER 3

METHODOLOGY

Introduction

A review of the literature on the areas of information behavior, search tasks, Web search behavior, and Internet health information showed that there have been studies on the process of searching the Web, but few on the process of how users search the Internet for health information. Search tasks have often been studied to identify search activities and searching patterns. Web searching researchers usually use experimental methods with both quantitative and qualitative data analysis (Choo et al., 1998; Holscher & Strube, 2000; Kim, 2006; Wang et al., 2000).

Methods used in task based information searching studies generally include creating search tasks, recruiting participants, setting experimental environment, conducting the experiment and collecting data, and analyzing data among task attributes or other factors which influence searching, search behavior, or search process variables. All kinds of techniques have been used in these studies of Web interactions, such as log files (Holscher & Strube, 2000), tracking software (Kim, 2006), or video and audio recording (Wang et al., 2000).

Research Design

This experimental study analyzed the relationships between types of health information tasks and Chinese graduate students' Internet health information search processes. Forty-five Chinese graduate students searched the Internet for health information and completed three health information tasks in a lab setting. Data of the students' health information search processes were gathered from Web browser history files. Characteristics of the students were

collected from a questionnaire distributed at the beginning of the session. Students' feedback about each task was collected through a pre-search questionnaire and a post-search questionnaire.

The key variables in the study included types of tasks and the variables obtained in the search process. Figure 3-1 is a diagram of the research framework.

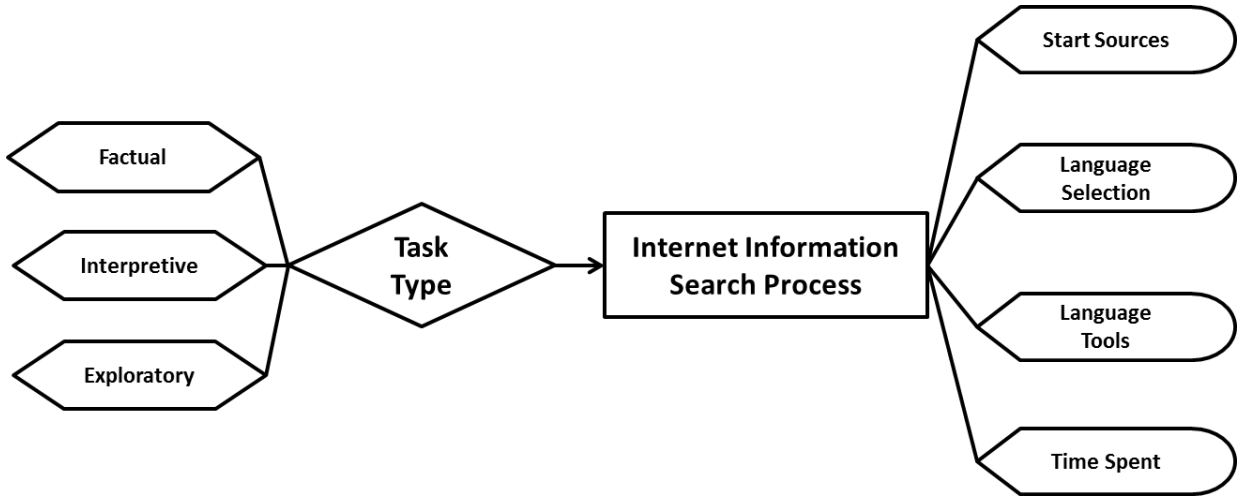


Figure 3-1. Research framework.

The independent variable was the types of tasks. The dependent variables included four variables observed in the information search process: (a) sources used to start a search, (b) language selection, (c) use of online translation tools, and (d) time spent. The research questions and null hypotheses are included below:

R1. Do Chinese graduate students vary in the selection of sources used to start their search depending upon the types of health information tasks?

H_0. There is no significant difference in the selection of sources used to start their search among the types of health information tasks.

R2. Do Chinese graduate students vary in their language selection depending upon the types of health information tasks?

H_0. There is no significant difference in their language selection among the types of health information tasks.

R3. Do Chinese graduate students vary in their use of online translation tools depending upon the types of health information tasks?

H_0. There is no significant difference in their use of using online translation tools among the types of health information tasks.

R4. Do Chinese graduate students vary in the time spent depending upon the types of health information tasks?

H_0. There is no significant difference in the time spent among the types of health information tasks.

The research design for this study is discussed in the following sections: participants, types of tasks, variables of the information search process, questionnaires, setting and data collection procedures, data analysis, and pilot study.

Participants

The targeted population of the study consisted of international students from China who were enrolled at the University of North Texas (UNT). Based on statistics from UNT's International Office, there were 332 Chinese students enrolled in the 2011 fall semester, including 124 undergraduate students and 218 graduate students. UNT's graduate academic level has three categories: master's level, doctoral level, and second bachelor's level (University of North Texas, 2011).

I obtained approval for human subject research from the UNT Institutional Review Board (IRB) on July 3rd, 2011 (see Appendix A). An invitation was sent by email to the Chinese students via the UNT's International Office and the UNT Chinese Students and Scholars Association's directory list (cssa@unt.edu) (see Appendix B). I followed up with those students who were interested in the study by phone, email, or in person, and 45 Chinese graduate

students were recruited for the study. According to the central limit theorem, a sample size of up to 30 subjects is a general practice that can yield a normal distribution of data (Smith & Wells, 2006).

Types of Tasks

The type of the tasks was an independent variable, which could have an impact on the health information search process. Search tasks may vary in the information seeking behavior of the participants. The researcher adopted three types of tasks from Kim (2009): factual task, interpretive task, and exploratory task. Three health information search tasks were designed following Kim's type of tasks. According to Kim (2009), a factual task is a fact finding task, which includes naming, defining, identifying, and listing. It has a definite answer which can be identified in the text. An example of a factual task for health information is "What are the symptoms of diabetes II?" An interpretive task is a "thinking/understanding and searching task" (Kim, 2009, p.683) which requires an answer rather than simply and concisely locating one. An example of an interpretive task is "At which age should women get a mammogram?" An exploratory task is open-ended, which can broaden the searcher's knowledge on a specific topic, and it can be difficult to determine when the best answer is found (Kim, 2009). An example of an exploratory task is "Should senior citizens take antibiotics for a cough?" For health information tasks design, the topic and the content should reflect health information needs of the targeted population.

Three tasks (Task 1-3) were created for this study, and each task represented each type of the tasks: factual task, interpretive task, and exploratory task. Following are the tasks used in the study.

1. Factual task

   When playing soccer in the University of North Texas recreation center, your friend Eric Lin slipped on the floor and hurt his left foot. He was diagnosed with a stress fracture. Please find a definition of stress fracture. Provide a definition of the term and include the URL(s) of the information source(s) where you found your answer.

2. Interpretive task

   Radiation leaks from the Fukushima nuclear reactor and the following radiation spreading to neighboring countries have raised concerns over the health effects of radiation exposure. How does radiation exposure impact your health? Please present your answer based on your search results and provide the URL(s) of the information source(s) where you found your answer.

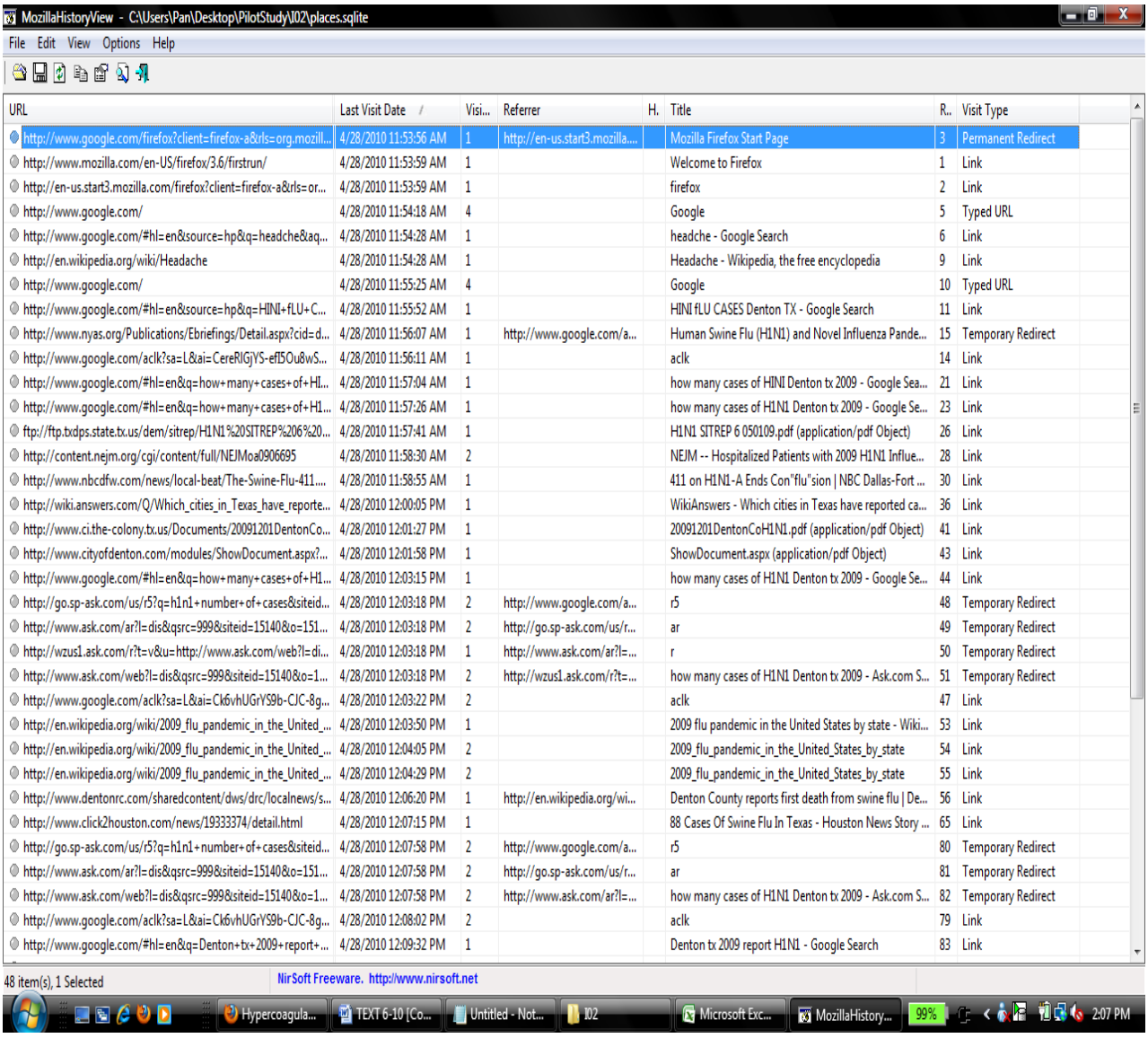
3. Exploratory task

   A friend's father experienced a stroke, and fortunately, he is in stable condition in a hospital. Your friend seeks your help in looking for information about strokes and would like to know if there is any relationship between strokes and blood thickness because her father only had a positive sign of blood thickness before the stroke. Please document the relationship based on your search results and provide the URL(s) of the information source(s) where you found your answer.

Variables in the Information Search Process

Four variables were identified in information search process: sources used to start a search, language selection, use of online translation tools, and time spent. The source used to start a search was determined by the first URL a participant used to begin the search. Language selection was determined by the language the participant used for search terms and search results. The use of online translation tools was the frequency of using online translation tools to assist in the search. The time spent was the time used to complete each task search. The search results included the source(s) that were used to answer the task questions. In the Mozilla Firefox 5.0, the browser's history was stored in the places.sqlite file. The Web browser history file can be read using NirSoft Mozilla History View. The history view presented the following

information: the URL, first visit date, last visit date, visit counter, referrer, title, and host name. This provided an overview of the participant's information search process, and helped to identify the values of variables in the search process. Figure 3-2 shows an example of history view.



URL	Last Visit Date	Visi...	Referrer	H.	Title	R..	Visit Type
http://www.google.com/firefox?client=firefox-a&rls=org.mozill...	4/28/2010 11:53:56 AM	1	http://en-us.start3.mozilla....		Mozilla Firefox Start Page	3	Permanent Redirect
http://www.mozilla.com/en-US/firefox/3.6/firstrun/	4/28/2010 11:53:59 AM	1			Welcome to Firefox	1	Link
http://en-us.start3.mozilla.com/firefox?client=firefox-a&rls=or...	4/28/2010 11:53:59 AM	1			firefox	2	Link
http://www.google.com/	4/28/2010 11:54:18 AM	4			Google	5	Typed URL
http://www.google.com/#hl=en&source=hp&q=headche&aq...	4/28/2010 11:54:28 AM	1			headche - Google Search	6	Link
http://en.wikipedia.org/wiki/Headache	4/28/2010 11:54:28 AM	1			Headache - Wikipedia, the free encyclopedia	9	Link
http://www.google.com/	4/28/2010 11:55:25 AM	4			Google	10	Typed URL
http://www.google.com/#hl=en&source=hp&q=HINI+fLU+C...	4/28/2010 11:55:52 AM	1			HINI fLU CASES Denton TX - Google Search	11	Link
http://www.nyas.org/Publications/Ebriefings/Detail.aspx?cid=d...	4/28/2010 11:56:07 AM	1	http://www.google.com/a...		Human Swine Flu (H1N1) and Novel Influenza Pande...	15	Temporary Redirect
http://www.google.com/aclk?sa=L&ai=CereRIGjYS-efI5Ou8wS...	4/28/2010 11:56:11 AM	1			aclk	14	Link
http://www.google.com/#hl=en&q=how+many+cases+of+HI...	4/28/2010 11:57:04 AM	1			how many cases of HINI Denton tx 2009 - Google Sea...	21	Link
http://www.google.com/#hl=en&q=how+many+cases+of+H1...	4/28/2010 11:57:26 AM	1			how many cases of H1N1 Denton tx 2009 - Google Se...	23	Link
ftp://ftp.txdps.state.tx.us/dem/sitrep/H1N1%20SITREP%206%20...	4/28/2010 11:57:41 AM	1			H1N1 SITREP 6 050109.pdf (application/pdf Object)	26	Link
http://content.nejm.org/cgi/content/full/NEJMoa0906695	4/28/2010 11:58:30 AM	2			NEJM -- Hospitalized Patients with 2009 H1N1 Influe...	28	Link
http://www.nbcdfw.com/news/local-beat/The-Swine-Flu-411....	4/28/2010 11:58:55 AM	1			411 on H1N1-A Ends Con"flu"sion | NBC Dallas-Fort ...	30	Link
http://wiki.answers.com/Q/Which_cities_in_Texas_have_reporte...	4/28/2010 12:00:05 PM	1			WikiAnswers - Which cities in Texas have reported ca...	36	Link
http://www.ci.the-colony.tx.us/Documents/20091201DentonCo...	4/28/2010 12:01:27 PM	1			20091201DentonCoH1N1.pdf (application/pdf Object)	41	Link
http://www.cityofdenton.com/modules/ShowDocument.aspx?...	4/28/2010 12:01:58 PM	1			ShowDocument.aspx (application/pdf Object)	43	Link
http://www.google.com/#hl=en&q=how+many+cases+of+H1...	4/28/2010 12:03:15 PM	1			how many cases of H1N1 Denton tx 2009 - Google Se...	44	Link
http://go.sp-ask.com/us/r5?q=h1n1+number+of+cases&siteid...	4/28/2010 12:03:18 PM	2	http://www.google.com/a...		r5	48	Temporary Redirect
http://www.ask.com/ar?l=dis&qsrc=999&siteid=15140&o=151...	4/28/2010 12:03:18 PM	2	http://go.sp-ask.com/us/r...		ar	49	Temporary Redirect
http://wzus1.ask.com/r?t=v&u=http://www.ask.com/web?l=di...	4/28/2010 12:03:18 PM	1	http://www.ask.com/ar?l=...		r	50	Temporary Redirect
http://www.ask.com/web?l=dis&qsrc=999&siteid=15140&o=1...	4/28/2010 12:03:18 PM	2	http://wzus1.ask.com/r?t=...		how many cases of H1N1 Denton tx 2009 - Ask.com S...	51	Temporary Redirect
http://www.google.com/aclk?sa=L&ai=Ck6vhUGrYS9b-CJC-8g...	4/28/2010 12:03:22 PM	2			aclk	47	Link
http://en.wikipedia.org/wiki/2009_flu_pandemic_in_the_United_...	4/28/2010 12:03:50 PM	1			2009 flu pandemic in the United States by state - Wiki...	53	Link
http://en.wikipedia.org/wiki/2009_flu_pandemic_in_the_United_...	4/28/2010 12:04:05 PM	2			2009_flu_pandemic_in_the_United_States_by_state	54	Link
http://en.wikipedia.org/wiki/2009_flu_pandemic_in_the_United_...	4/28/2010 12:04:29 PM	2			2009_flu_pandemic_in_the_United_States_by_state	55	Link
http://www.dentonrc.com/sharedcontent/dws/drc/localnews/s...	4/28/2010 12:06:20 PM	1	http://en.wikipedia.org/wi...		Denton County reports first death from swine flu | De...	56	Link
http://www.click2houston.com/news/19333374/detail.html	4/28/2010 12:07:15 PM	1			88 Cases Of Swine Flu In Texas - Houston News Story ...	65	Link
http://go.sp-ask.com/us/r5?q=h1n1+number+of+cases&siteid...	4/28/2010 12:07:58 PM	2	http://www.google.com/a...		r5	80	Temporary Redirect
http://www.ask.com/ar?l=dis&qsrc=999&siteid=15140&o=151...	4/28/2010 12:07:58 PM	2	http://go.sp-ask.com/us/r...		ar	81	Temporary Redirect
http://www.ask.com/web?l=dis&qsrc=999&siteid=15140&o=1...	4/28/2010 12:07:58 PM	2	http://www.ask.com/ar?l=...		how many cases of H1N1 Denton tx 2009 - Ask.com S...	82	Temporary Redirect
http://www.google.com/aclk?sa=L&ai=Ck6vhUGrYS9b-CJC-8g...	4/28/2010 12:08:02 PM	2			aclk	79	Link
http://www.google.com/#hl=en&q=Denton+tx+2009+report+...	4/28/2010 12:09:32 PM	1			Denton tx 2009 report H1N1 - Google Search	83	Link

Figure 3-2. Example of history view.

Questionnaires

The data collection instruments consisted of a background questionnaire, a pre-search

questionnaire and a post-search questionnaire. A background questionnaire (See Appendix C) collected data of demographics, education background, and Web experience. A pre-search questionnaire (See Appendix D-Task 1, Appendix E-Task 2, & Appendix F-Task 3) collected information on knowledge about the task topic, task difficulty, language presentation preference, and language preference of participants. A post-search questionnaire (See Appendix D-Task 1, Appendix E-Task 2, & Appendix F-Task 3) collected feedback on task difficulty, search satisfaction, language used in the answer, difficulties in finding the answer, and assistance needed. All questionnaires were developed based upon questionnaires used in other studies, Cleveland et al. (2008), Wang et al. (2000), and Kim (2006). For this study, the instruments were Web-based using LimeSurvey, supported by the Texas Center for Digital Knowledge (TXCDK), College of Information, the University of North Texas.

Setting and Data Collection Procedure

Setting

UNT is one of Texas' largest universities and offers 97 bachelor's, 101 master's and 48 doctoral degree programs. UNT enrolls more than 36,000 students, among which, 2,869 are international students from 121 countries (University of North Texas, 2011). This study took place in a computer classroom at UNT Discovery Park that contained 48 computers equipped with an Internet connection and a Microsoft Simplified Chinese Language Pack. The operating system of each computer was Microsoft Windows 7 Enterprise. The default Web browser was Mozilla Firefox 5.0. The computers and the Web browser were tested prior to conducting the study to ensure stability and usability.

Data Collection Procedure

Each participant logged into a computer with a valid UNT Enterprise-Wide User-Id (EUID) and password. The researcher briefly introduced the study, and asked everyone to read and sign the approved Informed Consent Form (see Appendix G). Then, the researcher configured computer settings and opened the study page (https://sites.google.com/site/dellapan/study), which provided instructions and links to the background questionnaire and the three tasks. For each of the task, it included the task content, pre-search questionnaire, answer sheet, and post search questionnaire. Participants were given a participant ID as a token number to start. Participants selected the order of tasks to start and worked on one task at a time. Before the search, participants needed to fill in a pre-search questionnaire. Participants' online activities were automatically stored in a browser history file, featured in the default Mozilla Firefox Web browser. Participants needed to provide their answers in the answer sheet displayed. After each task was completed, participants filled out a post-search questionnaire. The individual Web browser history file was collected before the participants logged out. Other data were stored on the Limesurvey server. The procedure took an estimated 30-45 minutes.

Data Analysis

Data Sources

Data sources were collected from the Web browser history file, answer sheet, background questionnaire, pre-search questionnaire, and post-search questionnaire. The data of the sources used, search terms selected, time spent, and the search results were retrieved and saved in Microsoft Excel worksheets. Information from questionnaires and answer sheets were compiled into Microsoft Excel worksheets as well.

Coding

The types of task were coded as: factual task (1), interpretive task (2), and exploratory tasks (3). The type of task was a categorical variable.

The variables observed in the search process included: the source used to start the search, the language selection, the use of online translation tools, and time spent. The source used to start the search was labeled by two categories: search engine (1); other source (2). The category of other source could be a health portal, a specific health related Website, or any sources except search engines. Language selection was evaluated and decided by the language(s) in which the search term(s) and the search result(s) were displayed: English (1), Chinese (2), or both English & Chinese (3). The codes used to record the combination of language selection in search terms and search results was: (1) for the use of a single language; and (2) for the use of the mixed two languages (see Table 3-1).

Table 3-1

Codes for Language Combination Used in Search Terms and Search Results

Search Terms	Search Results	Combination Code
English	English	1
Chinese	Chinese	1
English & Chinese	English & Chinese	2
English & Chinese	English	2
English & Chinese	Chinese	2
Chinese	English & Chinese	2
English	English & Chinese	2

Whether the participants used online translational tools or not was identified as “Yes” or “No.” The use of online translation tools was recorded as well as the frequency of the use of these tools. The time spent in searching for the task was determined by approximating the

length of time between the beginning of the search and the time to locate the answer. The search results were analyzed at the first level of the source's URL.

In the background questionnaire, participants' characteristics included age, gender, and the years living in the U.S., education, and Web search experience. The years of living in the U.S. ranged from less than 1 year, 1-3 years, 3-5 years, to more than 5 years. Three questions in this questionnaire were related to education. Participants identified their UNT academic status (master's level, doctoral level, and post bachelor level), and provided their undergraduate major and current field of study. The questions related to their Web search experience included training courses, Internet usage, health information usage, search skills, search confidence, search reasons, and health topics searched in the previous year. Participants answered "yes" or "no" to the questions if they had taken training courses on Internet searching and health information searching. The Internet and health information usage were measured by a three levels of frequency (monthly, weekly, or daily). On search skills, participants ranked themselves on 3 levels (beginner, intermediate, or expert). Search confidence to find Internet information and health information was measured on 1-5 scale, (*not confident, not very confident, confident, very confident, or extremely confident*). The participants were asked if they had searched the Internet during the past year on the following topics:

- Specific disease or medical condition
- Clinical trials
- Nutritional information
- Fitness/exercise information
- Drug information

- Health insurance information
- Immunization information
- Specific medical treatment or procedure
- Alternative medicines and/or treatments (i.e. herbal remedies, acupuncture, hypnosis)
- Other (please be specific)

Also, the participants were asked about the reasons for searching the Internet for health information which included:

- Your own health concerns
- Other's health concerns
- Research (work-related, school-related)
- Health news and knowledge development
- No specific reason
- Other (please be specific)

In the pre-search questionnaire, knowledge about the task topic was measured on 1-5 scale (*not knowledgeable, not very knowledgeable, knowledgeable, very knowledgeable, or extremely knowledgeable*); and task difficulty was measured on 1-5 scale (*not difficult, not very difficult, difficult, very difficult, or extremely difficult*); participants provided information on the language they would like to use to answer and the language that might have more relevant answers. In the post-search questionnaire, the search difficulty was also measured on 1-5 scale (*from not difficult to extremely difficult*); search satisfaction was measured on 1-5 scale (*from*

not satisfied to extremely satisfied); participants provided the language the answer was presented, the difficulties they might encounter, and assistance needed during the search.

Content Analysis

I reviewed data on participants' information processes. Based on coding rules discussed upon, content analysis was conducted to identify and code the variables: source to start the search; the language(s) used in search terms and the results; the use of online translation tools; and time spent. After the analysis, two invited coders also checked the results. The percentage of agreement was used to measure intercoder reliability.

Statistics

Analysis of the data was calculated using IBM SPSS Statistics 19. Variables in the search processes were classified as either categorical data or numerical data. The categorical variables were types of the tasks; source used to start the search; and language selection. The numerical variables were the frequency of using online translation tools and time spent. To examine the relationships between a categorical variable (the types of the tasks) and a categorical variable (source to start the search, or language selection), non-parametric chi-square test of independence and correlation coefficient of Cramer's V were selected. For the relationship between a categorical variable (the types of the tasks) and a numerical variable (the use of online translation tools, or time spent), one way repeated measures analysis of variance (ANOVA) was applied to test the significant difference.

Also, the relationships between dependent variables in the search processes and demographic data (gender, age, educational level, and major) were checked. Measuring dependency of two variables from categorized data, non-parametric cross-table chi-square

testing of independence was applied. One-way ANOVA was used for a categorical variable and a numerical variable.

For all the tests, the level of significance, set a priori, for testing the hypotheses was $\alpha = .05$.

Pilot Study

In April 2010, a pilot study was conducted in the research lab at the College of Information, UNT. The goals of the pilot study were to test the research instruments and to modify the final experimental design if needed. Three UNT graduate students from the Department of Library and Information Sciences participated in the pilot study. The researcher collected 8 observed and recorded search sessions, but 1 search session was not saved due to a technical issue. The task scenarios given to the participants of the pilot study are presented below. All the instruments provided were paper-based, which was different from the major study.

Task Scenarios

Three students involved in the pilot study were assigned three task scenarios, and each task represented one type of task: a factual task, an interpretive task, and an exploratory task. The tasks are included below.

A. Factual task
   Swine flu (H1N1 Flu): The outbreak of H1N1 Flu as a pandemic is on the alert. You want to know the occurrences of the flu cases in the town where you are studying and living, Denton, Texas. Please list the officially reported total number of H1N1 flu cases in the year of 2009 and provide the name of online information source or a uniform resource locator (URL) where you found the answer.

B. Interpretive task
   Head magnetic resonance imaging (MRI) procedure: You get a headache and have seen a doctor. Your doctor schedules you for a head MRI at a nearby hospital. Before

visiting the hospital, you would like to do research to increase your awareness of the procedure. Please compile a list of instructions to follow to prepare for the procedure, and provide the online information sources or URLs.

C. Exploratory task
Stroke & hyperviscosity: A friend's father experienced a stroke, and fortunately he is in stable condition in a hospital. Your friend seeks your help in looking for information about strokes and would like to know if there is any relationship between strokes and blood thickness. Please document the relationship based on your search results and provide the information sources and URLs where you found the answers.

Participants

Among these three graduate students, there was one doctoral student in the age group of over 40 years and two master students in the age group of 25-30 years. Their undergraduate majors were in library science, child development and family studies, and English respectively. All of the participants had been in the U.S. for more than 5 years. Table 3-2 shows the participants' demographic information in gender, age, education, and levels of Internet search skills.

Table 3-2

Participants' Demographics and Internet Search Skills

Participant ID	Gender	Age	Degree Pursue	Current Major	Undergraduate Major	Internet Search Skills (1-5)
I01	Female	> 40 years	Ph.D.	Information Science	Library Science	4*
I02	Female	25 - 30 years	Master's	Library and Information Sciences	Child Dev. and Family Studies	4*
I03	Female	25 - 30 years	Master's	Library and Information Sciences	English	4*

* Based on a level of 1-5 scale, from 1 (*beginner*) to 5 (*expert*).

Web Search Experiences

Participants' Web search experiences were identified through the background questionnaire covering training courses, Internet usage, health information usage, search skills, search confidence, search reason, and health topics searched in the previous year. With regard to training courses on Internet search, three participants answered "Yes," which indicated they had taken at least one training course. With regard to training courses on health information, only one participant reported "Yes," and the other two participants did not take any training courses. About Internet usage, all of three participants indicated they used the Internet more than once a day. For health information usage, two participants indicated the search frequency of 1-3 times one month, and one participant chose 1-3 times one week.

For the confidence to find information and health information on the Internet were measured on 1-5 scale, from *not confident* to *very confident*. For Internet search confidence, three participants indicated a level of 4, which was the level between *average* (3) and *very confident* (5). For health information search confidence, one participant indicated a level of 4, and two participants indicated a level of 3 (*average*). The reason(s) for searching health information, two participants searched for their own health concerns, and one participant was interested in health news and knowledge development. The following health topics were searched by the number of participants indicated in parenthesis: drug information (3), specific medical treatment or procedure (3), specific disease or medical condition (2), nutritional information (2), fitness/exercise information (2), clinical trials (1), and health insurance information (1).

In summary regarding the participants' Web search experiences, they often used the Internet and they ranked their search skills high. They searched less frequently for online health information, and their confidence in finding health information online was average. When they searched online health information, they searched a variety of health topics.

Participants' Information Search Processes

The following section presents the participant' information search process for each task.

Factual Task (Task A)

Participant I01 visited a total of 37 links to locate the answer to Task A. The participant mainly used 2 search engines to conduct search. The participant used Google.com 10 times, and used Ask.com 2 times. Table 3-3 shows search terms which participant I01 used. The participant searched in English, and no online translation tools were used during the process. The total time spent by participant I01 was 19 minutes and 57 seconds. The source chosen as the answer was Texas Department of State Health Services (URL: http://www.dshs.state.tx.us/idcu/disease/influenza/surveillance/2009/).

Participant I02 visited a total of 2 links to locate the answer to Task A using a search engine. The participant used Google.com once, using the search term of "H1N1 occurrences in denton texas." The participant searched in English, and no online translation tools were applied during the process. The total time spent by participant I02 was 1 minute and 44 seconds. The source chosen as the answer was Denton County Health Department H1N1 (swine) Flu Update (URL: http://dentoncounty.com/dept/health/PDFs/Current-Denton-County-H1N1-Info.pdf).

Table 3-3

Participants I01, I02, I03: Search Sources and Search Terms

Participant	Task	Search Sources	Search Terms
I01	Task A	Google Search	HINI fLU CASES Denton TX
		Google Search	how many cases of HINI Denton tx 2009
		Google Search	how many cases of H1N1 Denton tx 2009
		Google Search	how many cases of H1N1 Denton tx 2009
		Ask.com	how many cases of H1N1 Denton tx 2009
		Ask.com	how many cases of H1N1 Denton tx 2009
		Google Search	Denton tx 2009 report H1N1
		Google Search	Denton tx 2009 report H1N1
		Google Search	Denton tx 2009 report H1N1
		Google Search	Denton tx 2009 report H1N1
		Google Search	Denton tx 2009 H1N1 NUMBER
		Google Search	during 2009 how many cases of H1N1 in Denton tx
	Task B	Google Search	mri
	Task C	Google Search	relationship stroke and blood thickness
I02	Task A	Google Search	H1N1 occurrences in denton texas
	Task B	Google Search	head mri procedure
		Google Search	stroke AND blood thickness
		Google Search	blood thickness
	Task C	Google Search	stroke AND hypercoagulability
		WedMD	stroke AND blood thickness
I03	Task A	Google Search	UNT library
	Task B	N/A	N/A
	Task C	Google Search	stroke and blood thickness
		MedlinePlus	stroke and blood thickness

Participant I03 visited a total of 9 links to locate the answer to Task A. The participant used Google.com to locate UNT library catalog. Through the UNT library, the participant visited UNT Libraries - Electronic Resources (A&Is) and further searched PubMed Central (PMC). No search terms were recorded, and the Web source of the result was not identified. The participant searched in English, and no online translation tools were used during the process. The total time spent by participant I03 was 33 seconds. Participant I03 provided answers as

indicated below without a source citation: “Swine Flu cases as of 4/17/2010; Hospitalizations: 3; ICU Admissions: 2; Deaths: 2.”

Interpretive Task (Task B)

Participant I01 visited a total of 2 links to locate the answer to Task B, including a search engine. The participant I01 used Google.com once to search for the term “mri.” The participant searched in English, and no online translation tools were used during the process. The total time spent by participant I01 was 7 seconds. The source chosen as the answer was from RadiologyInfo.org (URL: http://www.radiologyinfo.org/en/info.cfm?pg=bodymr).

Participant I02 visited a total of 2 links to locate the answer to Task B, including a search engine. The participant used Google.com once to search the term “head mri procedure.” The participant searched in English, and no online translation tools were used during the process. The total time spent by participant I02 was 10 seconds. The source chosen as the answer was from RadiologyInfo.org (URL: http://www.radiologyinfo.org/en/info.cfm?pg=headmr).

In reviewing the Web browser history file, there was no indication how participant I03 conducted the search for Task B, due to a technical error. The result was just one line written by the participant as “Remain perfectly still, sometimes you will need to hold your breath.” The total time spent was estimated as 49 seconds.

Exploratory Task (Task C)

Participant I01 visited a total of 3 links to locate the answer to Task C including a search engine. The participant I01 used Google.com once to search the term “relationship stroke and blood thickness.” The participant searched in English, and no online translation tools were used during the process. The total time spent by participant I01 was 37 seconds. The source chosen

as the answer was “"Thick" Blood May Increase Stroke Risk” from Science Daily (URL: http://www.sciencedaily.com/releases/1999/08/990817065603.htm).

Participant I02 visited a total of 12 links to locate the answer to Task C including a search engine. The participant I02 started a Google search using the terms “stroke AND blood thickness,” “blood thickness,” and “stroke AND hypercoagulability.” Also, WedMD was searched using the term “stroke AND blood thickness.” The participant searched in English, and no online translation tools were used during the process. The total time spent by participant I02 was 6 minutes. The source chosen as the answer was “Hypercoagulability as a cause of stroke in adults” from the Free Library (URL: http://www.thefreelibrary.com/Hypercoagulability+as+a+cause+of+stroke+in+adults.+%28Featured+CME...-a0100877514).

Participant I03 visited a total of 14 links to locate the answer to Task C including a search engine. The participant I03 conducted search through Google.com, MedlinePlus, and the UNT library. The search terms used were “stroke and blood thickness” in both Google and MedlinePlus. No terms could be identified in PubMed which was found through the UNT library. The participant searched in English, and no online translation tools were used during the process. The total time spent by participant I03 was 2 minutes and 32 seconds. The source chosen as the answer was “Stroke: Hope Through Research” from the National Institute of Neurological Disorders and Stroke (URL: http://www.ninds.nih.gov/disorders/stroke/detail_stroke.htm#147771105). The participant wrote down the answer as “Yes, there is a relationship between blood thickening and ischemic stroke. Plaque build-up in arteries causes stenosis (narrowing of artery), which causes stroke.

High alcohol consumption can also increase blood viscosity, which can lead to stroke."

Summary of Information Search Processes

Table 3-4 summarizes the above-mentioned description of participants' information search processes, and presents the variables of the number of links visited, search engines, search terms example, times spent, and result source which were observed and collected in the pilot study.

Table 3-4

Summary of Information Search Processes

Task	Search Process	Participant I01	Participant I02	Participant I03
A (Factual)	Links visited	37	2	9
	Search engines (Frequency)	Google (10); Ask.com(2)	Google (1)	UNT Library
	Search terms	during 2009 how many cases of H1N1 in Denton tx	H1N1 occurrences in denton texas	N/A
	Time spent	19 min 57 s	1 min 44 s	33 s
	Result source	Texas Department of State Health Services	Denton County Health Department	N/A
B (Interpretive)	Links visited	2	2	N/A
	Search engines (Frequency)	Google(1)	Google (1)	N/A
	Search terms	Mri	mri procedure	N/A
	Time spent	7 s	19 s	49 s
	Result source	RadiologyInfo.org	RadiologyInfo.org	N/A
C (Exploratory)	Links visited	3	12	14
	Search engines (Frequency)	Google(1)	Google (3) WebMD(1)	Google.com; MedlinePlus; and UNT library
	Search terms	relationship stroke and blood thickness	stroke AND blood thickness	stroke and blood thickness
	Time spent	37 s	6 min	2 min 32 s
	Result source	Science Daily	The Free Library	National Institute of Neurological Disorders and Stroke

Based on the observations of the information search processes, most of the participants selected Google as the start source. All searches were conducted in English; therefore, the use of online translation tools was not applicable. The average time spent on a task was 3 minutes and 36 seconds. There were obvious differences in the Web links visited between the types of tasks. As more Web pages were visited, more time was needed for selecting and reading. Also, there was individual's difference between participants. For example, participant I01 spent almost 20 minutes on Task A, which was much longer than average. The participant I01 might have been stuck in the task not because of the task type, but due to language skills and search terms used. Participant I02 searched using the term "H1N1 occurrences in denton texas ," which helped to locate the result quickly. However, participant I01 copied the terms as stated in the Task A scenario, which may indicate a lack of language capability to select more efficient search terms.

For the factual task, participants presented their finding results from the Texas Department of State Health Services, and the Denton County Health Department. For the interpretative task, participants presented their finding results from RadiologyInfo.org. For the exploratory task, participants presented their finding results from Science Daily, the Free Library, and the National Institute of Neurological Disorders and Stroke.

Pre-search and Post-search Questionnaires Results

Table 3-5 presents the results from the pre-search questionnaire and the post-search questionnaire. The pre-search questionnaire included the participants' opinions about the topic familiarity, the difficulty, and the language they used and found the answer. The post-search questionnaire included participants' opinions on search task's difficulty, satisfaction of the

search process, and the language used in the search. Topic familiarity was measured on 1-5 scale, from not to a quite bit familiar. Search difficulty was measured on 1-5 scale, from nothing to a quite bit difficult. Post-search satisfaction was also measured on a 1-5 scale, from not satisfied to a quite bit satisfied.

Table 3-5

Pre-search & Post-search Results in Topic Familiarity, Difficulty, and Language

		Pre-search				Post-search		
Task	Participant ID	*Topic Familiarity*[a]	*Difficulty*[b]	*Language to Use*	*Language of Answers*	*Difficulty*[b]	*Satisfaction*[c]	*Language Used*
A (Factual)	I01	3	2	English	English	5	3	English
	I02	3	2	Both	English	1	5	English
	I03	3	3	English	English	2	5	English
B (Interpretive)	I01	1	2	English	English	2	4	English
	I02	1	2	English	English	1	5	English
	I03	2	2	English	English	3	4	English
C (Exploratory)	I01	1	2	English	English	3	3	English
	I02	1	3	English	English	3	3	English
	I03	1	4	English	English	3	5	English

Note.[a] Topic familiarity is measured on a 1-5 scale (*1. not, 2., 3. somewhat, 4., and 5. a quite bit*). [b] Difficulty is measured on a 1-5 scale (*1. nothing, 2., 3. somewhat, 4., and 5. a quite bit*). [c] Post-search satisfaction is measured on a 1-5 scale (*1. not, 2., 3. somewhat, 4., and 5. a quite bit*).

Lessons Learned and Implications from the Pilot Study

The pilot study indicated that Web browser history files were able to archive the search terms the participants used, as indicated on the search page's URL or the result page's URL. Most search engines supported this feature. The results from the pilot study showed that the participants did not conduct multilingual information search. They only used English in their searching processes. Also, there was no Microsoft Chinese language pack available on the computer used for the pilot study. The lack of language package hindered the experiment. As such, it is evident that the computers in the computer classroom must install the Microsoft Simplified Chinese Language Pack.

Most participants of the pilot study only selected one source to complete the task, which may not reflect the true nature of information searching. Participants should have been assisted with instructions on how they could save Web pages in the browser's bookmarks, which may be used as sources later, or have a stipulated number for the task answer, such as at least 3 information sources required for each task.

Participants reported that the background questionnaire left out two points, including participants' academic major information, and a missing key word. One participant questioned wording in health information tasks as well. The researcher's doctoral dissertation committee suggested the changes of the scales on questionnaires.

Based on the pilot test results, the following modifications were made:

- Prior to major study, the computers were configured with the Microsoft Simplified Chinese Language Pack in the computer classroom
- Questionnaires were revised according to the feedback received from the pilot test participants and the researcher's doctoral dissertation committee
- Health information tasks and the instructions were modified for clarity

Summary

This chapter introduced the research methodology for the study. The pilot study was presented. The next chapter presents the results of the study.

CHAPTER 4

RESULTS

Introduction

This chapter presents the results of the study of Chinese graduate students' Internet search for health information using three types of tasks: factual task (Task 1), interpretative task (Task 2), and exploratory task (Task 3). The first section below describes the participants' characteristics and their Web search experiences. The second section presents findings of the participants' search processes from a pre-search questionnaire, task answer sheet, Web history file, and post-search questionnaire. The third section reports results of correlation tests between types of tasks and four variables identified in the search process: (a) source used to start the search, (b) language selection, (c) use of online translation tools, and (d) time spent.

Descriptive Characteristics of Participants and Web Search Experiences

Participants

Forty-five Chinese graduate students participated in this study, with 25 females (55.6%) and 20 males (44.4%). Table 4-1 shows the participants' gender and length of living in the U.S. by age group. Eighty percent of participants' (80%) were under 31 years of age, and the majority came from the age group of 26-30 (51.1%). Almost ninety percent of the participants had been living in the U.S. less than five years, with 1-3 years the most frequent time spam. Among the participants, there were 26 master's students, 18 doctoral students, and 1 post-baccalaureate student (see Table 4-2 for their affiliated colleges and academic status at the University of North Texas). The participants' undergraduate majors and their current fields of

study were diverse, with a large representation from business (18, 40%) and engineering (11, 24.4%) (see Appendix H).

Table 4-1

Participants' Gender and Years of Living in the U.S. by Age Group

Age Group	Gender		Years of Living in the U.S.			
	Female	Male	< 1 Year	1-3 years	3-5 Years	>5 years
21-25 Years	8	5	4	8	1	0
26-30 Years	13	10	1	10	12	0
31-35 Years	2	1	0	2	1	0
36-40 Years	2	2	0	0	1	3
41-45 Years	0	0	0	0	0	0
46-50 Years	0	2	0	0	0	2
Total	25	20	5	20	15	5

Table 4-2

Participants' College and Academic Status

College	Ph.D.	Master's & Post-baccalaureate	Total
Arts and Sciences	7	2	9
Business Administration	2	16[a]	18
Education	1	4	5
Engineering	8	3	11
Information	0	1	1
Public Affairs and Community Service	0	1	1

Note: [a]1 post-baccalaureate student in the College of Business was included.

Web Search Experiences

Participants' Web search experiences were identified through the background questionnaire (see Appendix C) in which participants were asked questions on training courses,

Internet search frequency, search skills, and search confidence, as well as their purposes for searching health information and health topics searched in the previous year.

With regards to training courses on Internet searching, the majority of the participants, 37 (82.2%), answered "No," which showed they had never taken any training courses; 8 participants (17.8%) answered "Yes," which indicated they had taken training courses. With regards to training courses on how to search the Internet for health information, no participants had taken training courses.

Table 4-3 presents participants' responses related to search frequency, search skills, and search confidence with regards to Internet searching and Internet health information searching. Categories of frequency were provided as well as the levels of search skills and search confidence. All but one participant (44, 97.8%) searched daily the Internet for information. Regarding Internet health information, most participants (30, 66.7%) only searched monthly. The majority of participants (25, 55.6%) ranked themselves as intermediate for Internet information searching; however, the majority (27, 60%) ranked themselves as beginner for Internet health information searching. Almost the same number of participants considered themselves confident in both Internet information searching (20, 44.4%) and Internet health information searching (18, 40%). However, the ratings for very confident or extremely confident and not very confident or not confident were almost exactly reversed. Twenty participants (44.4%) rated themselves as very confident or extremely confident for Internet information searching, but 21 participants (46.7%) rated themselves as not very confident or not confident for Internet health information searching.

Table 4-3

Participants' Search Frequency, Skills, and Confidence on Searching for Internet Information and Health Information

	Search Frequency				Search Skills			Search Confidence				
	Never	Monthly	Weekly	Daily	Beginner	Intermediate	Advanced	Not Confident	Not very confident	Confident	Very confident	Extremely confident
Internet Information	0	0	1	44	5	25	15	0	5	20	18	2
Internet Health Information	6	30	7	2	27	13	5	3	18	18	5	1

The participants' purpose(s) for searching health information were ranked by frequency: personal health concerns (40, 88.9%); other individuals' health concerns (35, 77.8%); health news and knowledge development (17, 37.8%); research (work-related, or school-related) (7, 15.6%); no specific reasons (3, 6.7%). The health topics that were searched by participants are listed in Table 4-4. Nutritional information, fitness/exercise information, and specific disease or medical conditions were the top three health topics searched in the previous year.

Table 4-4

Health Topics Searched in the Previous Year

Health Topics	Frequency
Nutritional information	32
Fitness/exercise information	31
Specific disease or medical condition	30
Specific medical treatment or procedure	22
Health insurance information	15
Alternative medicines and /or treatments	9
Immunization information	8
Drug information	7
Clinical trials	4
Other	1

Participants' Information Search Processes

After completing the background questionnaire, participants accessed three health information tasks: Task 1, Task 2, and Task 3 (See Appendix D, Appendix E, & Appendix F), through the webpage of the study: https://sites.google.com/site/dellapan/study. Each task included the task, a pre-search questionnaire, an answer sheet, and a post-search questionnaire. Forty-four participants (97.3%) completed the tasks following the order of the numbers assigned to the task, which was Task 1, Task 2, and Task 3. Only one participant (2.2%) started with Task 2, then Task 3, and finished Task 1 at the end. Intercoder reliability was measured by the percentage of agreement when conducting content analysis for the source used to start, language selection, and online translation tools. The results of over 80% or higher indicated a high percentage of agreement (see Table 4-5).

Table 4-5

Intercoder Reliability Testing-The Percentage of Agreement

		Language		
Coding	Source to start	Search Term	Result	Used Translation Tool (Yes)
Percentage of Agreement	90.30%	80%	98%	93.5%

The findings of each task, including the pre-search questionnaire, variables in information search process, and the post-search questionnaire, are presented below.

Task 1: Factual Task

Task 1: "When playing soccer in the University of North Texas recreation center, your friend Eric Lin slipped on the floor and hurt his left foot. He was diagnosed with a stress fracture.

Please find a definition of stress fracture. Provide a definition of the term and include the URL(s) of the information source(s) where you found your answer."

Task 1 was related to stress fracture. All participants completed the task. The average search time spent was 3 minutes 10 seconds, and the average number of webpages visited was 9.73.

Pre-search Questionnaire

Before searching for Task 1, the participants were asked about their knowledge of the task's topic, their opinion of the difficulty of searching for the answer, and the language(s) they would use in their search. When asked about their knowledge about the topic of Task 1, 29 participants (64.4%) felt that they were not very knowledgeable, and 8 participants (15.6%) felt they were not knowledgeable; 8 participants (17.8%) felt knowledgeable, and one participant (2.2%) extremely knowledgeable. Regarding the difficulty of Task 1, 28 participants (62.2%) felt it was not very difficult, and 9 participant felt it was not difficult (20%); 6 participants (13.3%) felt it was difficult, and 2 participants (4.4%) felt it was very difficult.

When the participants were asked which language would have more relevant information regarding the topic of Task 1 (stress fracture), 25 participants (55.6%) thought more relevant information would be found in English; 13 participants (28.9%) thought it would be in Chinese; and 5 participants (11.1%) thought it would be in both Chinese and English. When asked in which language they would present the results of their search, 22 participants (48.9%) thought it would be in English; 17 participants (37.8%) considered Chinese; 5 participants (11.1%) thought it would be in both Chinese and English; and 1 participant (2.2%) said they would determine later.

Variables in Search Process

The Web browser history file and the answer sheet of Task 1 helped the reconstruction of each participant's search process in a time frame, from the source used to start the search, the webpages visited, the search terms entered, and the search results presented. For this study, the variables in the search process were the source selected to start, language selection, use of translation tools, and time spent to conduct the search. A description of the results can be found below, as well the search results.

Source to Start

The source used by each participant to start the search was coded into two categories: search engine or other source (see Appendix I). Thirty-nine participants (86.7%) started their search with search engines: Google.com (35, 77.8%) and Baidu.com (4, 9.9%). Six participants (13.3%) started with online translation tools, including Dict.cn (2, 4.4%), Iciba.com (2, 4.4%), Google Translate (1, 2.2%), and Dictionary.com (1, 2.2%). Dict. cn and Iciba.com are Chinese online dictionaries. Among these 6 participants, one participant who started with Dictionary.com mentioned that because the task asked for a definition, a dictionary was "an ideal source for definitions." The other five participants used online translation tools to translate the terms of "stress," "fracture," or "stress fracture," from English to Chinese, and then they used search engines to continue searching.

Using a search engine was the most popular method to start the search for Internet health information. No health information portals or medical websites were considered as sources to start, neither in English nor Chinese.

Language Selection

The participants' language selections in search terms and search results were coded as: English (1), Chinese (2), or both English and Chinese (3). The combinations were also coded (see Appendix J). Regarding the language for the search terms used during the search, 28 participants (62.2%) used English; 14 participants (31.1%) used search terms in both English and Chinese; and 3 participants (6.7%) used Chinese. Regarding the search results, 33 participants (73.3%) presented their search results in English; 7 participants (15.6%) in Chinese; and 5 participants (11.1%) provided their results in both Chinese and English. In total, 31 participants (68.9%) used search terms in either English or Chinese, and 38 participants (88.9%) provided their findings in either English or Chinese, which indicated that most participants used one language when searching for Internet health information.

A total of 36 participants (80%) were consistent with their language selection, regarding the search terms used, and the search results presented. Among 9 participants (20%) who used search terms in both Chinese and English, 5 participants (11.1%) presented their results in English and 4 participants (8.9%) in Chinese later.

Online Translation Tools

Individual participant's use of online translation tools was coded as "Yes" or "No" and the use frequency was recorded (see Appendix K). Twenty eight participants (62.2%) did not use online translation tools during the search, and 17 participants (37.8%) used online translation tools. As shown in Table 4-6, the following translation tools were used: Dict.cn (6), Baidu Dictionary (4), Iciba.com (4), Google Translate (4), Odict.net (1), and Dict.hjenglish.com (1). Dict.hjenlish.com and Odict.net are Chinese online dictionaries. None of the participants used

the Google's advance search feature in the language setting. Twelve participants (26.7%) used online translation tools one time to translate the term "stress fracture," and five participants (11.1%) used the translation tools more than one time. One participant (2.2%) used Google Translate to translate the entire text of Task 1 rather than translate the search terms.

Table 4-6

Online Translation Tools & Terms Used by Participants in Task 1

Participant ID	Tools	Frequency/Terms
CHI 143	Dict.cn; Baidu Dictionary	9 (diagnose, stress, stress fracture; URL; stress fracture; satisfied; assistance; symptom)
CHI 521	Google Translate; Odict.net	4 (stress fracture; urls; transaction; translation)
CHI 161	Google Translate	3 (full text by sentence)
CHI 142	Dict.cn; Dict.hjenglish.com	2 (stress fracture)
CHI 906	Google Translate	2 (cramp; stress fracture)
CHI 115	Iciba.com	1 (stress fracture)
CHI 140	Google Translate	1 (stress fracture)
CHI 141	Iciba.com	1 (stress fracture)
CHI 147	Dicn.cn	1 (stress fracture)
CHI 148	Iciba.com	1 (stress fracture)
CHI 149	Iciba.com	1 (stress fracture)
CHI 162	Dict.cn	1 (stress fracture)
CHI 229	Baidu Dictionary	1 (stress fracture)
CHI 519	Baidu Dictionary	1 (stress fracture)
CHI 529	Dict.cn	1 (stress fracture)
CHI 539	Dict.cn	1 (stress fracture)
CHI 737	Baidu Dictionary	1 (stress fracture)

Time Spent

Table 4-7 presents the statistics of the time spent in completing Task 1, the time spent in searching, and the average number of webpages visited. The average time spent in completing Task 1 was 8 minutes and 59 seconds, and the average search time spent was 3

minutes and 10 seconds. The average time spent in answering the pre-search questionnaire, the task question, and the post-search questionnaire was 5 minutes 21 seconds. The average number of webpages visited for Task 1 was 9.73. Individual participant's time spent was input into a worksheet for further testing (see Appendix L).

Table 4-7

Statistics of Task Time, Search Time Spent, and Webpages Visited in Task 1

Statistics	Task Time	Search Time	Webpages Visited
Mean	8 min 59 s	3 min 10 s	9.73
Minimum	35 s	2 s	2
Maximum	26 min 28 s	18 min 17 s	38
Std. Deviation	2 min 86 s	4 min 23 s	9.54
Median	6 min 43 s	1 min 19 s	6

Search Results

For Task 1, 37 participants (82.2%) used a single resource to answer the task, while 8 participants (17.8%) provided multiple resources as their results. Table 4-8 shows a total of 19 Web sources were used for answering Task 1. Twenty six participants presented their result from Wikipedia.

Post-search Questionnaire

In the post-search questionnaire, 35 participants (77.8%) reported that completing Task 1 was not difficult; 9 participants (20%) thought it was not very difficult; and only 1 participant (2.2%) felt it was difficult. Similar results were reported regarding the satisfaction level, 18 participants (40%) felt satisfied; 22 participants (48.9%) felt very satisfied; 4 participants (8.9%) felt extremely satisfied; and only 1 participant (2.2%) felt not satisfied.

Table 4-8

Search Results' Web Sources in Task 1

Source	Frequency	Language
Wikipedia	26	English
Baike.baidu.com	10	Chinese
Orthoinfo.aaos.org	4	English
Lifescript.com	3	English
Medterms.com	2	English
Aapsm.org	1	English
Ask.yahoo.com	1	English
Dictionary.reference.com	1	English
Drwwalkerfott.reachlocal.net	1	English
Fitnessmotivator.com	1	English
Footanke.com	1	English
Health.com	1	English
Hudong.com	1	Chinese
Livingwellmag.com	1	English
Mayoclinic.com	1	English
Medicinenet.com	1	English
Orthopedics.about.com	1	English
Shenmeshi.com	1	Chinese
Sportsmedcine.about.com	1	English

All the participants responded to the question of "Please describe any difficulty you had in finding information to answer the task" in English, and one participant mixed a few Chinese words. Twenty-four participants (53.3%) did not report any difficulties, and twenty-one participants (46.7%) mentioned the difficulties in the searches. The reported difficulties were categorized into the areas of medical terms/topic knowledge, task content, translation, information selection, and answers (quality/authority) (see Table 4-9).

Table 4-9

Difficulties Reported in Task 1

Difficulties	Number of Participants	Example(s)
Medical Terms/Topic Knowledge	10	"Some professional medical word not understand. I need use dictionary to find the word's meaning first."
Information Selection	4	"So much information online, it is difficult to pick up." "there are lots of information, I have to choose the best answer"
Answers (quality/authority)	4	"My major is not about health, so it is difficult to make sure the answer is right or not;" "The information appears in the news or Wikipedia, and it is not in the medical science journal or presented by authority, but it can be a guide."
Translation	3	"the Chinese meany of Stress_fracture;" "Sometimes I want to pass these information to my parents in China, but it's kind of difficult to translate these words into Chinese."
Task Content	0	N/A

All the participants answered the question of "What kind of assistance do you wish you would have had to complete the task search?" Forty-four participants (97.8%) wrote the comment in English and one participants (2.2%) wrote in Chinese. Nineteen participants (42.2%) reported that they did not need any assistance. Twenty-six participants (57.8%) made the following comments: when searching for Internet health information, they would like to have a dictionary or translation software (10); they would like to have quality health information resources, such as website and science journal (4); they would like to have basic medical knowledge (4); they would like to have information presented in multi-media, such as picture or video (4); they would like to have health care professionals or people who are familiar with medical terminology (2); and they also mentioned the need of having an information filter (1), current information (1), Google (1), and the Internet (1).

Task 2: Interpretive Task

Task 2: “Radiation leaks from the Fukushima nuclear reactor and the following radiation spreading to neighboring countries have raised concerns over the health effects of radiation exposure. How does radiation exposure impact your health? Please present your answer based on your search results and provide the URL(s) of the information source(s) where you found your answer.”

Task 2 was related to the impact of radiation on human health. All participants completed the task. The average search time spent was 4 minutes and 15 seconds, and the average number of webpages visited was 9.29.

Pre-search Questionnaire

Before searching for Task 2, the participants were asked their knowledge of the task’s topic, their opinion of the task difficulty searching for the answer, and the language(s) they would use in their search. When asked about their knowledge about the topic of Task 2 (radiation and health impact), 27 participants (60%) felt that they were not very knowledgeable; 6 participants (13.3%) felt that they were not knowledgeable; 8 participants (17.8%) felt knowledgeable; 3 participants (6.7%) felt very knowledgeable (3, 6.7%); and 1 participant (2.2%) felt they were extremely knowledgeable. Regarding the difficulty of Task 2, 21 participants (46.7%) felt it was not very difficult, and 13 participants (28.9%) felt it was not difficult; 10 participants (22.2%) felt it was difficult, and only 1 participant (2.2%) felt very difficult.

When the participants were asked which language would have more relevant information regarding the topic of Task 2 (radiation and health impact), 27 participants (60%) thought more relevant information would be in English; 9 participants (20%) thought it would

be in Chinese; 9 participants (20%) thought it would be in both Chinese and English. When asked about in which language they would present the search results of their search, 26 participants (57.8%) thought it would be in English; 13 participants (28.9%) thought it would be in Chinese; 6 participants (13.3%) thought it would be in both Chinese and English.

Variables in Search Process

The Web browser history file and the answer sheet of Task 2 helped the reconstruction of each participant's search process in a time frame. A description of the results can be found below, including source selected to start, language selection, use of translation tools, time spent to conduct the search, and search results.

Source to Start

The source used by each participant to start the search was coded into two categories of search engine and other source (see Appendix I). For Task 2, 37 participants (82.2%) used search engines including Google.com (33, 73.3%) and Baidu.com (4, 8.9%); 8 participants (17.8%) started with other Web sources: Wikipedia (3, 6.7%), Google Translate (3, 6.7%), and Dict.cn (2, 4.4%). The three participants who used Google Translate directly copied and pasted the content in Task 2 for full text translation. Two participants used Dict.cn for translating terms "radiation leak," "Fukashima," and "radiation exposure," and then went to Baidu.com for further searches.

No health information portals or medical websites were considered as sources to start, neither in English nor Chinese.

Language Selection

Participants' language selections in search terms and search results were coded as: English (1), Chinese (2), or both English and Chinese (3); the combinations were coded (see Appendix J). Regarding the language used in the search terms, 31 participants (68.9%) used English; 10 participants (22.2 %) used both English and Chinese; 4 participants (8.9 %) used Chinese. Regarding the search results, 34 participants (75.6%) presented their search results in English; 7 participants (15.6%) presented their search results in Chinese; 4 participants (8.9%) provided their search results in both Chinese and English. In total, 35 (77.8%) participants provided their findings in either English or Chinese, and 41 participants (91.1%) provided their findings in English or in Chinese, which also indicated that most participants used one language in Internet health information searching.

A total of 37 participants (82.2%) were consistent with their language selection in the search terms used and the search results presented. Six participants (13.3%) used search terms in both Chinese and English; and for later search results, 3 participants (6.7%) presented in Chinese and 3 participants (6.7%) in English.

Online Translation Tools

Individual participant's use of online translation tools was coded as "Yes" or "No" and the use frequency was recorded (see Appendix K). Regarding the usage of translation tools, 32 participants (71.1%) did not use online translation tools; 13 participants (28.9%) did. The use of online translation tools among these participants was as following: Dict.cn (5), Google Translate (4), Baidu Dictionary (3), and Iciba.com (1). As shown in Table 4-10, 6 participants (13.3%) used online translation tools one time; 7 participants (15.6%) used translation tools more than one

time in the search; 3 participants (6.7%) used Google Translate to translate the entire text of Task 2.

Table 4-10

Online Translation Tools & Terms Used by Participants in Task 2

Participant ID	Tools	Frequency/Terms
CHI 143	Dict.cn	6 (Radiation leak, Fukushima nuclear reactor, Fukushima nuclear, fukushima, radiation leak , guan xin de fang yi)
CHI 737	Baidu Dictionary	3 (radiation exposure; fu she pu lu-jiechu; fushe po lu)
CHI 906	Google Translate	2 (full task; full text)
CHI 162	Dict.cn	2 (Fukushima; radiation exposure)
CHI 529	Dict.cn	2 (Fukushima, radiation exposure)
CHI 228	Baidu Dictionary	2 (Fukushima nuclear; fukushima)
CHI 140	Google Translate	2 (authority website)
CHI 149	Iciba.com	1 (superficial)
CHI 539	Baidu Dictionary	1 (radiation exposure)
CHI 536	Dict.cn	1 (radiation exposure)
CHI 147	Dict.cn	1 (nuclear leak)
CHI 161	Google Translate	1 (full task)
CHI 521	Google Translate	1 (full task)

Time Spent

Table 4-11 presents the statistics of the time spent in completing Task 2, the time spent in search, and the webpages visited. The average time spent in completing Task 2 was 9 minutes and 47 seconds, and the average search time spent was 4 minutes 15 seconds. The average time spent in answering the pre-search questionnaire, the task question, and the post-search questionnaire was 5 minutes 33 seconds. The average number of webpages visited was 9.29. Individual participant's time spent was input into a worksheet for further testing (see Appendix L).

Table 4-11

Statistics of Task Time, Search Time Spent, and Webpages Visited in Task 2

Statistics	Task Time	Search Time	Webpages Visited
Mean	9 min 47 s	4 min 15 s	9.29
Minimum	1 min 3 s	<1 s	2
Maximum	22 min 10 s	16 min 48 s	37
Std. Deviation	3 min 28s	4 min 31 s	10.19
Median	9 min	3 min 14 s	7

Search Results

For Task 2, 31 participants (68.9%) used a single resource to answer the task, while 14 (31.1%) participants provided multiple resources as search results. A total of 32 websites were identified in their search answers (see Table 4-12). Authoritative resources could be identified in these websites visited, such as information provided by government agencies (e.g., epa.gov, nih.gov, energy.gov, and nrc.gov). Participants also presented their results from information they obtained from news media (e.g., bbc.com.uk, latimes.com), and social media (e.g., blog.sina.com.cn, aseinbook.com).

Post-search Questionnaire

In the post-search questionnaire, 23 participants (51.1%) reported that it was not very difficult to complete Task 2; 18 participants (40%) reported that it was not difficult; and 4 participants (8.9%) felt it was difficult. Regarding the satisfaction level, 25 participants (55.6%) felt satisfied; 8 participants (17.8%) felt very satisfied; and 3 participants (6.7%) felt extremely satisfied; while 9 participants (20%) felt not very satisfied.

Table 4-12

Search Results' Web Sources in Task 2

Results	Frequency	Language
Epa.gov	10	English
Wikipedia	5	English
Aseinbook.com	4	English
Bbc.co.uk	4	English
Library.thinkquest.com	4	English
Baike.baidu.com	3	Chinese
Latimes.com	3	English
Medlineplus.gov	3	English
Technologyreview.com	3	English
Care2.com	2	English
Nlm.nih.gov	2	English
Tech.sina.com.cn	2	Chinese
Zhidao.baidu.com	2	Chinese
Answers.yahoo.com	1	English
Baidu.com	1	English
Beforeyoutakethatpill.com	1	English
Blog.sina.com.cn	1	Chinese
Cmt.com.cn	1	Chinese
Health.State.ny.us	1	English
Health.sohu.com	1	English
Hss.energy.gov	1	English
Huffingtonpost.com	1	English
Ks.cn.yahoo.com	1	Chinese
News.cn.yahoo.com	1	Chinese
News.sohu.com	1	Chinese
Nrc.gov	1	Chinese
Physics.isu.edu	1	English
Situationguardian.co.uk	1	English
Slideshare.net	1	English
Stuarthsmith.com	1	English
Thefamilygp.com	1	English
Trailx.com	1	English

All the participants responded to the question of "Please describe any difficulty you had in finding information to answer the task." Forty-four participants (97.8%) wrote the comment in English and one participant (2.2%) wrote in Chinese. Twenty-five participants (55.6%) did not report any difficulties during the searches, including one participant who explained that it was because many people were concerned about this topic but most information looked like the same. Twenty participants (44.4%) participants reported difficulties, which were categorized into the areas of medical terms/topic knowledge, translation, information selection, and answers (quality/authority) (see Table 4-13).

Table 4-13

Difficulties Reported in Task 2

Difficulties	Number of Participants	Example(s)
Information Selection	8	"There are a lot of information about this topic, but the relevant information are not very easy to get," "THE WIKIPEDIA DID NOT CONTAIN ANY USEFUL INFORMATION AND I HAVE TURNED TO GOOGLE FOR MORE. TO SELECT A WEBSITE THAT CONTAINS USEFUL INFORMATION IS HARD"
Answers (quality/ authority)	7	"pick the real reliable and scientifically-sound information," "It was a little hard to determine the liability of the sources," "How to quantize the dose of the radiation exposure."
Medical Terms/Topic knowledge	2	"I don't know background knowledge," "I do not have common sense on this question;"
Task Content	2	"In beginning of this question, it talked about radiation leaks in Japan, and it's nuclear radiation. However, the following question asked about radiation and health. I am not sure the radiation in here is only talk about nuclear radiation or also include others, so I find all kinds of radiations (I think) and health topic." "I was thinking what kinds of impacts the investigator needs: short-term? long term? Anyway, I provide both…"
Translation	1	"Japanese name is always difficult to translate"

All the participants answered the question of "What kind of assistance do you wish you would have had to complete the task search?" Forty-three participants (95.6%) wrote the comment in English and two participants (4.4%) wrote in Chinese. Eighteen participants (40%) reported that they did not need any assistance. Twenty-seven participants (60%) made the following comments: when searching for Internet health information, they would like to have quality health information resources, such as websites (9); they would like to have information presented in multi-media, such as picture or video (4); they would like to have a dictionary or translation support (3); they would like to have basic medical knowledge (3); they would like to have health care professionals or people who are familiar with medical terminology (3); and they also mentioned the need of the Internet (2), Google (1), Wikipedia (1), and a specific subject (1).

Task 3: Exploratory Task

Task 3: "A friend's father experienced a stroke, and fortunately, he is in stable condition in a hospital. Your friend seeks your help in looking for information about strokes and would like to know if there is any relationship between strokes and blood thickness because her father only had a positive sign of blood thickness before the stroke. Please document the relationship based on your search results and provide the URL(s) of the information source(s) where you found your answer."

Task 3 was related to the relationship between thick blood and stroke. All participants completed the task. The average search time spent was 5 minutes 52 seconds, and the average number of webpages visited was 15.51.

Pre-search Questionnaire

Before searching for Task 3, the participants were asked about their knowledge of the task's topic, their opinion of the difficulty searching for the answer, and the language(s) they would use in their search. When asked about their knowledge about the topic of Task 3, 21 participants (46.7%) felt they were not very knowledgeable, and 16 participants (35.6%) felt themselves not knowledgeable; 8 participants (17.8%) felt they were knowledgeable (7, 15.6%), and 1 participant (2.2%) felt himself extremely knowledgeable. Regarding the difficulty of the task, 18 participants (40%) felt it was not very difficult, and 7 participants (15.6%) felt not difficult; 13 participants (28.9%) felt it was difficult, and 7 participants (15.6%) felt very difficult.

When the participants were asked which language would have more relevant information regarding the topic of Task 3 (thick blood and stroke), 28 participants (62.2%) thought more relevant information would be found in English; 10 participants (22.2%) thought it would be in both Chinese and English; 7 participants (15.6%) thought it would be in Chinese. When asked about which language they would present the results of their search, 27 participants (60.0%) thought it would be in English; 13 participants (28.9%) thought it would be in Chinese; 5 participants (11.1%) thought it would be in both Chinese and English.

Variables in Search Process

The Web browser history file and the answer sheet of Task 3 helped the reconstruction of each participant's search process in a time frame. A description of the results can be found below, including source selected to start, language selection, use of translation tools, time spent conducting the search, and search results.

Source to Start

The source used by each participant to start the search was coded into two categories of search engine and other source (see Appendix I). For Task 3, 38 participants (84.4%) used search engines: Google.com (35) and Baidu.com (3); 7 participants (15.6%) started with other Web sources: Google Translate (3), Dict.cn (2), and Iciba.com (1); and Wikipedia (1). Using a search engine was the most popular method to start the search for Task 3. Also, there were no health information portals or medical professional websites considered as primary sources to start with, neither in English nor Chinese.

Language Selection

The participants' language selections in search terms and search results were coded as Chinese, English, or both English and Chinese; the combinations were coded (see Appendix J). Regarding the language for the search terms used during the search, 28 participants (62.2%) used English; 14 participants (31.1%) utilized searches in both English and Chinese; and 3 participants (6.7%) used search terms in Chinese. Regarding the search results, 31 participants (68.9%) presented their search results in English; 10 participants (22.2%) presented their search results in Chinese; 4 participants (8.9%) provided their results in both Chinese and English. In total, 31 participants (68.9%) used search terms in either English or Chinese, and 41 participants (91.1%) provided their findings in either English or Chinese.

Thirty-six participants (80%) were consistent with their language selection in search terms and results presented. Among nine participants (20%) who used search terms in both English and Chinese, 7 participants (15.6%) presented their results in Chinese, and 2 participants (4.4%) presented their answers in English later.

Online Translation Tools

Individual participant's use of online translation tools was coded as "Yes" or "No" and the use frequency was recorded (see Appendix K). Regarding the usage of online translation tools, 31 participants (68.9%) did not use online translation tools during the search; 14 participants (31.1%) used translation tools. The use of online translation tools among the participants was as follows: Google Translate (5), Baidu Dictionary (4), Dicn.cn (4), Iciba.com (2), and Youdao.com (1). Youdao.com is a Chinese online dictionary.

Table 4-14

Online Translation Tools & Terms Used by Participants in Task 3

Participant ID	Tools	Frequency/Terms Used
CHI 143	Dict.cn	9 (stoke; fortunately; stable condition; thickness; blood thickness; thickness; 3 Chinese terms)
CHI 529	Dict.cn	4 (blood thickness; carotid intima; blood thickness; dyscrasia)
CHI 228	Baidu Dictionary; Youdao.com	4 (blood thickness; blood thickness; stoke)
CHI 140	Google Translate	3 (stroke; thickness; viscosity atheroscieosis)
CHI 162	Dict.cn	3 (stroke; blood thickness; thickness)
CHI 737	Google Translate; Baidu Dictionary	3 (b-blood thickness; stroke; g-blood thickness)
CHI 149	Iciba.com	2 (blood thickness; thickness)
	Google Translate	2 (authority; websites)
CHI 148	Dict.cn	1 stroke
CHI 147	Iciba.com	1 (hypertension)
CHI 161	Google Translate	1 (full task)
	Google Translate	1 (full task)
CHI 519	Baidu Dictionary	1 (Chinese term)
CHI 539	Baidu Dictionary	1 (Chinese term)

Time Spent

Table 4-15 presents the statistics of time spent in completing Task 3 and time spent in Internet search. The average time spent in completing Task 3 was 11 minutes and 4 seconds, and the average search time spent was 5 minutes and 52 seconds. The average time spent in answering the pre-search questionnaire, task question, and post-search questionnaire was 5 minutes and 12 seconds. The average number of webpages visited was 15.51.

About the time period of search, 2 participants (4.4%) completed the search in less than 1 minute; 18 participants (40%) completed the search in 1-5 minutes; 18 participants (40%) completed the search in 5-10 minutes; 7 participants (15.6%) completed the search in 10-16 minutes. Individual participant's time spent was input into a worksheet for further testing (see Appendix L).

Table 4-15

Statistics of Task Time, Search Time Spent, and Webpage Visited in Task 3

Statistics	Task Time	Search Time	Webpages Visited
Mean	11 min 04 s	5 min 52 s	15.51
Minimum	1 min 49 s	15 s	3
Maximum	20 min 19 s	15 min 51 s	49
Std. Deviation	3 min 19 s	4 min 1 s	10.19
Median	10 min 23 s	5 min 21 s	12

Search Results

On Task 3 answer sheets, 27 participants (60%) presented a single resource for answers; 18 participants (40%) provided multiple resources as their results. From a total of 27 Web sources providing answers (see Table 4-16), 9 used Sciencdaily.com for answers; 6 provided

their findings from Mombu.com; 5 provided their findings from Baike.baidu.com; 5 used definitions from Wikipedia; and 3 used findings from Zhidao.baidu.com.

Table 4-16

Search Results' Web Sources in Task 3

Source	Frequency	Language
Sciencedaily.com	9	English
Mombu.com	6	English
Baike.baidu.com	5	Chinese
Wikipedia	5	English
Zhidao.baidu.com	3	Chinese
Baiyun120.com	2	Chinese
Healthierharvest.com	2	English
Jigsawhealth.com	2	English
Medicinenet.com	2	English
PubMed Health	2	English
Webmd.com	2	English
120ask.com	1	Chinese
Answer.yahoo.com	1	English
Aw-bc.com	1	English
Blog.sina.com.cn	1	Chinese
Cancersmoc.com	1	English
Chinesenews.com	1	Chinese
Circ.ahajournals.org	1	English
Cnsspetrums.com	1	English
Health.com	1	English
Heart.com	1	English
News.pharmnet.com.cn	1	Chinese
Nonsolonews.net	1	English
Scritube.com	1	English
Stroke.org	1	English
Stroke.org.tw	1	Chinese
Strokecovery.com	1	English

Post-search Questionnaire

In the post-search questionnaire, 18 participants (40%) reported that it was not very difficult to finish Task 3, and 8 participants (17.8%) felt it was not difficult; 16 participants

(35.6%) felt it was difficult, and 3 participant reported it was very difficult (3, 6.7%) to complete the task. Regarding the satisfaction level, 27 participants (60%) felt satisfied, and 7 participants (15.6%) felt very satisfied; 10 participants (22.2%) felt not very satisfied, and 1 participant (2.2%) felt not satisfied.

All the participants responded to the question: "Please describe any difficulty you had in finding information to answer the task." Forty-four participants (97.8%) wrote the comments in English including one participant (2.2%) mixed a few Chinese words with English terms. Only one participant (2.2%) provided the comment in Chinese. Thirteen participants (28.9%) did not report any difficulties during their searches. Thirty-two participants (71.1%) reported the difficulties in the categories of medical terms/topic knowledge, task content, information selection, and answers (quality/authority) (see Table 4-17).

Table 4-17

Difficulties Reported in Task 3

Difficulties	Number of Participants	Example(s)
Medical Terms/Topic Knowledge	17	"There are lots of academic journals involved in this topic and sometimes I don't quite understand what are they talking about." "I cannot understand these completely since I am not familiar with these English medical words."
Information Selection	8	The information about blood thickness and stroke is not many as I thought, both in Chinese and English," "Searching relationship between strokes and blood thickness causes no result," "There are no many information to find online. "
Answers (Quality/Authority)	5	"It was difficult to find a direct answer to the relationship between thick blood and stroke," "There are lots of academic journals involved in this topic and sometimes I don't quite understand what are they talking about," and "there are many other factors which can affect the stroke, blood presser is the main factors. it is hard to explain this question clearly." "I do not know which authorized websites can be used as references," "The difficulty is that I try to find a reliable answers among so many information."
Translation	1	"Do not know the translation of stroke"
Task Content	0	

All the participants answered the question of "What kind of assistance do you wish you would have had to complete the task search?" Forty-three participants (95.6%) wrote the comment in English and two participants (4.4%) wrote in Chinese. Twelve participants (26.6%) reported that they did not need any assistance. Thirty-three participants (73.4%) made the following comments: when searching for Internet health information, they would like to have quality health information resources, such as website or database (9); they would like to have screen capture translation tool or dictionaries (9); they would like to have health care professionals or people who are familiar with medical terminology (6); they would like to be prepared with basic medical knowledge (4); they would like to have popular search engines to have a feature of searching health information (2); they would like to have information presented in multi-media, such as pictures (1); and they also mentioned the need of the Internet (1), or more details about the task (1).

Results of Statistical Tests

The summary of the variables in the search process by task types is concluded below (see Table 4-18).

Research Question 1: "Do Chinese graduate students vary in the selection of sources used to start their search depending upon the types of health information tasks?" The results of chi-square testing of independence (see Appendix M), χ^2 (2, n = 45) = 0.338, p = 0.844, show there was no statistical significance in the selection of sources used to start the search among the three types of health information search tasks. The null hypothesis, there was no significant difference in the selection of sources used to start their search among the types of health

information tasks, was not rejected. Also, the correlation coefficient was calculated by: Cramer's V = 0.05, p >.05 (see Appendix M).

Table 4-18

Summary of Search Process Variables

Variables	Results	Task 1 Frequency (Percentage)	Task 2 Frequency (Percentage)	Task 3 Frequency (Percentage)
Source to Start	Search Engine	39 (86.8%)	37 (82.2%)	38 (84.4%)
	Other Source	6 (13.3%)	8 (17.8%)	7 (15.6%)
Language Selection	Search Terms			
	English	28 (62.2%)	31 (68.9%)	28 (62.2%)
	Chinese	3 (6.7%)	4 (8.9%)	3 (6.7%)
	English& Chinese	14 (31.1%)	10 (22.2%)	14 (31.1%)
	Results			
	English	33 (73.3%)	34 (75.6%)	31 (68.9%)
	Chinese	7 (15.6%)	7 (15.6%)	10 (22.2%)
	English& Chinese	5 (11.1%)	4 (8.9%)	4 (8.9%)
Use of Translation Tools	No	28 (62.2%)	32 (71.8%)	31 (68.9%)
	Yes	17 (37.8%)	13 (28.9%)	14 (31.1%)
Time Spent	Average	3 min 10 s	4 min 15 s	5 min 52 s

Research Question 2: "Do Chinese graduate students vary in their language selection depending upon the types of health information tasks?" The results of chi-square testing of independence (see Appendix N), χ^2 (2, n = 45) = 3.841, p = 0.63, showed that there was no statistical significance in language selection among the types of health information tasks. The null hypothesis, there was no significant difference in the language selection among the types of health information tasks, was not rejected. Also, the correlation coefficient was determined through Cramer's V = 0.083, p >.05 (see Appendix N).

Research Question 3: “Do Chinese graduate students vary in their use of online translation tools depending upon the types of health information tasks?” A one-way repeated measures ANOVA was conducted to compare the effect of task types on use frequency of translation tools in search process for Internet health information (see Appendix O). Mauchly’s test indicated that the assumption of sphericity had been violated, χ^2 (2) = 14.547, $p < .05$, therefore degrees of freedom were corrected using Greehouse-Geisser estimates of sphericity ($\epsilon = 0.777$). The results show that there was no significant effect on types of tasks on the uses of online translation tools, F (1.554, 68.375) = 1.398, $p = 0.252$. So, the null hypothesis, there was no significant difference in their use of using online translation tools among the types of health information tasks, was not rejected. These results suggested no difference on the uses of online translation tools among types of tasks.

Research Question 4: “Do Chinese graduate students vary in the time spent depending upon the types of health information tasks?” A one-way repeated measures ANOVA was conducted to compare the effect of task types on time spent in search process for Internet health information (see Appendix P). Mauchly’s test indicated that the assumption of sphericity had not been violated, χ^2 (2, n = 45) = 0.981, $p > .05$. The variance of the differences between tasks was equal. The results showed that there was significant effect from types of tasks on search time spent, F (2, 88) = 5.617, $p = 0.005$. So, the null hypothesis, there was no significant difference in the time spent among the types of health information tasks, was rejected. The η^2= 0.113, indicated the relationship between type of task and time spent was moderate, which explained 11.3% the variance of time spent. These results suggested that time spent on types of tasks was statistically significantly different. Pair-wise comparisons were conducted to assess

which means differ from each task. Specifically, there was a significant difference in the time spent for Task 3 (M = 5 min 52 s, SD = 4 min 01 s) and Task 1 (M = 3 min 10 s, SD = 4 min 23 s); t (44) = 3.156, $p < 0.05$. There was a significant difference in time spent for Task 3 (M = 5 min 52 s, SD = 4 min 01 s) and Task 2 (M = 4 min 14 s, SD = 4 min 31 s); t (44) = 2.144, $p < 0.05$. It took longer time for participants to complete Task 3 than Task 1 and Task 2.

Also, I looked for relationships between dependent variables and demographic variables (gender, age, educational level, and major). Measuring dependency of two variables from categorized data, cross-table chi-square testing of independence was applied. One-way ANOVA was used for a categorical variable and a numerical variable. Statistical analyses showed that no statistically significant differences were found between the gender, age, educational level and the dependent variables of the information search process (source to start, language selection in search and results, use of translation tools, and time spent). However, there were two exclusions, regarding the use of translational tools and majors, students of science/engineering majors used fewer translational tools while students of other majors used translational tools in the search more often in Task 1 (χ^2 (1, N = 45) = 6.749, p = 0.009; Cramer's V = 0.387) and Task 3 (χ^2 (1, N = 45) = 7.160, p = 0.007; Cramer's V = 0.399).

Table 4-19

Demographic Info. vs. Time Spent: One Way ANOVA Results

Time Spent	Gender (F/M)	Age (<=30, >30)	Degree(Ph.D., Master/Post-bachelor)	Major (Science/Engineering, Business/Education/Others)
Time Spent				
Task 1	F(1,43)=.822, p=.370	F(1,43)=.254, p=.617	F(1,43)=.213, p=.647	F(1,43)=.010, p=.920
Task 2	F(1,43)=.1.059, p=.309	F(1,43)=2.185, p =.147	F(1,43)=3.726, P=.060	F(1,43)=2.172, p=.148
Task 3	F(1,43)=1.903, p=.175	F(1,43)=2.320, p =.135	F(1,43)=.283, p=.597	F(1,43)=.842, p=.364

For Task 1, Task 2, and Task 3, topic familiarity, pre-search task difficulty, post-search task difficulty, post-search difficulty and post-search satisfaction were also studied to see if they differed from variables in information search process among three tasks. The researcher only found a statistically significant relationship between the post-search difficulty and time spent on Task 2, which indicated that for those participants who ranked a higher difficult degree spent more time in completing the search (see Table 4-20).

Table 4-20

Topic Knowledge, Pre-search Difficulty, Post-search Difficulty, Satisfaction vs. Time Spent: One Way ANOVA Results

Time Spent	Topic Knowledge	Pre-Difficulty	Post-Difficulty	Post-Satisfaction
Task 1	F(3,41)=.109, p=.955	F(3,41)=1.048, p=.382	F(2,42)=1.414, p=.255	F(3,41)=.760, p=.523
Task 2	F(4,40)=.929, p=.457	F(3,41)=1.904,p=.144	F(2,42)=8.086, p=.001*	F(3,41)=1.149, p=.341
Task 3	F(3,41)=2.050, p=.122	F(3,41)=.628, p=.601	F(3,41)=.381, p=.767	F(3,41)=1.208, p=.319

*$p < 0.05$.

Summary

In summary, 45 Chinese graduate students searched Internet health information for three types of tasks: a factual task, an interpretive task, and an exploratory task. The researcher analyzed the relationships between the types of tasks and four variables identified in the search process: source selected to start the search, language selection, use of translation tools, and time spent through chi-square of testing independence and one-way repeated measures ANOVA. Results indicated that there was a significant effect of types of tasks on time spent; there were no statistical significances in source selected to start the search, language selection, and use of translation tools among these types of tasks.

CHAPTER 5

DISCUSSIONS AND CONCLUSIONS

Introduction

The purpose of the study was to examine the relationships between types of health information tasks and the Internet information search processes of Chinese graduate students, with a focus on the aspects of source to start the search, language selection, use of online translation tools, and time spent in searching. In a computer classroom, 45 Chinese graduate students at the University of North Texas searched the Internet and completed three health information search tasks: factual task, interpretative task, and exploratory task. Data from the Chinese graduate students' health information search processes were gathered from Web browser history files, answer sheets, and questionnaires. Parametric and non-parametric statistical analyses were conducted to test the relationship between the types of tasks and variables identified in the search process.

This chapter is organized in four sections: (a) discussion of Internet health information searching processes; (b) conclusions and observations; (c) significance of the study; and (d) recommendations for future study.

Discussion of Internet Health Information Searching Processes

The results analyzed in Chapter 4 showed that types of tasks only had a statistically significant impact on the time spent conducting the search for the different tasks, but did not have statistically significant effects on the source selected to start the search, language selection, or the use of language tools. A discussion of each research question is addressed below.

Research Question 1: “Do Chinese graduate students vary in the selection of sources used to start their search depending upon the types of health information tasks? “For the sources used to start the search, there was no statistically significant difference among the types of tasks. The types of tasks did not influence the participants’ decision on where to start the search.

Regarding the sources used in the three tasks, Task 1, Task 2, and Task 3, search engines were the first choice to start the search by the majority of participants: 34 Chinese graduate students (75.6%) used search engines as a starting point for all three tasks; 30 participants (66.7%) used Google for all three tasks; and 40 participants (88.9%) used Google in at least one task. Also, looking across the three tasks, 11 participants (24.4%) started their search with non-search engines including: online dictionaries (9), Google Translate (7), and Wikipedia (4). No health information portals or medical websites were selected as a starting source. Also, none of the participants had previously taken training courses on Internet health information searching, so most likely, the participants were not familiar with online resources of high quality health information.

It is not surprising that search engines were the major sources used to start the search for Internet health information. Powerful search features have made search engines the most popular online tool. Using search engines has become a default search pattern for Internet health information (Fox & Jones, 2009; Heliman, 2011).

Research Question 2: “Do Chinese graduate students vary in their language selection depending upon the types of health information tasks?” For language selection, there was no

statistically significant difference among the types of tasks. The types of tasks did not influence the participants' language selection.

The majority of participants used English as the primary language in the search process: 24 participants (53.3%) used English for their search terms and their presentation of the results for all the tasks; 33 participants (73.3%) used English for their search terms in at least one task; and 36 participants (80%) presented their results in English in at least one task. Twenty-nine participants (64.4%) were consistent with their language selection in the search terms and results in Task 1, Task 2, and Task 3, with 24 participants (53.3%) using English consistently.

All the participants were Chinese graduate students enrolled at the University of North Texas. Since the students had to meet graduate school entrance requirements, it was assumed that they had good English skills to support their graduate study. Previous research showed that the language use by bilingual academic users depended on the particular activities at hand (Rieh & Rieh, 2005). The activity explored in this study was Internet health information searching, and the findings showed the language preference by Chinese graduate students was English. Also, it should be noted that the tasks were provided in English, which might have influenced the language selection.

Research Question 3: "Do Chinese graduate students vary in their use of online translation tools depending upon the types of health information tasks?" For the use of online translation tools, there was no statistically significant difference among the types of tasks. The types of tasks did not influence the use of online translation tools. Twenty-seven participants (60%) did not use online translation tools, and 18 participants (40%) used online translation tools in at least one task.

Among the 18 participants (40%) who used online translational tools, 9 participants (20%) used these tools in each of the three tasks, and 11 participants (24%) used the tools more than one time in at least one task. The translational tools used included 6 Chinese online dictionaries and Google Translate. The frequencies of using the specific tools were: Dict.cn (15), Google Translate (13), Baidu Dictionary (11), Iciba.com (7), and other Chinese online dictionaries, Odict.net (1), Dict. youdao.com (1), and Dict.hjenglish.com (1). Most of the translated terms were the key terms in the different tasks. A few terms were not related to the tasks, but might have contributed to the participants' cognitive process. The other translation format included a full text translation, and perhaps it was due to lack of understanding English.

The use of online translation tools occurred at the beginning, during or after the search. At the beginning of the search, the participants used these tools to help understand the concepts. Similarly in MedlinePlus, the dictionary, as one of major types of resources, was often accessed by users to understand the concept to gain a background information about the health topics before searching (Zhang et al, 2012). During the search, it was common for participants to translate English terms into Chinese. A few participants used online translation tools after they found their search results, where the translation function was used more as a verification of the findings. No students tried Google's advanced language setting, which could have helped them to search the terms in the language of their choice in the search.

Research Question 4: "Do Chinese graduate students vary in the time spent depending upon the types of health information tasks? "For the use of time spent, there was statistically significant difference among the types of tasks. The types of tasks did influence the time spent in the search. Participants spent more time in completing Task 3, the exploratory task, which

asked the relationship between thick blood and stroke. The overall average of search time spent on a task was 4 minutes and 26 seconds, and the average of time spent on searching for each task was: Task 1 (3 min 10 s); Task 2 (4 min 15 s); and Task 3 (5 min 52 s). According to the range of time spent, 25 participants (55.6%) spent more than 5 minutes on Task 3; 32 participants (71.1%) completed the search less than 5 minutes on Task 2; and 35 participants (77.8%) finished searching less than 5 minutes on Task 1.

Previous studies found that the difficulty and complexity of the task increased information load, and increased the amount of time in searching (Campbell, 1988; Gwizdka & Spence, 2006). In this study, participants mentioned that there was not enough information available for Task 3, and they had difficulties in finding information from authoritative sources or scientific evidence. Comparing Task 3 to Task 1 and Task 2, the participants felt that Task 3 had a higher degree of difficulty. Also, participants visited more webpages in Task 3.

For daily life tasks (Kim, 2006), the average time to complete the factual task was longer than the interpretive task and the exploratory task. In this study for the health information tasks, the average time spent on the exploratory task was longer than the time spent on the factual task and the interpretive task. The subject domain of the tasks and the possible different levels of difficulty in the same type of the tasks may explain the different findings related to the time spent searching the Internet for health information.

Conclusions and Observations

Conclusions

Major conclusions of the study are:

- The types of tasks did not influence the source selected to start an Internet health information search by Chinese graduate students.

  Comment: Search engines were primary sources as the starting point for searching health information on the Internet.

- The types of tasks did not influence language selection conducting an Internet health information search by Chinese graduate students.

  Comment: English was the primary language for searching health information on the Internet.

- The types of tasks did not influence the use of language tools conducting an Internet health information search by Chinese graduate students.

  Comment: Online translation tools were not highly used by the participants to search for health information on the Internet.

- The types of tasks influenced time spent conducting an Internet health information search by Chinese graduate students.

  Comment: Time spent was impacted by the difficulty of the tasks.

Observations

Following are observations which can be made from the study:

1. The participants' gender, age, years of living in the U.S., and education level did not influence their searching for health information on the Internet.
2. Participants who majored in science or engineering used online translation tools less often.
3. Google was the preferred search engine used.

4. The key words in the tasks were the most frequently used search terms.
5. For each task, participants obtained results from different types of resources. For Task 1, factual task, the use of an online encyclopedia was presented as the primary source. For Task 2, interpretative task, the most common sources were from government agencies and media. For Task 3, exploratory task, many participants used a report from Sciencedaily.com, though it was published in 1999, and it was based on a journal article with scientific evidence.
6. There was not a consistency in the use of online translation tools when they were used in the search process.
7. Even though the majority of the participants felt that they were not knowledgeable about the tasks' health topics, they did not feel it would be difficult searching for health information.
8. Task content and language translation were not reported as major difficulties in the search process.

Significance of the Study

The findings of the study can be used in academic library services, multilingual health information system design, and task-based health information searching.

Academic librarians could use the findings of the study to design instructional, information, and outreach services targeted to international students, particularly Chinese students, on the topic of health information. Chinese students are the largest and fastest growing group of international students in the U.S. If academic librarians have a better

understanding of how Chinese graduate students searching for health information on the Internet, they can provide tailored training courses and instructional materials.

Health information systems that target health consumers or general public bridge the gap among medical knowledge, healthcare services, and health consumers. The understanding of information needs and information behaviors of a targeted population is the first step to design a health information system. This study provides implications for the development of multilingual health information resources and the design of multilingual health information systems from the aspects of language support, format, search features, and user interface.

Multilingual users have their language preference of language selection for Internet information searching. As suggested by the participants of this study, they particularly wanted to have language support and information presented in multimedia. The language features can be tailored to an individual setting and provide customized options to support screen capture of words translation. For consumer health information, multimedia presentation can be a fast and direct approach to Internet users and help general health consumers to understand medical knowledge. In order to retrieve more relevant information, a section of health information can be embedded into popular search engines, with advanced features to filter information or broad search fields, and to automatically annotate information source.

The study also contributes to the body of knowledge to task-based health information searching, a step toward understanding of Chinese graduate students searching behavior. Task-based health information seeking behavior studies can help researchers to know more about the art of online information search in the domain of health information.

Recommendations for Future Research

Future research could include replications of the study by changing the following aspects: the language of the tasks; the subject domain of task content; or the study population. Also, different levels of difficulty in the same type of task should be considered when examining the effect of types of tasks on information searching behavior.

Other recommendations for future research in health information research include: 1) studying other human factors on Internet health information search process among different user groups, such as Chinese undergraduate students, 2) integrating the findings of user behavior into health information systems design, and 3) using standard tasks in health information portals or medical websites for usability and user experience testing.

Based on search results from this study and the usage of bilingual health information, it is important to create guidelines for training Chinese students on the use of quality health information and to create a prototype of Chinese and English health information system.

Finally, more research should be conducted to explore health information searching behavior of Chinese students by observing individual's search behaviors in specific health information resources. There is a need to apply standard tasks for these resources, such as health information portals or medical websites to conduct the usability test or study user experiences.

Summary

This chapter provided an overview of the study and the findings related to the research questions. The major conclusions of this study were discussed among with the significance of the study and recommendations for future research.

APPENDIX A

THE APPROVED IRB LETTER

UNT
UNIVERSITY OF
NORTH TEXAS
Discover the power of ideas.

OFFICE OF THE VICE PRESIDENT FOR RESEARCH AND ECONOMIC DEVELOPMENT
Research Services

June 8, 2011

Dr. Ana Cleveland
Department of Library & Information Sciences
University of North Texas
RE: Human Subjects Application No. 11-259

Dear Dr. Cleveland:

In accordance with 45 CFR Part 46 Section 46.101, your study titled "The Role of Health Tasks in the Health Information Searching of Chinese Graduate Students" has been determined to qualify for an exemption from further review by the UNT Institutional Review Board (IRB).

Enclosed is the consent document with stamped IRB approval. Please copy and **use this form only** for your study subjects.

No changes may be made to your study's procedures or forms without prior written approval from the UNT IRB. Please contact Jordan Harmon, Research Compliance Analyst, ext. 3940, if you wish to make any such changes. Any changes to your procedures or forms after 3 years will require completion of a new IRB application.

We wish you success with your study.

Sincerely,

Brad Hayden for PLK

Patricia L. Kaminski, Ph.D.
Associate Professor
Chair, Institutional Review Board

PK:jh

1155 Union Circle #305250 | Denton, Texas 76203-5017 | TEL 940.565.3940 | FAX 940.565.4277
TTY 940.369.8652 | http://research.unt.edu

APPENDIX B

INVITATION EMAIL

Invitation E-mail

Dear students,

My name is Xuequn Pan, and I am a Ph.D. candidate in the Interdisciplinary Information Science PhD Program, College of Information. I am working with Dr. Ana D. Cleveland, Regents Professor and Director of Health Informatics Program, on my dissertation *The Role of Health Tasks in the Health Information Searching of Chinese Graduate Students*.

We would like to invite you to participate in a study to examine the association between health information tasks and the online search process of Chinese graduate students and analyze how search tasks influence the search process.

We are looking for 45 current Chinese graduate students (post-baccalaureate, master's, or doctoral) at the University of North Texas to participate.

In the study, participants will complete 3 health information tasks using the Internet. The participation in the project is voluntary, and the duration is about 30-45 minutes. Participants are ensured confidentiality. The results of the study will help information professionals to understand Chinese students' search behaviors for online health information and the roles of different health information tasks in their search processes, which can assist in the design of health information resources for the Chinese population, and in the development of library services which aim to improve Chinese students' search abilities and utilization of health information.

Please contact me at xuequn.pan@unt.edu or (940) 565-3559 by June 30, 2011 if you are interested in participating.

Thank you!

Sincerely,

Xuequn Pan
Ph.D. Candidate
Department of Library and Information Sciences
College of Information
University of North Texas

APPENDIX C

BACKGROUND QUESTIONNAIRE

Background Questionnaire

The Role of Health Tasks in the Health Information Searching of Chinese Graduate Students

We appreciate your interest in this study!

The background questionnaire has a total of 16 questions within 5 sections:
Section I: Demographic Information
Section II: Education
Section III: Training
Section IV: Internet Usage & Search Skills
Section V: Health Information

Please click on "Next>>," and provide the appropriate answers for the following questions. It will take you approximately 5-10 minutes to complete the questionnaire. Please submit it when you finish all the questions.

There are 16 questions in this survey

Section I: Demographic Information

1 [1]What is your gender? *

Please choose **only one** of the following:

- ○ Female
- ○ Male

2 [2]What is your age? *

Please choose **only one** of the following:

- ○ 18-20 years
- ○ 21-25 years
- ○ 26-30 years
- ○ 31-35 years
- ○ 36-40 years
- ○ 41-45 years
- ○ 46-50 years
- ○ 51-55 years
- ○ 56 and older

3 [3]How long have you lived in the U.S.? *

Please choose **only one** of the following:

- ○ Less than 1 year
- ○ 1 to 3 years
- ○ 3 to 5 years
- ○ More than 5 years

Section II: Education

4 [1]What is your academic status at the UNT? *

Please choose **only one** of the following:

- ○ Master's Level
- ○ Ph.D. Level
- ○ Post-baccalaureate Level (Second bachelor's)

5 [2]What was your undergraduate major? *

Please write your answer here:

6 [3]What is your current major? *

Please write your answer here:

Section III: Training

7 [1]Have you taken any training courses on Internet information searching?

Please choose **only one** of the following:

- ○ Yes
- ○ No

8 [2]Have you taken any training courses on Internet health information searching?

Please choose **only one** of the following:

- ○ Yes
- ○ No

Section IV: Internet Usage & Search Skills

9 [1]How often do you use the Internet to search for information? *

Please choose **only one** of the following:

- ○ Monthly
- ○ Weekly
- ○ Daily
- ○ Never

10 [2]How often do you use the Internet to search for health information? *

Please choose **only one** of the following:

- ○ Monthly
- ○ Weekly
- ○ Daily
- ○ Never

11 [3]In terms of your Internet skills, what level do you consider yourself to be? *

Please choose **only one** of the following:

- ○ Beginner
- ○ Intermediate
- ○ Advanced

12 [4]In terms of your Internet health information search skills, what level do you consider yourself to be? *

Please choose **only one** of the following:

- ○ Beginner
- ○ Intermediate
- ○ Advanced

13 [5]How confident do you usually feel being able to find the information you need on the Internet? *

Please choose **only one** of the following:

- ○ Not confident
- ○ Not very confident
- ○ Confident
- ○ Very confident
- ○ Extremely confident

14 [6]How confident do you usually feel being able to find health information you need on the Internet? *

Please choose **only one** of the following:

- ○ Not confident
- ○ Not very confident
- ○ Confident
- ○ Very confident
- ○ Extremely confident

Section V: Health information

15 [1]Which of the following health topics have you searched on the Internet during the past year? *

Please choose **all** that apply:

- ☐ Specific diseases or medical conditions
- ☐ Specific medical treatment or procedure
- ☐ Alternative medicines and/or treatments (i.e. herbal remedies, acupuncture, hypnosis)
- ☐ Nutritional information
- ☐ Fitness/exercise information
- ☐ Drug information
- ☐ Health insurance information
- ☐ Immunization information
- ☐ Clinical trials
- ☐ Other: _____

16 [2]For what purpose do you search for health information on the Internet? *

Please choose **all** that apply:

- ☐ Your personal health concerns
- ☐ Health concerns of other individuals
- ☐ Research (work-related, school-related)
- ☐ Health news and knowledge development
- ☐ Not any specific reason
- ☐ Other: _____

Thank you for completing the background questionnaire!

31.12.1969 – 18:00

Submit your survey.
Thank you for completing this survey.

APPENDIX D

TASK 1

(Pre-search Questionnaire, Answer Sheet, and Post-search Questionnaire)

Task 1

When playing soccer in the University of North Texas recreation center, your friend Eric Lin slipped on the floor and hurt his left foot. He was diagnosed with a stress fracture.

Please find a definition of stress fracture. Provide a definition of the term and include the URL(s) of the information source(s) where you found your answer.

Steps:
1. Click on "Next>>," and answer a pre-search questionnaire before you start the task
2. Conduct online search using the Internet
3. Go to "Next>>," and provide answer in the answer box
4. Click on "Next>>," and fill out a post-search questionnaire
5. Submit the form

There are 10 questions in this survey

Pre-search Questionnaire

Task 1

1 [1]How knowledgeable are you about the health topic presented in this task?

*

Please choose **only one** of the following:

- ○ Not knowledgeable
- ○ Not very knowledgeable
- ○ Knowledgeable
- ○ Very knowledgeable
- ○ Extremely knowledgeable

2 [2] How difficult do you think this task will be?
*

Please choose **only one** of the following:

- ○ **Not difficult**
- ○ **Not very difficult**
- ○ **Difficult**
- ○ **Very difficult**

○ **Extremely difficult**

3 [3] In which language do you think more relevant information will be found about this task?
*

Please write your answer here:

4 [4]In which language would you like to have your answer to this task?
*

Please write your answer here:

Answer to Task 1

Please complete the search task, and present your answer here. Click on "Next>>" to a post-search questionnaire.

5 [1]Please provide your answer and the URL where you located the answer: *

Please write your answer here:

Post-search Questionnaire

Task 1

6 [1] How difficult was it to finish this search task? *

Please choose **only one** of the following:

- ○ Not difficult
- ○ Not very difficult
- ○ Difficult
- ○ Very difficult
- ○ Extremely difficult

7 [2] How satisfied were you with your search results for the task? *

Please choose **only one** of the following:

- ○ Not satisfied
- ○ Not very satisfied
- ○ Satisfied
- ○ Very satisfied
- ○ Extremely satisfied

8 [3] In which language did you find your answer to the task? *

Please write your answer here:

9 [4]Please describe any difficulty you had in finding information to answer the task. *

Please write your answer here:

10 [5]What kind of assistance do you wish you would have had to complete the task search? *

Please write your answer here:

31.12.1969 – 18:00

Submit your survey.
Thank you for completing this survey.

APPENDIX E

TASK 2

(Pre-search Questionnaire, Answer Sheet, and Post-search Questionnaire)

Task 2

Radiation leaks from the Fukushima nuclear reactor and the following radiation spreading to neighboring countries have raised concerns over the health effects of radiation exposure. How does radiation exposure impact your health? Please present your answer based on your search results and provide the URL(s) of the information source(s) where you found your answer.

Steps:
1. Click on "Next>>," and answer a pre-search questionnaire before you start the task
2. Conduct online search using the Internet
3. Go to "Next>>," and provide answer in the answer box
4. Click on "Next>>," and fill out a post-search questionnaire
5. Submit the form

There are 10 questions in this survey

Pre-search Questionnaire

Task 2

1 [1] How knowledgeable are you about the health topic presented in this task?
*

Please choose **only one** of the following:

- ○ Not knowledgeable
- ○ Not very knowledgeable
- ○ Knowledgeable
- ○ Very knowledgeable
- ○ Extremely knowledgeable

2 [2] How difficult do you think this task will be?
*

Please choose **only one** of the following:

- ○ **Not difficult**
- ○ **Not very difficult**
- ○ **Difficult**

- ○ **Very difficult**
- ○ **Extremely Difficult**

3 [3] In which language do you think more relevant information will be found about this task? *

Please write your answer here:

4 [4]In which language would you like to have your answer to this task? *

Please write your answer here:

Answer to Task 2

Please complete the search task, and present your answer here. Click on "Next>>" to a post-search questionnaire.

5 [1]Please provide your answer and the URL(s) where you located your answer: *

Please write your answer here:

Post-search Questionnaire

Task 2

6 [1] How difficult was it to finish this task?
*

Please choose **only one** of the following:

- ○ Not difficult
- ○ Not very difficult
- ○ Difficult
- ○ Very difficult
- ○ Extremely difficult

7 [2] How satisfied were you with your search results for the task?
*

Please choose only one of the following:

- ○ Not satisfied
- ○ Not very satisfied
- ○ Satisfied
- ○ Very satisfied
- ○ Extremely satisfied

8 [3] In which language did you find your answer to the task?
*

Please write your answer here:

9 [4]Please describe any difficulty you had in finding information to answer the task?
*

Please write your answer here:

10 [5]What kind of assistance do you wish you would have had to complete the task search? *

Please write your answer here:

31.12.1969 – 18:00

Submit your survey.
Thank you for completing this survey.

APPENDIX F

TASK 3

(Pre-search Questionnaire, Answer Sheet, and Post-search Questionnaire)

Task 3

A friend's father experienced a stroke, and fortunately, he is in stable condition in a hospital. Your friend seeks your help in looking for information about strokes and would like to know if there is any relationship between strokes and blood thickness because her father only had a positive sign of blood thickness before the stroke. Please document the relationship based on your search results and provide the URL(s) of the information source(s) where you found your answer.

Steps:
1. Click on "Next>>," and answer a pre-search questionnaire before you start the task
2. Conduct online search using the Internet
3. Go to "Next>>," and provide answer in the answer box
4. Click on "Next>>," and fill out a post-search questionnaire
5. Submit the form

There are 10 questions in this survey

Pre-search Questionnaire

Task 3

1 [1] How knowledgeable are you about the health topic presented in the task? *

Please choose **only one** of the following:

- ○ Not knowledgeable
- ○ Not very knowledgeable
- ○ Knowledgeable
- ○ Very knowledgeable
- ○ Extremely knowledgeable

2 [2] How difficult do you think this task will be? *

Please choose **only one** of the following:

- ○ Not difficult
- ○ Not very difficult
- ○ Difficult
- ○ Very difficult

○ Extremely difficult

3 [3] In which language do you think more relevant information will be found about this task?
*

Please write your answer here:

4 [4]In which language would you like to have your answer to this task?
*

Please write your answer here:

Answer to Task 3

Please complete the search task, and present your answers here. Click on "Next>>" to a post-search questionnaire.

5 [1]Please provide your answer with the URL(s) where you located your answer: *

Please write your answer here:

Post-search Questionnaire

Task 3

6 [1] How difficult was it to finish this task? *

Please choose **only one** of the following:

- ○ Not difficult
- ○ Not very difficult
- ○ Difficult
- ○ Very difficult
- ○ Extremely difficult

7 [2] How satisfied were you with your search results for the task? *

Please choose **only one** of the following:

- ○ **Not satisfied**
- ○ **Not very satisfied**
- ○ **Satisfied**
- ○ **Very satisfied**
- ○ **Extremely satisfied**

8 [3] In which language did you find your answer to the task? *

Please write your answer here:

9 [4]Please describe any difficulty you had in finding information to answer the task? *

Please write your answer here:

10 [5]What kind of assistance do you wish you would have had to complete the task search? *

Please write your answer here:

31.12.1969 – 18:00

Submit your survey.
Thank you for completing this survey.

APPENDIX G

INFORMATION CONSENT FORM

University of North Texas Institutional Review Board

Informed Consent Form

Before agreeing to participate in this research study, it is important that you read and understand the following explanation of the purpose, benefits and risks of the study and how it will be conducted.

Title of Study: The Role of Health Tasks in The Health Information Searching OF Chinese Graduate Students

Principal Investigator: Dr. Ana D. Cleveland, University of North Texas (UNT) Department of Library and Information Sciences.

Purpose of the Study: The purpose of this study is to examine the relationships between types of health information tasks and the Internet information search process of Chinese graduate students at the University of North Texas.

Study Procedures: All participants will conduct online search tasks in the computer classroom D212 at UNT Discovery Park. Each participant logs into a computer with a valid UNT EUID and password. Participants will access to online questionnaires which include a background questionnaire and 3 health information tasks (https://sites.google.com/site/dellapan/study). Each task includes an assigned task, a pre-search questionnaire, an answer sheet, and a post-search questionnaire. Participants will use the Internet to complete all the tasks. Participants' online activities will be automatically stored in a browser history file featured in the default Firefox Web browser. An individual's Web browser history file will be collected before participants log out. All the procedures will take about 30-45 minutes.

Foreseeable Risks: No foreseeable risks are involved.

Benefits to the Subjects or Others: We expect the study to benefit Chinese graduate students by helping them understand health information tasks and their uses of Internet health information, and help information professionals to design high quality health information resources and to provide better library services to Chinese graduate students.

Compensation for Participants: There is not any compensation for participants.

Procedures for Maintaining Confidentiality of Research Records: The confidentiality of participants' identities will be maintained in any publications or presentations regarding this study. Results will be reported on an aggregate basis.

Questions about the Study: If you have any questions about the study, you may contact *Dr. Ana D. Cleveland or Xuequn Pan* at telephone number *(940) 565-3559*.

Review for the Protection of Participants: This research study has been reviewed and approved by the UNT Institutional Review Board (IRB). The UNT IRB can be contacted at (940) 565-3940 with any questions regarding the rights of research subjects.

Research Participants' Rights:

Your signature below indicates that you have read or have had read to you all of the above and that you confirm all of the following:

- *Dr. Ana D. Cleveland or Xuequn Pan* has explained the study to you and answered all of your questions. You have been told the possible benefits and the potential risks and/or discomforts of the study.
- You understand that you do not have to take part in this study, and your refusal to participate or your decision to withdraw will involve no penalty or loss of rights or benefits. The study personnel may choose to stop your participation at any time.
- Your decision to participate or to withdraw from the study will have no effect on your standing in any course or your course grade.
- You understand why the study is being conducted and how it will be performed.
- You understand your rights as a research participant and you voluntarily consent to participate in this study.
- You have been told you will receive a copy of this form.

_____
Printed Name of Participant

_____ _____
Signature of Participant Date

For the Principal Investigator or Designee:

I certify that I have reviewed the contents of this form with the subject signing above. I have explained the possible benefits and the potential risks and/or discomforts of the study. It is my opinion that the participant understood the explanation.

_____ _____
Signature of Principal Investigator or Designee Date

APPENDIX H

EDUCATION BACKGROUND

CHI#	Undergraduate Major	Current Major
CHI111	International Economics and Trade	MBA in Finance
CHI112	Finance	Accounting
CHI113	English	Education
CHI114	Materials Science and Engineering	Materials Science and Engineering
CHI115	Materials Science and Engineering	Materials Science and Engineering
CHI116	Math	Math
CHI118	Optical Electronic Engineering	Material Science and Engineering
CHI119	Dance Education	Early Childhood Education
CHI121	EE	Computer Science
CHI122	Computer Science	Computer Science
CHI131	Material Physics	Material Science
CHI140	International Economics and Trade	Educational Research
CHI141	Computer Science	Library and Information Science
CHI142	English	Accounting
CHI143	Business Administration	MBA Finance
CHI145	English Education	Logistics and Supply Chain Management
CHI146	Investment Economics	Accounting
CHI147	Computer Science	Management Science
CHI148	Commercial English	Logistics and Supply Chain Management
CHI149	Electronic Commerce	Information Systems
CHI161	Music	MBA in decision science
CHI162	Corporate Management	Logistics and Supply Chain Management
CHI225	Linguistics	Social Science
CHI228	Bachelor of Arts	Taxation
CHI229	Business Administration	Finance
CHI510	Finance	Accounting
CHI519	Mechanical	Mechanical
CHI521	Finance	Finance
CHI529	Accounting	Logistics & Supply Chain Management
CHI532	English Language and Literature	Counseling
CHI536	Civil Engineer	Applied Geography
CHI539	Electrical Engineering	Computer Science
CHI541	Mathematics	Mathematics
CHI591	Electrical Engineering	Computer Science and Engineering
CHI615	History and politics	Philosophy
CHI638	Broadcast and Television Director	Critical Study
CHI639	Science	Physics
CHI666	English Teacher Education	Early Childhood Education
CHI715	Computer Science	Computer Science
CHI722	Applied Physics	Physics
CHI737	English	Finance
CHI901	Physics	Physics
CHI902	Materials Science	Computer Science
CHI905	English Literature	Accounting
CHI906	Social Work	Public Administration

APPENDIX I

SOURCE TO START

Participant #	Task 1		Task 2		Task 3	
	Start Source	Code	Start Source	Code	Start Source	Code
CHI111	Google	1	Google	1	Google	1
CHI112	Google	1	Google	1	Google	1
CHI113	Google	1	Google	1	Google	1
CHI114	Google	1	Google	1	Google	1
CHI115	Google	1	Google	1	Google	1
CHI116	Google	1	Google	1	Google	1
CHI118	Google	1	Baidu	1	Google	1
CHI119	Google	1	Google	1	Google	1
CHI121	Google	1	Google	1	Google	1
CHI122	Google	1	Google	1	Google	1
CHI131	Baidu	1	Baidu	1	Baidu	1
CHI140	Google Translate	2	Google Translate	2	Google Translate	2
CHI141	Google	1	Google	1	Google	1
CHI142	Google	1	Google	1	Google	1
CHI143	Dict.cn	2	Dict.cn	2	Dict.cn	2
CHI145	Google	1	Google	1	Google	1
CHI146	Google	1	Google	1	Google	1
CHI147	Google	1	Google	1	Google	1
CHI148	Iciba.com	2	Google	1	Google	1
CHI149	Iciba.com	2	Google	1	Iciba.com	2
CHI161	Google	1	Google Translate	2	Google Translate	2
CHI162	Dict.cn	2	Dict.cn	2	Dict.cn	2
CHI225	Google	1	Google	1	Google	1
CHI228	Google	1	Google	1	Google	1
CHI229	Baidu	1	Baidu	1	Baidu	1
CHI510	Google	1	Google	1	Google	1
CHI519	Baidu	1	Wikipedia	2	Google	1
CHI521	Google	1	Google Translate	2	Google Translate	2
CHI529	Google	1	Google	1	Google	1
CHI532	Dictionary.com	2	Google	1	Google	1
CHI536	Google	1	Google	1	Google	1
CHI539	Google	1	Google	1	Google	1
CHI541	Google	1	Google	1	Google	1
CHI591	Google	1	Google	1	Google	1
CHI615	Google	1	Google	1	Google	1
CHI638	Google	1	Wikipedia	2	Wikipedia	2
CHI639	Google	1	Google	1	Google	1
CHI666	Google	1	Google	1	Google	1
CHI715	Google	1	Wikipedia	2	Google	1
CHI722	Google	1	Google	1	Google	1
CHI737	Baidu	1	Baidu	1	Baidu	1
CHI901	Google	1	Google	1	Google	1
CHI902	Google	1	Google	1	Google	1
CHI905	Google	1	Google	1	Google	1
CHI906	Google	1	Google	1	Google	1

APPENDIX J

LANGUAGE SELECTION

Participant #	Task 1					Task 2					Task 3				
	Search Term	Result	Search_L	Result_L	Combine_L	Search Term	Result	Search_L	Result_L	Combine_L	Search Term	Result	Search_L	Result_L	Combine_L
CHI111	English, Chinese	English, Chinese	3	3	2	English, Chinese	English	3	1	2	English, Chinese	English	3	1	2
CHI112	English	English	1	1	1	English	English	1	1	1	English	English	1	1	1
CHI113	English	English	1	1	1	English	English	1	1	1	English	English	1	1	1
CHI114	English	English	1	1	1	English	English	1	1	1	English	English	1	1	1
CHI115	English, Chinese	English, Chinese	3	3	2	English	English	1	1	1	English	English	1	1	1
CHI116	English	English	1	1	1	English	English	1	1	1	English	English	1	1	1
CHI118	English, Chinese	English, Chinese	3	3	2	Chinese, English	Chinese, English	3	3	2	English, Chinese	English, Chinese	3	3	2
CHI119	English	English	1	1	1	English	English	1	1	1	English, Chinese	Chinese	3	2	2
CHI121	English	English	1	1	1	English	English	1	1	1	English	English	1	1	1
CHI122	English	English	1	1	1	English, Chinese	Chinese	3	2	2	English, Chinese	English, Chinese	3	3	2
CHI131	Chinese	Chinese	2	2	1	Chinese	Chinese	2	2	1	Chinese	Chinese	2	2	1
CHI140	English	English	1	1	1	English	English	1	1	1	English	English	1	1	1
CHI141	English, Chinese	English	3	1	2	English, Chinese	English	3	1	2	English, Chinese	English, Chinese	3	3	2
CHI142	English, Chinese	Chinese	3	2	2	Chinese	Chinese	2	2	2	Chinese, English	Chinese	3	2	2
CHI143	Chinese	Chinese	2	2	1	Chinese	Chinese	2	2	1	Chinese, English	Chinese	3	2	2
CHI145	English	English	1	1	1	English	English	1	1	1	English	English	1	1	1
CHI146	English	English	1	1	1	English	English	1	1	1	English	English	1	1	1
CHI147	English, Chinese	English, Chinese	3	3	2	English, Chinese	Chinese, English	3	3	2	English, Chinese	Chinese, English	3	3	2
CHI148	Chinese, English	English	3	1	2	English	English	1	1	1	English	English	1	1	1
CHI149	Chinese, English	English	3	1	2	English	English	1	1	1	Chinese English	English	3	1	2
CHI161	English	English	1	1	1	English	English	1	1	1	English	English	1	1	1
CHI162	Chinese, English	English	3	1	2	Chinese, English	Chinese	3	2	2	Chinese	Chinese	2	2	2

Participant #	Task 1					Task 2					Task 3				
	Search Term	Result	Search_L	Result_L	Combine_L	Search Term	Result	Search_L	Result_L	Combine_L	Search Term	Result	Search_L	Result_L	Combine_L
CHI228	English	English	1	1	1	English, Chinese	English	3	1	2	English, Chinese	Chinese	3	2	2
CHI229	Chinese	Chinese	2	2	1	Chinese, English	English, Chinese	3	3	2	Chinese, English	Chinese	3	2	2
CHI510	English	English	1	1	1	English	English	1	1	1	English	English	1	1	1
CHI519	Chinese, English	Chinese	3	2	2	English	English	1	1	1	English (Chinese)	English	1	1	1
CHI521	Chinese, English	Chinese	3	2	2	Chinese	Chinese	2	2	1	Chinese	Chinese	2	2	1
CHI529	English	English	1	1	1	English	English	1	1	1	English	English	1	1	1
CHI532	English	English	1	1	1	English	English	1	1	1	English	English	1	1	1
CHI536	English	English	1	1	1	English	English	1	1	1	English	English	1	1	1
CHI539	English, Chinese	English, Chinese	3	3	2	English, Chinese	English, Chinese	3	3	2	English, Chinese	Chinese	3	2	2
CHI541	English	English	1	1	1	English	English	1	1	1	English	English	1	1	1
CHI591	English	English	1	1	1	English	English	1	1	1	English	English	1	1	1
CHI615	English	English	1	1	1	English	English	1	1	1	English, Chinese	English	3	1	2
CHI638	English	English	1	1	1	English	English	1	1	1	English	English	1	1	1
CHI639	English	English	1	1	1	English	English	1	1	1	English	English	1	1	1
CHI666	English	English	1	1	1	English	English	1	1	1	English	English	1	1	1
CHI715	English	English	1	1	1	English	English	1	1	1	English	English	1	1	1
CHI722	English	English	1	1	1	English	English	1	1	1	English	English	1	1	1
CHI737	English, Chinese	Chinese	3	2	2	English, Chinese	Chinese	3	2	2	Chinese, English	Chinese	3	2	2
CHI901	English	English	1	1	1	English	English	1	1	1	English	English	1	1	1
CHI902	English	English	1	1	1	English	English	1	1	1	English	English	1	1	1
CHI905	English	English	1	1	1	English	English	1	1	1	English	English	1	1	1
CHI906	Chines, English	English	3	1	2	English	English	1	1	1	English	English	1	1	1

APPENDIX K

ONLINE TRANSLATION TOOLS

Participant #	Task 1			Task 2			Task 3		
	Tool Yes/No	Name (s)	Frequency	Yes/No	Name (s)	Frequency	Yes/No	Name(s)	Frequency
CHI111	0	n/a	0	0	n/a	0	0	n/a	0
CHI112	0	n/a	0	0	n/a	0	0	n/a	0
CHI113	0	n/a	0	0	n/a	0	0	n/a	0
CHI114	0	n/a	0	0	n/a	0	0	n/a	0
CHI115	1	Iciba.com	1	0	n/a	0	0	n/a	0
CHI116	0	n/a	0	0	n/a	0	0	n/a	0
CHI118	0	n/a	0	0	n/a	0	0	n/a	0
CHI119	0	n/a	0	0	n/a	0	0	n/a	0
CHI121	0	n/a	0	0	n/a	0	0	n/a	0
CHI122	0	n/a	0	0	n/a	0	0	n/a	0
CHI131	0	n/a	0	0	n/a	0	0	n/a	0
CHI140	1	Google Translate	1	1	Google Translate	2	1	Google Translate	3
CHI141	1	Iciba.com	1	0	n/a	0	0	n/a	0
CHI142	1	Dict.cn;dict.hjenglish.com	2	0	n/a	0	0	n/a	0
CHI143	1	Dict.cn; Baidu Dictionary	9	1	Dict.cn	6	1	Dict.cn	9
CHI145	0	n/a	0	0	n/a	0	0	n/a	0
CHI146	0	n/a	0	0	n/a	0	0	n/a	0
CHI147	1	Dict.cn	1	1	Dict.cn	1	1	Dict.cn	1
CHI148	1	Iciba.com	1	0	n/a	0	1	Iciba.com	1
CHI149	1	Iciba.com	1	1	Iciba	1	1	Iciba.com	2
CHI161	1	Google Translate	3	1	Google Translate	1	1	Google Translate	1
CHI162	1	Dict.cn	1	1	Dict.cn	2	1	Dict.cn	3
CHI225	0	n/a	0	0	n/a	0	0	n/a	0
CHI228	0	n/a	0	1	Baidu Dictionary	2	1	Baidu Dictionary; Youdao Dictionary	3
CHI229	1	Baidu Dictionary	1	0	n/a	0	0	n/a	0
CHI510	0	n/a	0	0	n/a	0	0	n/a	0

Participant #	Task 1			Task 2			Task 3		
	Yes/No	Name (s)	Frequency	Yes/No	Name (s)	Frequency	Yes/No	Name(s)	Frequency
CHI519	1	Baidu Dictionary	1	0	n/a	0	1	Baidu Dictionary	1
CHI521	1	Google Translate;Odict.net	4	1	Google Translate	1	1	Google Translate	1
CHI529	1	Dict.cn	1	1	Dict.cn	2	1	Dict.cn	4
CHI532	0	n/a	0	0	n/a	0	0	n/a	0
CHI536	0	n/a	0	1	Dict.cn	1	0	n/a	0
CHI539	1	Dict.cn	1	1	Baidu Dictionary	1	1	Baidu Dictionary	1
CHI541	0	n/a	0	0	n/a	0	0	n/a	0
CHI591	0	n/a	0	0	n/a	0	0	n/a	0
CHI615	0	n/a	0	0	n/a	0	0	n/a	0
CHI638	0	n/a	0	0	n/a	0	0	n/a	0
CHI639	0	n/a	0	0	n/a	0	0	n/a	0
CHI666	0	n/a	0	0	n/a	0	0	n/a	0
CHI715	0	n/a	0	0	n/a	0	0	n/a	0
CHI722	0	n/a	0	0	n/a	0	0	n/a	0
CHI737	1	Baidu Dictionary	1	1	Baidu Dictionary	3	1	Google Translate; Baidu Dictionary	3
CHI901	0	n/a	0	0	n/a	0	0	n/a	0
CHI902	0	n/a	0	0	n/a	0	0	n/a	0
CHI905	0	n/a	0	0	n/a	0	0	n/a	0
CHI906	1	Google Translate	2	1	Google Translate	2	1	Google Translate	2

APPENDIX L

TIME SPENT

Participant #	Task 1_Time	Task 2_Time	Task 3_Time
CHI111	0:06:48	0:10:42	0:01:57
CHI112	0:01:24	0:00:12	0:05:42
CHI113	0:00:15	0:03:18	0:03:16
CHI114	0:00:16	0:02:09	0:07:04
CHI115	0:05:10	0:00:04	0:06:48
CHI116	0:00:04	0:01:46	0:01:08
CHI118	0:03:58	0:05:02	0:13:39
CHI119	0:00:26	0:02:54	0:09:10
CHI121	0:00:09	0:00:27	0:01:30
CHI122	0:12:09	0:01:03	0:05:08
CHI131	0:00:34	0:00:05	0:03:36
CHI140	0:04:04	0:04:32	0:06:34
CHI141	0:18:17	0:05:07	0:05:21
CHI142	0:02:33	0:00:05	0:08:49
CHI143	0:15:28	0:08:45	0:10:18
CHI145	0:00:59	0:03:55	0:03:06
CHI146	0:00:06	0:00:04	0:01:12
CHI147	0:00:43	0:04:12	0:05:03
CHI148	0:01:20	0:03:43	0:09:37
CHI149	0:00:42	0:10:45	0:02:26
CHI161	0:04:28	0:14:25	0:06:37
CHI162	0:02:12	0:16:48	0:11:33
CHI225	0:00:13	0:00:01	0:01:24
CHI228	0:05:12	0:04:48	0:05:46
CHI229	0:00:42	0:05:58	0:08:07
CHI510	0:00:03	0:00:33	0:02:08
CHI519	0:03:11	0:02:17	0:03:36
CHI521	0:07:16	0:03:53	0:03:33
CHI529	0:00:26	0:04:00	0:12:37
CHI532	0:00:34	0:16:26	0:15:15
CHI536	0:00:09	0:11:44	0:02:53
CHI539	0:05:13	0:05:21	0:11:40
CHI541	0:00:03	0:03:02	0:09:22
CHI591	0:04:27	0:00:06	0:07:00
CHI615	0:01:09	0:00:14	0:15:52
CHI638	0:00:11	0:00:00	0:03:16
CHI639	0:00:03	0:00:28	0:00:34
CHI666	0:02:00	0:03:00	0:07:00
CHI715	0:03:18	0:00:53	0:00:15
CHI722	0:00:09	0:00:19	0:01:16
CHI737	0:01:19	0:00:57	0:03:54
CHI901	0:14:30	0:11:02	0:03:13
CHI902	0:02:01	0:03:14	0:06:54
CHI905	0:00:22	0:04:59	0:02:37
CHI906	0:08:12	0:07:38	0:06:15

APPENDIX M

STATISTICS-SOURCE TO START

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Task Type * Starting_Source	135	100.0%	0	.0%	135	100.0%

Task Type * Starting_Source Crosstabulation

			Starting_Source		
			Search Engine	Other Source	Total
Task Type	1	Count	39	6	45
		Expected Count	38.0	7.0	45.0
		% within Starting_Source	34.2%	28.6%	33.3%
	2	Count	37	8	45
		Expected Count	38.0	7.0	45.0
		% within Starting_Source	32.5%	38.1%	33.3%
	3	Count	38	7	45
		Expected Count	38.0	7.0	45.0
		% within Starting_Source	33.3%	33.3%	33.3%
Total		Count	114	21	135
		Expected Count	114.0	21.0	135.0
		% within Starting_Source	100.0%	100.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	.338[a]	2	.844
Likelihood Ratio	.339	2	.844
Linear-by-Linear Association	.084	1	.772
N of Valid Cases	135		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 7.00.

Symmetric Measures

		Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Nominal by Nominal	Phi	.050			.844
	Cramer's V	.050			.844
	Contingency Coefficient	.050			.844
Ordinal by Ordinal	Kendall's tau-b	.024	.079	.300	.764
	Spearman Correlation	.025	.083	.289	.773[c]
Interval by Interval	Pearson's R	.025	.083	.289	.773[c]
N of Valid Cases		135			

a. Not assuming the null hypothesis.
b. Using the asymptotic standard error assuming the null hypothesis.
c. Based on normal approximation.

APPENDIX N

STATISTICS-LANGUAGE SELECTION

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Task Type * Language_Selection	135	100.0%	0	.0%	135	100.0%

Task Type * Language_Selection Crosstabulation

			Language_Selection		
			Only English, or only Chinese	Combination	Total
Task Type	1	Count	31	14	45
		Expected Count	31.7	13.3	45.0
		% within Language_Selection	32.6%	35.0%	33.3%
	2	Count	34	11	45
		Expected Count	31.7	13.3	45.0
		% within Language_Selection	35.8%	27.5%	33.3%
	3	Count	30	15	45
		Expected Count	31.7	13.3	45.0
		% within Language_Selection	31.6%	37.5%	33.3%
Total		Count	95	40	135
		Expected Count	95.0	40.0	135.0
		% within Language_Selection	100.0%	100.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	.924[a]	2	.630
Likelihood Ratio	.939	2	.625
Linear-by-Linear Association	.053	1	.818
N of Valid Cases	135		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 13.33.

Symmetric Measures

		Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Nominal by Nominal	Phi	.083			.630
	Cramer's V	.083			.630
	Contingency Coefficient	.082			.630
Ordinal by Ordinal	Kendall's tau-b	.019	.083	.225	.822
	Spearman Correlation	.020	.088	.229	.819[c]
Interval by Interval	Pearson's R	.020	.088	.229	.819[c]
N of Valid Cases		135			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on normal approximation.

APPENDIX O

STATISTICS-ONLINE TRANSLATION TOOLS

General Linear Model

Within-Subjects Factors

Measure:OnlineTranslationTools

Task Type	Dependent Variable
1	Task1_Tools
2	Task2_Tools
3	Task3_Tools

Multivariate Tests[b]

Effect		Value	F	Hypothesis df	Error df	Sig.
Task	Pillai's Trace	.120	2.925[a]	2.000	43.000	.064
	Wilks' Lambda	.880	2.925[a]	2.000	43.000	.064
	Hotelling's Trace	.136	2.925[a]	2.000	43.000	.064
	Roy's Largest Root	.136	2.925[a]	2.000	43.000	.064

a. Exact statistic

b. Design: Intercept

Within Subjects Design: Task Type

Mauchly's Test of Sphericity[b]

Measure:OnlineTranslationTools

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon[a]		
					Greenhouse-Geisser	Huynh-Feldt	Lower-bound
Task Type	.713	14.547	2	.001	.777	.800	.500

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

a. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

b. Design: Intercept

Within Subjects Design: Task Type

Tests of Within-Subjects Effects

Measure:OnlineTranslationTools

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
Task Type	Sphericity Assumed	1.170	2	.585	1.398	.252
	Greenhouse-Geisser	1.170	1.554	.753	1.398	.252
	Huynh-Feldt	1.170	1.600	.731	1.398	.252
	Lower-bound	1.170	1.000	1.170	1.398	.243
Error(Task Type)	Sphericity Assumed	36.830	88	.419		
	Greenhouse-Geisser	36.830	68.375	.539		
	Huynh-Feldt	36.830	70.416	.523		
	Lower-bound	36.830	44.000	.837		

Tests of Within-Subjects Contrasts

Measure:OnlineTranslationTools

Source	TaskType	Type III Sum of Squares	df	Mean Square	F	Sig.
TaskType	Linear	.100	1	.100	.173	.679
	Quadratic	1.070	1	1.070	4.121	.048
Error(TaskType)	Linear	25.400	44	.577		
	Quadratic	11.430	44	.260		

Tests of Between-Subjects Effects

Measure:OnlineTranslationTools

Transformed Variable:Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	62.696	1	62.696	11.338	.002
Error	243.304	44	5.530		

APPENDIX P

STATISTICS-TIME SPENT

General Linear Model

Within-Subjects Factors

Measure:TimeSpent

Task Type	Dependent Variable
1	Task1_Time
2	Task2_Time
3	Task3_Time

Multivariate Tests[b]

Effect		Value	F	Hypothesis df	Error df	Sig.
Task Type	Pillai's Trace	.191	5.086[a]	2.000	43.000	.010
	Wilks' Lambda	.809	5.086[a]	2.000	43.000	.010
	Hotelling's Trace	.237	5.086[a]	2.000	43.000	.010
	Roy's Largest Root	.237	5.086[a]	2.000	43.000	.010

a. Exact statistic

b. Design: Intercept

Within Subjects Design: Task Type

Mauchly's Test of Sphericity[b]

Measure:TimeSpent

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon[a]		
					Greenhouse-Geisser	Huynh-Feldt	Lower-bound
Task Type	.981	.814	2	.666	.982	1.000	.500

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

a. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

b. Design: Intercept

Within Subjects Design: TaskType

Tests of Within-Subjects Effects

Measure:TimeSpent

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Task Type	Sphericity Assumed	596039.244	2	298019.622	5.617	.005	.113
	Greenhouse-Geisser	596039.244	1.963	303606.239	5.617	.005	.113
	Huynh-Feldt	596039.244	2.000	298019.622	5.617	.005	.113
	Lower-bound	596039.244	1.000	596039.244	5.617	.022	.113
Error(Task Type)	Sphericity Assumed	4669122.756	88	53058.213			
	Greenhouse-Geisser	4669122.756	86.381	54052.832			
	Huynh-Feldt	4669122.756	88.000	53058.213			
	Lower-bound	4669122.756	44.000	106116.426			

Tests of Within-Subjects Contrasts

Measure:TimeSpent

Source	Task Type	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Task Type	Linear	587739.211	1	587739.211	9.959	.003	.185
	Quadratic	8300.033	1	8300.033	.176	.677	.004
Error(Task Type)	Linear	2596713.289	44	59016.211			
	Quadratic	2072409.467	44	47100.215			

Tests of Between-Subjects Effects

Measure:TimeSpent

Transformed Variable:Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	9528135.000	1	9528135.000	100.024	.000	.694
Error	4191372.000	44	95258.455			

T-Test

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Task 3_Time	00:05:52.022	45	00:04:01.29918	00:00:35.97076
	Task 1_Time	00:03:10.400	45	00:04:23.50060	00:00:39.28035
Pair 2	Task 3_Time	00:05:52.022	45	00:04:01.29918	00:00:35.97076
	Task 2_Time	00:04:14.578	45	00:04:31.50879	00:00:40.47414
Pair 3	Task 2_Time	00:04:14.578	45	00:04:31.50879	00:00:40.47414
	Task 1_Time	00:03:10.400	45	00:04:23.50060	00:00:39.28035

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Task 3_Time & Task 1_Time	45	.076	.621
Pair 2	Task 3_Time & Task 2_Time	45	.298	.047
Pair 3	Task 2_Time & Task 1_Time	45	.250	.097

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	Task 3_Time - Task 1_Time	00:02:41.62222	00:05:43.55847	00:00:51.21467	00:00:58.40583	00:04:24.83861	3.156	44	.003
Pair 2	Task 3_Time - Task 2_Time	00:01:37.44444	00:05:04.89257	00:00:45.45070	00:00:05.84458	00:03:09.04431	2.144	44	.038
Pair 3	Task 2_Time - Task 1_Time	00:01:04.17778	00:05:27.65436	00:00:48.84383	-00:00:34.26049	00:02:42.61604	1.314	44	.196

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