USING THEORY OF REASONED ACTION (TRA) IN UNDERSTANDING SELECTION AND USE OF INFORMATION RESOURCES: AN INFORMATION RESOURCE SELECTION AND USE MODEL

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by

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The undersigned, appointed by the dean of the Graduate School, have examined the dissertation entitled

USING THEORY OF REASONED ACTION (TRA) IN UNDERSTANDING SELECTION AND USE OF INFORMATION RESOURCES: AN INFORMATION RESOURCE SELECTION AND USE MODEL

Presented by Donghua Tao,

A candidate for the degree of Doctor of Philosophy,

And hereby certify that, in their opinion, it is worthy of acceptance.

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ABSTRACT

With advanced computer and networking technologies, more and more information can be accessed electronically. Information overload has become an issue and it is increasingly difficult for a user to quickly identify and locate useful information resources. In order for libraries to provide user-centered services, it is important to examine not only what, but also why information resources are selected and used by users. The present study aims to explain users' information resources selection and use behavior with four objectives: 1) to identify specific resource characteristics, library environment, and individual differences factors that affect users' selection of information resources, 2) to propose a theoretical model-Information Resources Selection and Use Model (IRSUM) presenting the relationship among the factors based upon the Theory of Reasoned Action (TRA) and the Technology Acceptance Model (TAM), 3) to examine how the factors influence users' resource selection and use behavior, and 4) to stimulate thoughts and provide recommendations for managerial interventions to improve library collections and services.

Public health students' information resource selection and use behavior during completion of a research paper or project assignment that requires them to use a variety of information resources to seek information was investigated in a higher institution in the Midwestern United States. Both focus group and self-reported questionnaires were

used for data collection. Descriptive statistics and Structural Equation Modeling (SEM) techniques with SPSS 15.0 for Windows and AMOS 7.0 were used for data analysis.

The study found that electronic resources were the public health students' primary resources, of which online databases, e-journals, and the Internet were most frequently selected and used. Three behavior beliefs (perceived usefulness, perceived ease of use, and perceived least physical effort) and two normative beliefs (instructor's influence and reference librarian's influence) largely mediated the relationship of external variables with primary resource selection, while fully mediating the relationship of external variables with the actual use of the primary resource. Among the statistically significant paths found in the IRSUM, perceived ease of use had the strongest impact on students' selection of using primary resources while perceived usefulness had the strongest effect on students' actual use of primary resources.

These findings have important theoretical and practical implications. The research model fills a gap in the theoretical development in the study area of human information seeking behavior in information science. In practice, the study findings strongly suggest that system designers should enhance electronic resources' ease of use through a user-centered system design. Librarians should also actively get involved in the system design and implementation as representatives of users. In addition, advocating and leading information literacy education in their parent institutions, conducting user-centered collection development, marketing library resources and services through multiple approaches, and providing a comfortable and multi-functional library environment are all important and on-going tasks for librarians to optimize library's functions in order to keep up with the ever-changing information age and meet users' needs.

Chapter I
Introduction

Problem Statement

Background

Advances in computer and networking technologies have introduced both new capabilities and interesting challenges in accessing information. Since the 1980s, with more effective and powerful microcomputers, better telecommunications, and more efficient storage media (e.g., compact disks), computers have been widely used and the Internet has been popularized (Hewins, 1990). With these technologies, electronic information resources have also been growing continually. In addition to traditional information resources such as print books and periodicals, there are more resource options than before for people to acquire information. While excitement has been brought by the information explosion, it is increasingly difficult for a user to quickly identify and locate potentially useful information resources. Although in the past it might have been difficult to find specific information in limited resources; today it is just as difficult finding needed information with seemingly limitless resources. We still face the same problem with today's proliferation of information resources in various formats and more ways to access and retrieve information from them. A question most frequently asked even now is "where can I find this information?"

Libraries have been keeping pace with the development of new technologies by using MAchine Readable Cataloging (MARC), developing online public access catalogs (OPACs), providing the access to online databases, electronic journals and books, as well as many other resources. However, they have been facing the challenge of decreased

usage. New electronic information resources and services are emerging endlessly, which tremendously influence people's thought and ways of seeking information. In late 1998, there were thirty-five journal titles available online; in 2001, the number rose to over 4,000 (Harker, 2002). Many resources and services outside of libraries provide more options for users, such as Google Scholar, online blogs, Really Simple Syndication (RSS) feeds, Wiki, Open Access publications, and the like. It is now possible for users to be able to search for information on the Internet by themselves without the mediation of a librarian. Such convenience of being able to self-learn and self-search online provides users with an idea that everything can be found on the Internet. The Internet as a resource outside of libraries has become the first-sought resource for people to find information. Online Computer Library Center (OCLC) (2005) conducted an online worldwide survey to college students in both graduate and undergraduate levels and found that e-mail, search engines and instant messaging are three resources used most often and almost all respondents began their searches for information with a search engine. However, Pelzer and colleagues (1998) discovered that library staff were the last resource to use among all types of people resources, including classmates, instructors, and others. De Groote et al (2001) also reported from a gate count statistic that fewer patrons enter the library. How to confront these challenges or how to utilize various information resources to improve library collections and services has been a long-term task for all libraries and library professionals. In other words, it is important to understand how libraries can adjust their roles as an information repository and perform new functions effectively in today's ever-changing information society.

Users are the core for any type of library. The purpose of collecting useful information resources and providing proactive services is to achieve the goal of user-centered services. However, with various types of information resources and a variety of channels to access those resources, it is impossible for libraries to provide user-centered information services without understanding how users seek information. It is also important to examine what and why information resources are selected and used by users to meet their information needs. How do users perceive information resources in different formats? How do their perceptions influence their selection and use of information resources? Are there some individual and/or environmental factors that affect users' selection and use of information resources? If so, how do they exert their influences? For the purpose of understanding users' selection and use of information resources, this study proposed an Information Resource Selection and Use Model (IRSUM) based upon the Theory of Reasoned Action (TRA) and the Technology Acceptance Model (TAM) to investigate the effect of information resources characteristics, library environment, individual differences, and social influence factors on users' selection and use of information resources and how these factors exert their influence.

Previous Studies on Information Seeking and Information Resources Selection and Use

Information seeking and use is a key area in Library and Information Science. Since the first study on information behavior in 1948 (Wilson, 2000; Case, 2002), a paradigm shift, model and theory development, and several study focus changes have occurred in the human information behavior studies throughout more than 40 years.

Before the 1980s, most studies tried to answer "*what*" questions, e.g., what information resources, information systems and services do users use and how much use

do they make of these resources, systems and services (Dervin & Nilan, 1986). These studies were interested in examining the information seeking patterns themselves from a system's perspective rather than from the individual user's perspective. The research focused more on what systems possessed and what it is in the system that is lacking, and not on what was missing for users. Many studies were carried out in locations where users looked for information, such as libraries. What do users do at libraries, or how many times an individual information resource was used in the libraries were the major questions posed.

In 1986, the milestone review by Dervin and Nilan (1986) called for a user-centered perspective to study human information seeking and use. The focus shifted on how users select and use information and what happens during the information seeking process in terms of cognitive, psychological, and behavioral changes of users. Individual users became the center of the studies, which asked many "*how*" questions, such as how do people make use of systems/services and how do individual cognitive differences affect the way they use systems and services. The goal of these studies tried to determine the common cognitions of most users from the individual differences of cognitively based characteristics (i.e., learning style, motivation, personality type, etc.) in order to design dynamic and adaptive systems and services (Hewins, 1990).

Since the 1990s, more and more user-centered studies have been exploring various user groups' information seeking behavior from cognitive, psychological, and sociological approaches in everyday life, work and study settings, business environment, health care settings, and many other settings. However, not many studies specially focused on answering "*why*" questions, such as why users select and use a certain

information resource as well as what and how influential factors affect users' selection. Some scholars examined the impact that resource accessibility and quality had on resource usage and found inconsistent results (Rosenberg, 1967; Gerstberger & Allen, 1968; Allen, 1977; O' Reilly, 1982; Hardy, 1982; Pinelli, et al, 1991b; Marton & Choo, 2002; Zach, 2005). However, none of these studies were theory-based and conducted in a systematic way. The lack of "why" questions in previous studies limit the guidance of findings to improve system and service design. Fidel (2000, p. 91) stated that "user studies that ask 'why' questions, and thus aim at a somewhat deeper understanding of user behavior, are not very common even today."

Regarding user groups that have been studied, McKechnie et al. found that 32 percent of a large sample of investigations studied some kind of professional "workers" and another 17 percent of studies focused on academic or other researchers (Case, 2006). Among the studies asking "why do you select and use a certain information resource?" scientists, engineers, and business administrators were found to be the three main user groups. Studies on students' information seeking constitute 19 percent, but medical and health science students only take up a small part of it (Case, 2002; Case, 2006). Furthermore, most previous studies on medical and health science students' information seeking behavior are descriptive. "What" questions have still received more attention than "How" questions. There have been more studies that examined what information resources are most frequently used than studies that answered questions of how frequently resources are used and how medical and health science students search the library catalog or MEDLINE database, and so on. Although some studies discussed why medical and health science students use or do not use a certain information resource, the

influencing factors were only mentioned, or only statistical correlations between influencing factors and information resource selection and use behavior, but no relative influential importance has been examined. In addition, most of the studies concentrated on the changes of the internal status of users' knowledge, thoughts, and feelings (Kuhlthau, 1991; Allen, 1996) (cognitive and/or affective) during the information seeking process rather than taking the effect of external situations (e.g., social and/or environmental) into consideration. Few studies have conducted a systematic investigation to consider the effects of both internal factors (e.g., behavior beliefs and normative beliefs) and external factors (e.g., resource characteristics, library environment, individual differences, and social influence) on medical and health sciences students' selection and actual use of information resources.

Deficiencies of the Prior Research and the Current Study's Unique Contributions

Previous studies tried to infer users' preference for an information resource based on the observed behaviors and actions without further investigation of the reasons why users selected and used one type of information resource over others, the factors influenced their selection, and whether the selected information resource would actually be used. This type of *behavior-attitude* approach may bring misconceptions about a user's real perception or thoughts about using an information resource. Use of an information resource may not be because users like it but because an influential person suggested for them to use it or that resource might be the only resource available at the time when they were looking for information. Therefore, an information resource that users intend to use may not be the same one that they actually use. How can library and other information service providers create an easy access environment as well as high

quality information contained therein to make users actually use their intend-to-use resources? Knowing how users perceive using an information resource and what factors affect the formation of their perceptions of using the resource will definitely help us understand why users choose this information resource instead of others. In other words, knowing users' beliefs on using an information resource will help us to determine their attitude on using that information resource, which accordingly affects their intention to use or not to use that resource. This type of *belief-attitude-behavior intention-actual behavior* approach was applied in the Theory of Reasoned Action (TRA), which aims to explain and predict human behaviors. The present study used TRA as a theoretical framework to investigate why users select and use one type of information resource instead of others and how resource characteristics, library environment, individual differences, and social influences affect the resource selection and use. Few studies in library and information science have used TRA to examine users' information behavior thus far (Walster, 1994). This study aims to make a unique contribution by developing an Information Resource Selection and Use Model based on TRA.

Being different from most of the previous studies, the present study views the library as a source of information resources rather than as an information resource. Information resources, in this study, are defined as those physical entities, electronic products, and humans, which can represent, store, retrieve, and transfer information. Also, these information resources exist everywhere, inside and outside of libraries. For example, books, journals, and indexes and abstracts in both print and electronic formats are the main collections in libraries while websites and search engines on the Internet are the resources outside of libraries (although users can access them through the network

provided by libraries). Similarly, reference librarians and circulation staff are human information resources in libraries while classmates, instructors, and experts are human resources existing outside libraries. The library as an information repository is a physical and virtual place. People can access and use information resources that exist everywhere, both inside and outside of libraries (Figure 1.1). This study does not focus on the selection and uses of libraries or a particular information resource collected in libraries.

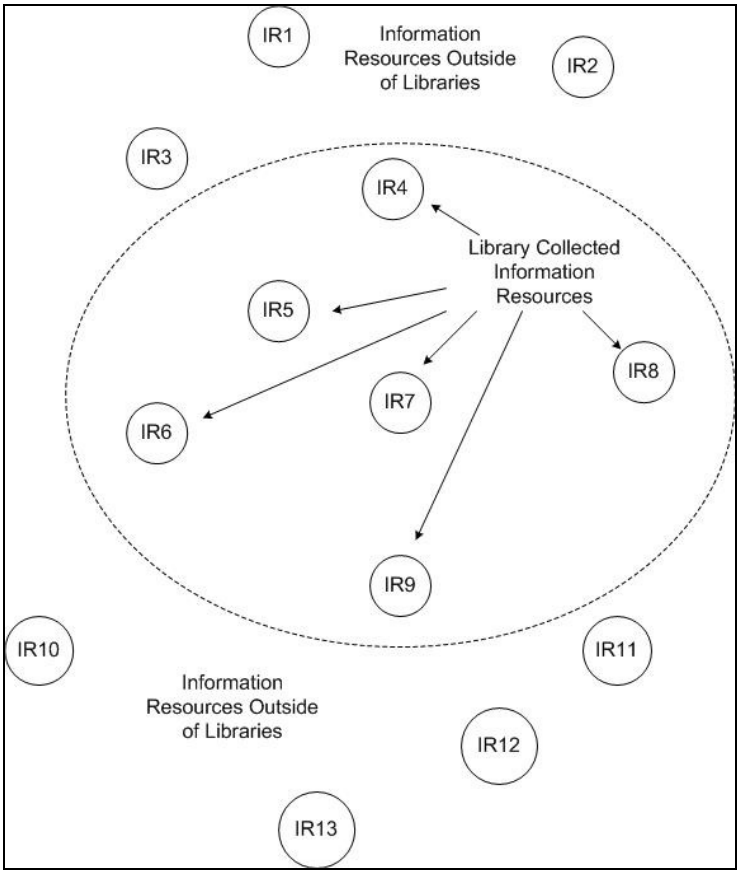

Figure 1.1. The sketch map of information resources existing inside and outside libraries (*Note: IR denotes Information Resource)

Instead, the researcher observes user selection and use of information resources beyond the library's physical building and virtual boundary. In this way, the study context is closer to real situations in which users select and use information resources. The final

goal of this study is to improve the library environment and services so that users are able to use library resources and services more effectively.

Regarding research methods, most studies of medical and health sciences students' information resources selection and use are descriptive studies that examined what information resources were used most frequently and how they used certain information resources. Some studies explained why students used a certain information resource over others conceptually, but did not examine the influencing factors quantitatively. Although qualitative methods have been taken as a more appropriate method to study information seeking behavior due to their highly situational and contextual characteristics, they aim to explore information seeking behavior and to identify factors; they do not test the significance. In order to deeply understand information resource selection and use behavior, the present study combined qualitative (focus group) and quantitative (questionnaire, Structure Equation Modeling, and path analysis) methods to systematically investigate the roles of resource characteristics, library environment, individual differences, and social influence factors in affecting users selection and use of information resources.

Theoretical Framework

The Overlap of Problem Solving, Decision Making and Information Seeking/Searching

Usually people need to seek information for solving a problem or making a decision. Wilson (1999) provided a problem solving model of the information seeking and searching process. The model associates information seeking activities with problem solving activities, such as problem recognition, problem identification, problem definition,

initiation, selection, exploration, formulation, collection, formulation/reformulation, and problem resolution (Wilson, 1999; Kuhlthau, 1991).

The present study takes a different view for the relationship of decision making and information seeking. Information seeking behavior is the purposive seeking for information as a consequence of a need to satisfy some goal (Wilson, 2000). During this process, two decision points direct the information seeking behavior. One is the decision to seek information or not, the other is the decision on which information resource to select. People need to balance several factors to make final decisions to start actions. As public health students are the study subjects in the present study, the relationship among problem solving, information seeking and decision making in the present study would be that public health student's selection of information resources was a particular activity encompassed within their information seeking process for solving information problems while finishing their research paper assignments.

Theory of Reasoned Action (TRA)

The TRA, originally introduced by Fishbein in 1967 and extensively refined, developed, and tested by Fishbein and Ajzen in 1975, defines relationships among beliefs, attitudes, norms, intentions, and behavior. According to this theory, an individual's behavior (e.g., use of one information resource rather than the others) is determined by his/her intention to perform the behavior (e.g., select to use the information resource), and this intention is a function of his/her attitude toward performing the behavior as well as the perceived social influence of people who are important to him/her. External variables encompass all variables not explicitly represented in the model, which include demographic or personality characteristics, the characteristics of the behavioral target,

and other variables that can influence the formation of beliefs. The Fishbein model asserts that those external variables impact behavior intention only indirectly by influencing the individual's behavior and normative beliefs (Ajzen & Fishbein, 1980; Davis, 1986; Dillon & Morris, 1996).

The purpose of the TRA is to predict and understand an individual's behavior by considering the effect of personal feelings (attitude) and the perceived social pressure (subjective norm). Besides knowing an individual performs a behavior and its frequency, researchers are also interested in knowing why people perform or do not perform a behavior, what determines their choice and what and how external variables influence their decision. The TRA is a generalized model to answer these questions. When applied in many empirical studies in diverse situations from voting in an election to the consumption of alcoholic beverages, it has been concluded that the TRA is applicable in understanding the determinants of human behavior in situations in which people may exert their choice (Sheppard et al, 1988; Dillon & Morris, 1996).

Technology Acceptance Model (TAM)

Following Fishbein and Azjen's *beliefs-attitude-behavior intention-actual behavior* approach, Davis (1989a) proposed the Technology Acceptance Model (TAM), which aims to predict information system acceptance and diagnose design problems before users experience the system or after a short interaction with the system. The TAM is the most widely cited model in the Management Information System (MIS) field. According to the TAM, a user's acceptance of any technology, measured by a person's intention to utilize an information system, is determined by two beliefs, namely, perceived ease of use and perceived usefulness. Moreover, the TAM proposes that the

effects of external variables on usage intention are mediated by perceived ease of use and perceived usefulness. In addition, perceived ease of use will also influence perceived usefulness. The easier it is for a user to interact with a system, the more likely he or she will find it useful and will intend to use it again.

Regarding the present study, the TRA and the TAM are useful theoretical frameworks to identify the specific beliefs and find out the influential importance of those beliefs on user information resource selection and how the external variables (e.g., individual differences, medical library environment, and information resource characteristics) affect resource selection through affecting users' beliefs. Based on the TRA and the TAM as well as reviewed literature, a measurable path model of information resource selection and use was constructed and tested in the present study for representing and understanding the roles of social, environment, and individual differences in affecting information resources selection and use.

Purpose of the Study

To address the deficiencies in the aforementioned studies, the present study aims to contribute to research and practice and is dedicated to explaining the phenomenon of selection and predicting use of information resources with four objectives: 1) to identify specific resource characteristics, library environment, individual differences, behavior beliefs and social influence as factors that affect public health students' selection and actual use of information resources in completion of a research paper or project that requires them to use a variety of information resources in a university in the Midwestern United States, 2) to propose a theoretical model to present the relationship among the factors based upon the Theory of Reasoned Action (TRA) and the Technology

Acceptance Model (TAM), 3) to examine how those factors influence public health students' information resource selection and use behavior, and 4) to stimulate thoughts about the librarian's role changes and to provide possible managerial recommendations to improve library collections and services usage.

Research Questions

Based on the perspective and theoretical framework stated above, the following research questions are formed:

1. What information resources are public health students' primary information resources for completing their research papers or projects?

2. Among the following three types of information resource: print, electronic, and human, which type of information resource is primarily used by public health students for completing their research paper or project?

3. Do public health students actually use the primary resource they initially selected to use for completing their research paper or project assignments?

4. How do public health students' beliefs (behavior beliefs) about the advantages and disadvantages of using a primary information resource (i.e., perceived usefulness, perceived ease of use, and perceived freedom of physical effort of using a primary information resource) influence their selection of using that primary information resource?

5. How do public health students' beliefs (normative beliefs) on specific referent's (e.g., instructors, classmates, and reference librarians) recommendations in using a primary information resource influence their selection of using that primary information resource?

6. How do primary information resource characteristics, library environment, and individual differences influence public health students' selection of using a primary information resource through affecting their behavior beliefs and normative beliefs?

7. Can the factors that determine public health student's selection of using a primary information resource also explain and predict the actual use of that primary information resource to finish their assignment?

Significance of the Study

Theoretical Significance

The study contributes to the conceptual development of information-seeking studies, especially about information resource and channel selection. Previous information behavior models focused more on either the whole information seeking process or the detailed user-system interaction (information searching). None of the existing models have provided a holistic view of why users choose a certain information resource instead of others and specified what determines the users' decision on selection of an information resource. The proposed Information Resource Selection and Use Model (IRSUM) reveals and explores information resource selection and use behavior, which will fill a gap of theoretical development in the study area of information seeking behavior. The enrichment of theory development in this area will provide a more comprehensive knowledge structure and instructional materials to programs in library science, information science, and information system studies.

Practical Significance

Learning influential factors affecting public health students' selection of using an information resource will provide health sciences reference librarians with a thorough understanding of information resources from users' perspectives as well as information service requirements. Understanding user's needs provides practical value for increasing library resources and services usage through more user-centered collection development, information literacy instruction, and managerial interventions, such as library information resources and services marketing, and the library environment's improvement and maintenance. In addition, perceived usefulness and perceived ease of use rated by users will provide valuable information for information retrieval (IR) system designers and developers to improve IR system's utility and usability. Theory and practice in education of library and information science would also be improved and enriched.

Outline of Research Methods

The Study Context

The present study was conducted on the medical campus of a higher education institution in the Midwest U.S. The Medical Center Library in that academic institution serves all faculty, students, and staff at the medical campus. All students in the School of Public Health who were enrolled in the academic year 2006-2007 were the study subjects. Information resource selection and use behavior while completing a research paper or project assignment that requires them to search a variety of information resources was investigated. Because research papers or project assignments have similar requirements

in terms of structure, length of paper, and level of difficulty, the impact of task characteristics is eliminated.

Research Methodology

Although qualitative methods have been taken as a more appropriate method to study information seeking behavior due to its highly situated and contextual characteristics, these methods aim to explore information seeking behavior and to identify factors; they do not test significance. A few studies using quantitative methods only revealed the correlation relationships between influential factors and resource selection but did not statistically test the influential importance of those factors. In order to understand information resource selection behavior, the present study combined qualitative (focus group) and quantitative (a questionnaire, SEM, path analysis) methods. The purpose of the focus group was to ensure the face validity and content validity of the questionnaires. The results of the focus group were combined with the findings of reviewed literature to identify public health students' behavior beliefs and normative beliefs with the variables measuring each belief, and the items to each variable proposed in the model.

In order to answer the question of "why" public health students choose one information resource to use instead of another, the present study focuses more on "how" factors affect the resource selection behavior than the selection behavior itself. Measurable variables (total 15) in the proposed model with multi-items were identified. The 15 variables include: one variable for intention to use, one for actual use, three for behavior beliefs on using an information resource, three normative beliefs on three specific referents' recommendations, and seven external factors, which include one for

electronic resource characteristics, one for print resource characteristics, one for reference services characteristics, one for library environment, one for user's information literacy skills, one for domain knowledge, and one for previous experience of using the selected primary resource. In the questionnaire, students were asked to pick their primary resource and the access approach from the listed possible resources and channels. Questions in 7-Likert scale in the questionnaire asked students to rate multiple items of each variable in the proposed model.

The collected data was analyzed with descriptive analysis and Structural Equation Modeling (SEM) statistic methods by using SPSS 14.0 for Windows and AMOS 7.0 statistic software applications.

Delimitations and Limitations of the Study

Delimitations of the Study

Under the broader context of problem solving, public health students need to seek information to solve problems. In order to find useful information for finishing their research paper assignments, they need to select and use information resources. Problem solving, information seeking, and decision making are interwoven. In this study, decision making is encompassed in the information seeking process while information seeking is a sub-process of the whole problem solving process.

Public health students' selection decision on an information resource is a bounded rational process rather than heuristics. Simon's bounded rationality (Simon, 1977) assumed that decision makers will not have perfect knowledge about all of the available alternatives and what they do is to make a rational decision within the bounds of the

limited capacity to handle complexity, ambiguity and information. In this study, information seeking of public health students is a purposive information seeking behavior with finishing an assignment as a goal.

Usually the purpose of information seeking and tasks are classified as external factors which have an impact on selection of information resources. However, this study was conducted in a context with the same or similar purposes and tasks (finishing a research paper or project) that require public health students to seek information. Therefore, the effects of the purpose and tasks on selection of information resources were under control and were not included in this study.

Information seeking is a process. During this process, users may go back and forth to seek multiple information resources at one time period or during the whole information seeking process until they find enough useful information. This study only focused on two points when public health students decide to select and believe they will eventually use a certain information resource and when they actually use the information resource. Therefore, the data was collected before public health students started the assignment and at the completion of their assignment.

Limitations of the Study

Since this study investigates the determinants of information resource selection, the information resources that were not selected by public health students were excluded.

The generalization of the findings was limited because the study focused on public health students and only those in one academic institution were sampled. Due to different academic environments, the findings may not apply to public health students in

other academic institutions. Surveying more students in other public health schools with the same instrument may obtain more generalized data.

Self-reported actual usage of the resource was limited by students' memory, which may not be as accurate as the data received through observations.

The study used the survey method to ask students to rate behavior beliefs and normative beliefs. Perceived beliefs may shift over time and students' rating on the beliefs on the selection of their primary resource may change in the future. Therefore, the study's findings will only indicate the students' beliefs for this time and possible changes can not be examined in this study.

There are many other factors that may influence public health students on selection and use of information resources, such as a problem situation, type of information need, type of information, personalities, cognitive style, organizational and institutional structure and functions, to name a few. Obviously, one study can not cover all the factors. The effects of these factors on selection of information resources could be good topics for future studies.

Chapter Summary

In conclusion, there are several key points of this study: First, the origin of the research topic of this study is from the researcher's observation and personal experience with problems and confusion faced by information seekers. Due to the large amount of information carried by so many information resources in various formats, people get confused about where to start to find information, or, in other words, which resource

should information seekers select so that they can find information they need fast and easily.

Second, in order to help information seekers with identifying information resources, this study aims to find out why people select and use one type of information resource instead of another, what factors affect their selection, and how resource characteristics, library environment, individual differences, and social influence factors affect the information resource selection.

Third, this study uses the Theory of Reasoned Action (TRA) and the Technology Acceptance Model (TAM) as the theoretical framework.

Fourth, based on the format of information resources, the present study classifies information resources into three categories: print, electronic, and human. Based on the ownership and licensing of information resources, there are two categories: inside of the library and outside of the library, which are defined as information source/channel in this study.

Fifth, public health students in a Midwestern higher education institution are the study subjects. Public health students' resource selection and use behavior is investigated during the completion of a research paper or project assignment that requires them to use a variety of information resources. The Medical Center Library serves all the faculty, students, and staff of the Medical Center for information services.

Sixth, focus groups and questionnaires were used to collect the data. The purpose of the focus group interviews was to ensure the face validity and content validity of the questionnaires. Multi-item questions measuring 15 constructs were phrased on a 7-Likert scale from 1 (strongly disagree) to 7 (strongly agree).

The following chapters are arranged as:

- Chapter II: A review of the literature, which details the concept of information seeking behavior, the current information seeking models and their deficiencies, theoretical frameworks, information resource uses of public health students, studies on information resource selection and influential factors, and other related topics.
- Chapter III: A proposed research model and methodology, which include overall research design, research methods, study context, data collection procedures, instruments, and data analysis methods and process.
- Chapter IV: Study findings.
- Chapter V: Discussion of the study findings
- Chapter VI: Implications, study limitations, and suggestions of further studies.

Chapter II
Review of the Literature

Overview

The first part of this chapter provides a conceptual review of literature, which includes an overview of information seeking behavior, information seeking models that are related to information resources and their deficiencies, theoretical frameworks and the rationales of using the Theory of Reasoned Action (TRA) and the Technology Acceptance Model (TAM), as well as the relationship among the TRA, the TAM, the Cost-Benefit Model, and the Principle of Least Effort (PLE). The second part of the chapter focuses on findings of empirical studies about information resources, sources, and channels used by public health students; impact behavior beliefs, normative beliefs, resource characteristics, library environment, and individual differences had on resource selection and use; the reasons for inconsistent findings, and the implications of the empirical studies on the development of the proposed research model.

The aim of the literature review is to provide a comprehensive picture about the theory development in information seeking behavior and the empirical evidence to support the proposed research model and to design the instrument for this study.

Overview of Study Areas of Information Seeking Behavior

What is Information Seeking Behavior?

There are different explanations on the concept of information seeking. Wilson (2000, p. 49) defined "Human Information Behavior" as "the totality of human behavior in relation to sources and channels of information, including both active and passive

information seeking, and information use." while "Information Seeking Behavior" is "the purposive seeking for information as a consequence of a need to satisfy some goal." In the course of seeking, the individual may interact with manual information systems (such as a newspaper or a library), or with computer-based systems (such as the World Wide Web). Dervin (1983) proposed that information seeking is a bridging process, which is seeking meaning in order to across a gap in one's understanding and make sense of the world. Kuhlthau (1993, p.9) argued that information seeking is "a learning process in which the choices along the way are dependent on personal constructs rather than on one universal predictable search for everyone." Marchionini (1995, P. 5-6) provided a problem oriented definition of information seeking, which is "a process in which humans purposefully engage in order to change their state of knowledge" and which is "closely related to learning and problem solving". Summarizing the definitions above, information seeking is a dynamic, nonlinear, and negotiated process and it is also a cognitive and constructive process. In the process, a person actively seeks information to move forward on or finish his task and satisfy particular needs.

Information seeking is a complex process. It contains three main elements: initiators, process and results. After seeking, several results might occur: 1) Information that meets the needs might be found (seeker is satisfied and the seeking process comes to an end); 2) no relevant information at all is found (unsatisfied, gives up, lingers or refers to new sources); 3) has a better understanding of the nature of the issue (begins new seeking process based on a new understanding of the issue). Based on different seeking results, the whole process either comes to an end or loops back to the beginning (see Figure 2.1) (Case, 2002; Dervin & Nilan, 1986; Johnson, 1997; Krikelas, 1983; Kuhlthau,

2004; Leckie, 1996; Niedzwiedzka, 2003; Taylor, 1968 &1986; Wilson, 1981, 1982, 1997 & 1999; Foster, 2004). In this study, information seeking behavior is a purposive seeking for information as a consequence of a need to satisfy some goal (Wilson, 2000). During this process, two decision points direct the information seeking behavior. One is the decision to seek information or not, the other is the decision of which information resource to select. This study focuses on the second decision point, which is the selection of information resources and its influential factors.

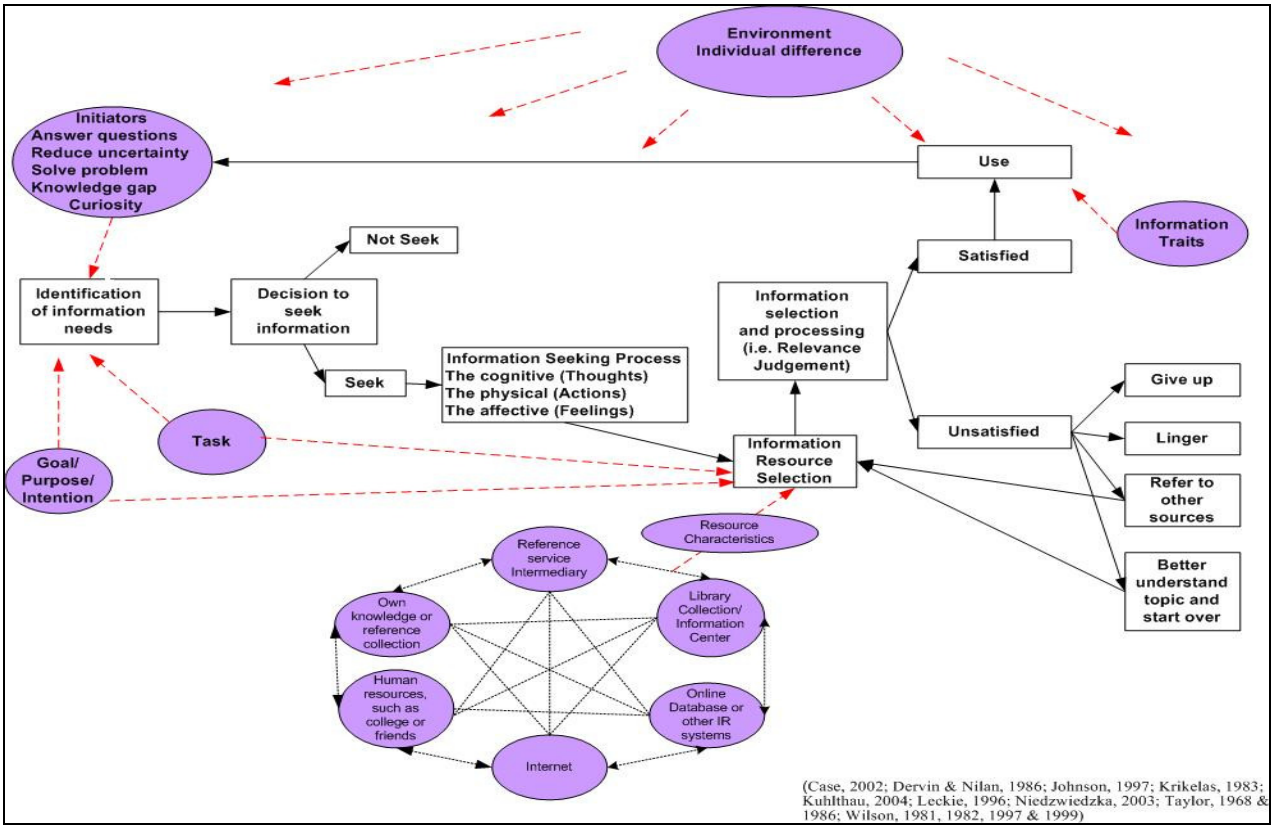

Figure 2.1. General information seeking process

During a whole seeking process, many influential factors affect the direction, progress, and results of information seeking, which include where to start, to whom to talk, what information resources to select and use, what kind of information is relevant, and so on. The sample of influential factors includes individual differences,

social/environment variables, information resource characteristics, task characteristics, and the like (See Figure 2.1). “A central component of information behavior is the notion of interacting with an array of potential sources that might address one’s interests and information needs.” (Case, 2006) Therefore, the influential factors affecting the whole information seeking process will also influence the selection of information resources. In this study, the factors of interest are behavior beliefs, normative beliefs, information resource characteristics, library environment, and individual differences.

What Aspects of Information Seeking Behavior Have Been Studied?

Based on Wilson’s definition on human information behavior and information seeking behavior (2000), information seeking is only part of the totality of information behavior, which additionally includes serendipitous information encountering, giving, sharing, and use of information (Case, 2006). The studies on information seeking include the exploration of the information seeking process itself and have also been expanded and intercrossed with the studies on information needs, information retrieval, and context of information seeking.

Many researchers studied information seeking as a process (Bates, 1989; Kuhlthau, 1991; Ellis, 1993; Leckie, Pettigrew, & Sylvain, 1996; Krikelas, 1983; Foster, 2004). They wanted to know what happens when a person seeks information, and examined components of the process. Kuhlthau’s Information Searching Process (ISP) model is a good example. The model illustrates six stages in high school/college students’ information seeking and the thoughts, feelings, and actions involved in those various stages (Kuhlthau, 2004). Affective and emotional aspects in information seeking and use are a popular topic in current information seeking studies.

Studies on information retrieval focus on the interaction with information systems of all kinds, including computer-based systems and interactions with a person. A holistic conceptual framework on the collaboration of information seeking and information retrieval is currently under development (Bates, 2002; Ingwersen, 2005).

So far, research into the context of human information behavior has received a lot of attention in the field of library and information science. Although the importance of understanding the role and functions of context to understand human information behavior has been recognized, there have been no agreements about how to conceptualize and measure context of information behavior. Based on various understandings of context, there are studies about information seeking in work, study, research settings (Choo & Auster, 1993; Detlor, 2003), everyday life information seeking (Savolainen, 1995), information seeking in the context of a task (Bystrom, 2002; Vakkari, 1999), and information seeking in various other contexts.

Among studies in information seeking, many information seeking models have been developed. Because this study focuses on the selection and use of information resources, the following literature review and discussions mainly focus on this topic.

Information Seeking Models Involving Information Resources and Resource Selection

Among many information seeking models, some of them touched upon the topic of information resources and influential factors on the selection of resources (Krikelas, 1983; Leckie, 1996; Johnson, 1997; Wilson, 1997; Taylor, 1986 & 1991; Sonnenwald, 1999 & 2001). These models view information resources from different perspectives and with common understandings.

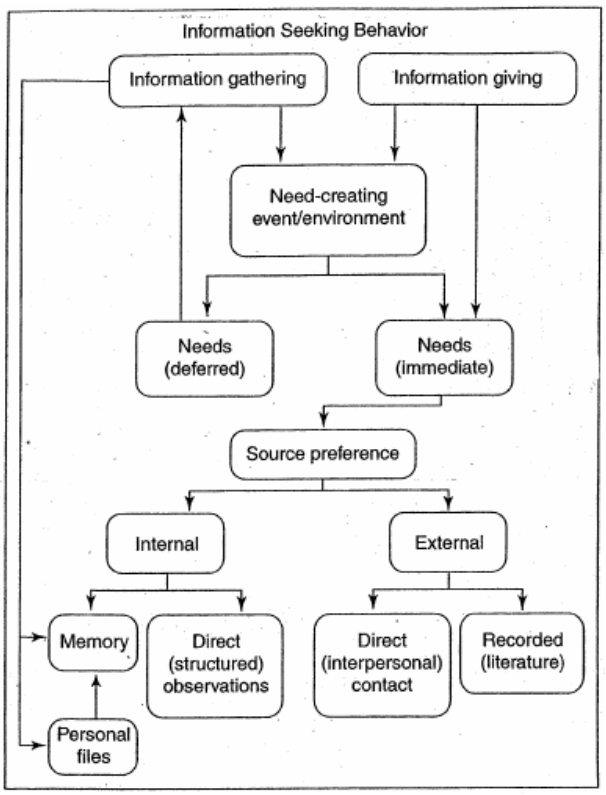

Figure 2.2. Krikelas' Model (Krikelas, 1983)

Krikelas' model (1983) (see Figure 2.2) described an information seeking process that is occupation-oriented. In this model, he classified resources as internal and external and he also explained when to use internal resources and when to use external resources. "Source preference" in Krikelas' model just presented the fact that people used preferred information resources, but had nothing to do with the resource selection and its influential factors. Krikelas also audaciously conceived that there might be a hierarchy of source preferences in an individual's mind to represent some basic concept of minimal effort. This idea has been empirically verified by Sonnenwald (1999 & 2001), who suggested that within a context and situation there is an "information horizon" in which we can act. Information horizon (or more specially, information source horizon) is a subjective map graphically representing the information resources users typically access and their

preferences for these resources. Although both Krikelas and Sonnenwald did not address the causal relationship of influential factors and resource preference, they provide us with the idea that the resource preference is associated with some contextual factors, such as tasks and purposes of seeking information, etc.

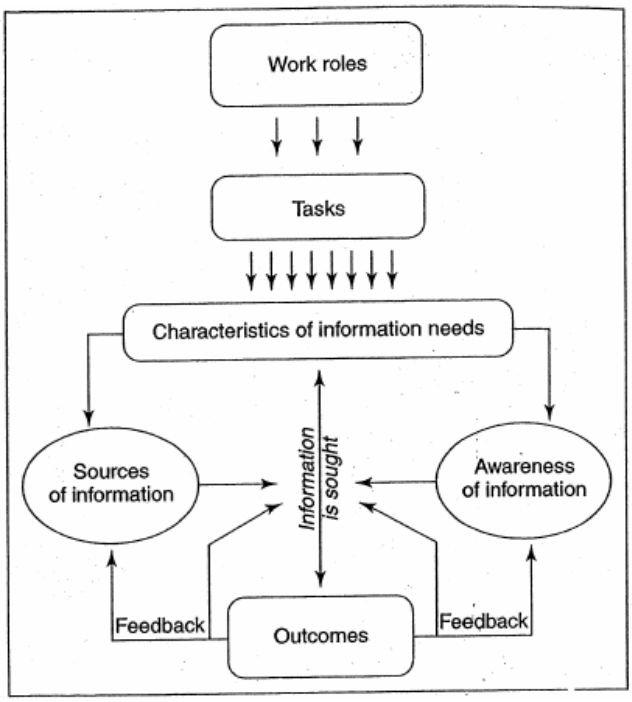

Figure 2.3. Leckie's Model (Leckie et al, 1996)

Leckie's general information seeking model for professionals (Leckie, Pettigrew, & Sylvain, 1996) (see Figure 2.3) took "sources of information" and "awareness of information" as two factors that influence information seeking. "Sources of information" in Leckie's model indicates the format of information resources while "awareness of information" indicates the perceptions and knowledge on the source, which include familiarity and prior success with resource, trustworthiness, packaging, timeliness, cost, quality, and accessibility. "Professionals use their own awareness of information sources and content to make assessments about the relative importance of various variables, such as timeliness versus cost, convenience versus quality, and so on." (Leckie, Pettigrew, &

Sylvain, 1996, p. 186) Actually, Leckie et al took resource characteristics and user's previous experience as two factors that directly affect professionals' information seeking.

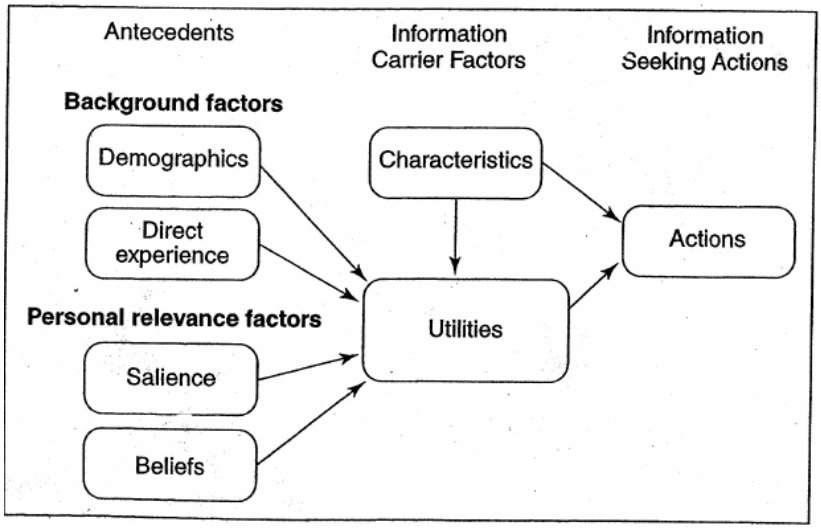

Figure 2.4. Johnson's Model (Johnson, 1997)

Johnson's model (Johnson, 1997) (see Figure 2.4) provided a causal relationship between demographics, direct experience, personal knowledge, resource characteristics, resource utility, and information seeking actions. "Information seeking actions" include conscious choices among channels and sources, but also imply processes, feelings, and a whole host of other behavioral and cognitive elements. Johnson pointed out that demographics, direct experience, personal knowledge, and channel/resource characteristics indirectly affect information seeking actions through directly affecting "expectations regarding likely satisfactions to be obtained", which is the utility of channels/sources. This causal relationship is similar to, but not as comprehensive as what the TRA presented.

Wilson's information seeking model (Wilson, 1997 & 1999) (Figure 2.5) emphasized the complex context of information seeking by borrowing theories from other fields, including decision making, psychology, health communication, consumer

research, and so on. In this model, he took "source characteristics" as one of the intervening variables to affect the information seeker's motivations to search for information, and how and to what extent. One of the motivators is the balance of risk and reward of using an information resource based on Risk/Reward Theory, which explains why some sources of information are used more than others. Therefore, resource characteristics are external variables which affect people's decision on which resource to use through affecting people's perceptions of risk and reward of using an information resource. From this point of view, the role of resource characteristics in the Wilson's model is as an external variable, just as it is in the TRA.

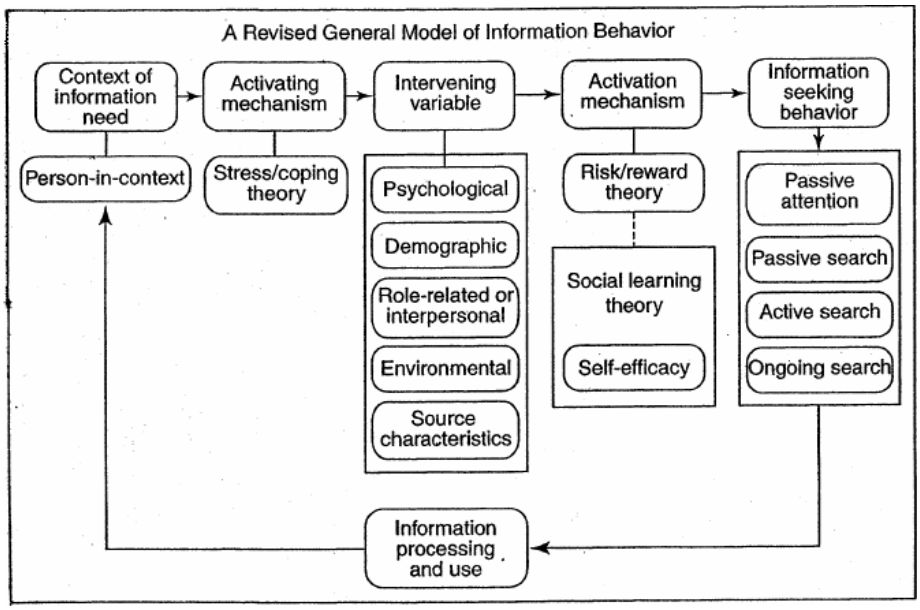

Figure 2.5. Wilson's Model (Wilson, 1999)

Wilson is not the first one to recognize the importance of context of information seeking. In an earlier study in 1986, Taylor (1986, 1991) proposed his conceptual framework Information Use Environments (IUE). He recognized that a user's environment or situation had a critical effect upon the nature of the information needed. In Taylor's statement, IUE was defined as "the set of those elements (a) that affect the

flow of information messages into, within, and out of any definable entity or group of clients; and (b) that determine the criteria by which the value of information messages will be judged in those contexts." (P. 25-26) The set of elements include characteristics of a particular set of people, characteristics of the organization or setting, characteristics of the problems, and characteristics of the solutions, i.e. anticipated information. From Taylor's definition, information use environment definitely affects people's selection of information contained in a documentary information resource through affecting their formation of the criteria in judging the usefulness of the resource. In other words, IUE will affect people's perception on the value of information resources based on the criteria judgment, which is similar to the idea in the TRA that the external variables (i.e., IUE) affect people's behavior through affecting people's beliefs on the consequences of performing the behavior. In his Value-Added Model, Taylor (1986, p. 50) provided six criteria considered by users to choose information resources. These criteria are: ease of use, noise reduction, quality, adaptability, time-savings, and cost-savings, which were considered as sample of system characteristics usable for this study.

All the models and frameworks discussed above provide a picture that information seeking researchers do recognize the effects of environmental and contextual factors on information seeking and resource selection. They all took resource characteristics as one of the environmental factors, which is external to the resource selection behavior itself. However, some of them thought the resource characteristics exert the direct influence on resource selection (Krikelas, 1983; Leckie, Pttigrew, & Sylvain, 1996) while others addressed the effect of resource characteristics on information seekers' motivation, beliefs, and perceptions, which, in turn, directly

influence the resource selection behavior (Wilson, 1997 & 1999; Johnson, 1997). However, there has been no thorough investigation about resource selection behavior and its influential factors either theoretically or empirically. This study aims to fill this gap by providing a detailed examination on public health students' selection of information resources to finish an assignment.

Theoretical Framework

Theory of Reasoned Action (TRA) and Technology Acceptance Model (TAM)

Theory of Reasoned Action (TRA)

The Theory of Reasoned Action (TRA) (see Figure 2.6) proposed that an individual's behavior (e.g., use of one information resource over others) is determined by his/her intention to perform the behavior, and this intention is influenced jointly by his/her attitude toward performing the behavior as well as the perceived social influence of people who are important to him/her (i.e. subjective norm), which, in turn, are determined by his/her behavior beliefs about the consequences of performing that behavior and normative beliefs that specific referents think he/she should or should not perform that behavior. External variables encompass all variables not explicitly represented in the model, which include demographic or personality characteristics, the characteristics of the behavioral target, and other variables that can influence the formation of the beliefs. The Fishbein model asserts that external variables influence behavior intention only indirectly by influencing the individual's beliefs (Ajzen & Fishbein, 1980; Davis, 1986; Dillon & Morris, 1996).

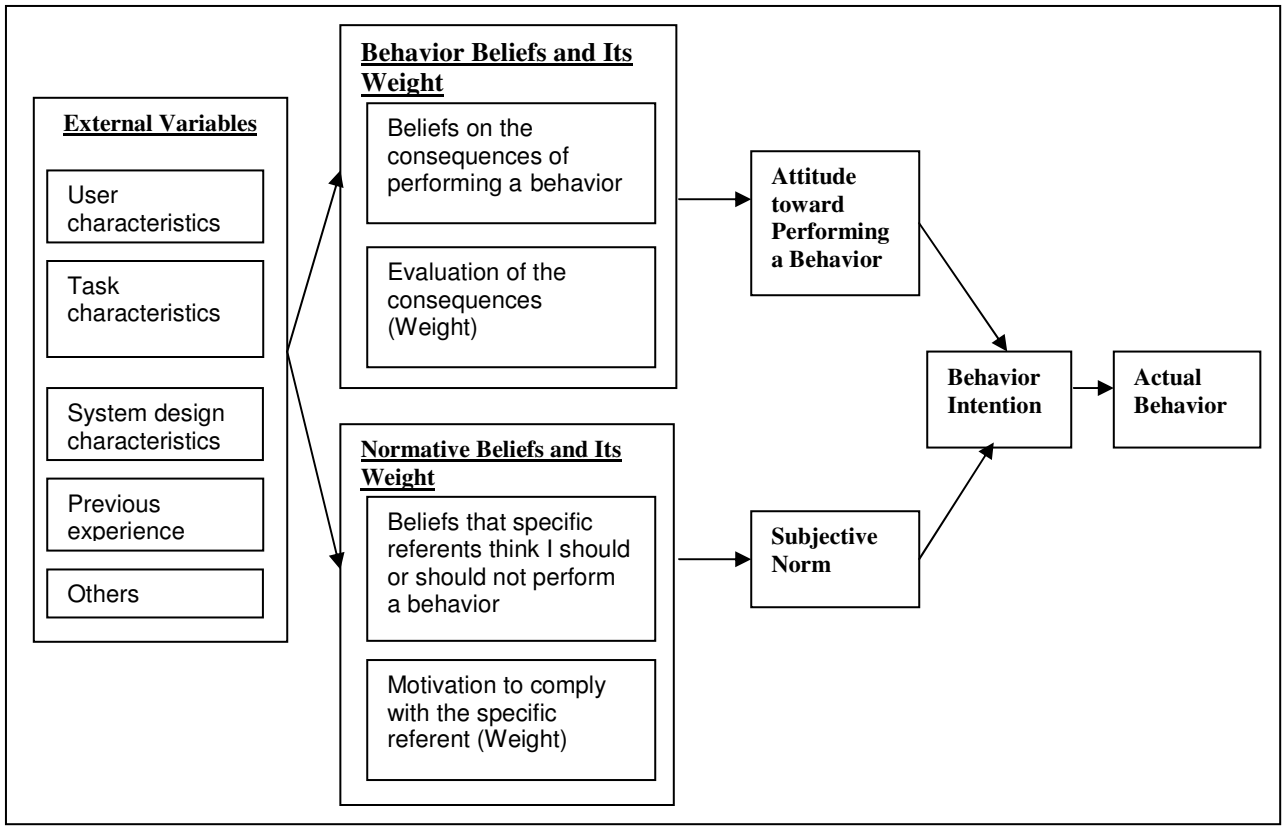

Figure 2.6. Theory of Reasoned Action (TRA) (Cited from Ajzen and Fishbein, 1980)

In the TRA, behavior intention (BI) has been defined as "an individual's subjective probability that he or she will perform a specified behavior. Attitude refers to an individual's evaluation of performing the behavior." Subjective norm refers to "the person's perception that most people who are important to him think he should or should not perform the behavior in question" (Fishbein & Ajzen, 1975, p. 302). Behavior beliefs are defined as "the person's subjective probability that performing the target behavior will result in a set of salient consequences, including both good and bad ones." The evaluation of the consequences refers to "an implicit evaluative response" to the consequences of performing the behavior (Fishbein & Ajzen, 1975, p. 29). Normative beliefs are defined as "the perceived expectations of specific referent individuals or groups." (Fishbein & Ajzen, 1975, p. 302)

The TRA was chosen as a theoretical framework for this study for the following reasons.

1) Same assumptions

TRA was developed and based on the assumption that human beings are usually rational and make systematic use of information made available to them. People consider the implications of their actions before they decide to perform or not perform a given behavior (Ajzen & Fishbein, 1980). This assumption is the same as the one in this study, which is that a user's selection decision is a rational process.

2) Behavior and actions

Based on Azjen & Fishbein (1980), a behavior can include a single action or a behavior category. For example, using or not using a specific information resource is a single action whereas a behavior category, such as dieting includes a set of single actions (e.g., eat only two meals a day, take diet pills, drink low caloric beverages, etc.). Combining these observable single actions to arrive at a single index is usually used to measure such behavior categories.

However, regardless of whether it is a single action or a set of actions, we view each action as a single action. The TRA takes a single action as a unit of analysis. Most of the time, in our daily life, we face the situation in which we need to select an action from a couple of alternatives to perform. For example, instead of observing whether or not a person buys a new car, it is possible to record which alternatives he/she chooses, such as Ford, Mazda, Toyota, Honda, or Chevrolet, etc. This multiple choice procedure can be viewed as a set of single actions and each alternative action as a single action, which can be explained with either performing it or not performing it (e. g., choosing

Ford or not choosing Ford). But in contrast to the actions used to construct a behavioral category, the alternative actions in the multiple choice alternatives are exclusive from each other so that they can not be combined into a single index but must instead be treated as separate behaviors. It is very easy to understand that if a person chooses a Ford car, it is not possible for him/her to choose a car with another make when he/she only buys one car at one time.

In this study, the behavior of selection and use of a primary information resource falls into a multiple choice procedure. Each information resource is an alternative for the action of selection and use. For each information resource, there is a decision for public health students to choose it or not to choose it. When students choose one information resource, he/she can not choose other information resources at the same time.

TRA also stated that any behavior should contain four elements: "the action, the target at which the action is directed, the context in which it occurs, and the time at which it is performed." (Ajzen & Fishbein, 1980, p. 39). Take behavior of public health student selection and use of their primary information resource for an assignment during the 2007 spring semester as an example. In this example, the primary information resource is the behavior target; use is the action; finishing an assignment is the context; 2007 spring semester is the time element. According to Ajzen & Fishbein (1980), all the constructs in the TRA should correspond to each other on the measurements in terms of these four behavior elements, called behavior criteria. In this sense, "Intention to use" means public health student's intention to use their primary information resource to finish an assignment during the 2007 spring semester. "Behavior beliefs" mean public health

students' beliefs about the consequences of using the primary resource to finish that assignment during the 2007 spring semester.

3) Behavior intention and selection of information resource

Azjen & Fishbein (1980) stated that "all behavior involves a choice, be it a choice between performing or not performing a given action or a choice among several qualitatively or quantitatively different action alternatives" (Ajzen & Fishbein, 1980, p.41). To use a person's intention to predict his choice, we can present him with the available alternatives and ask him which alternative he intends to perform. Davis(1986, p. 38) stated that "Intention reflects a decision that the person has made about whether to perform a behavior or not, and as such gets formed through a process of mental deliberation, conflict and commitment that may span a significant time period." Therefore, a person's intention to perform a behavior can be used to indicate the concept of choice of performing or not performing a behavior. In the case of this study, behavior intention will be transferred to a more straightforward construct, which is information resource selection.

Ajzen & Fishbein (1980) also emphasized that the preconditions of using behavior intention to predict a behavior are that the measures of behavior intention correspond to the behavioral criterion, and the intention has not changed prior to the performance of the behavior. Public health student's perceptions on information resources have already been formed and stay stably in their minds. However, we do not know if their intention to use an information resource will change when they actually use that resource, which will be investigated in this study. Azjen and Fishbein (1980) and many other empirical studies using the TRA and the TAM as a theoretical framework

also provide measurement examples to measure behavior intention for the multiple choice procedure, which will be discussed in detail in Chapter III.

4) Attitude towards performing a behavior (A_{act}) and attitude towards behavior target (A_o)

There are many external variables that may affect human behavior. The TRA shows that those external variables influence behavior indirectly through affecting an individual's beliefs. Among those external variables, it is worth taking a little time to explain attitude towards performing a behavior (A_{act}) and attitude towards the behavior target (A_o).

It has typically been assumed that a person's behavior towards a target is determined by his attitude toward that target rather than the attitude towards performing the behavior. For example, using or not using an information resource is attributed to a user's attitude towards that resource other than the user's attitude toward using that resource. Users' attitude towards resources is perceptions on the information resources while the users' attitude toward using or not using a resource is actually the behavior beliefs about the advantages and disadvantages of using that resource. They are related but not the same concept. People's attitude to an information resource may be different from the attitude toward using that resource, which actually determines their intention to use or not to use that resource. Quite a few previous studies investigated the effect of attitude toward a resource (rather than attitude toward using a resource) on using or not using that resource, which produced inconsistent findings due to the lack of correspondence between the attitude construct and the behavior criteria. In the TRA, Ao

is taken as an external variable, exerting influence on intention only through its effect on beliefs about the behavior's consequences (A_{act}).

Based on Ajzen & Fishbein's idea, the public health students' evaluation on an information resource's characteristics (print resources, electronic resources, and reference service) would be able to represent their attitude and perceptions on an information resource, which is classified as an external variable. The attitude and perceptions of an information resource will affect public health students' beliefs about the consequences of using that information resource (behavior beliefs), which, in turn, determine their selection decision.

Technology Acceptance Model (TAM)

Following Fishbein and Azjen's *beliefs-attitude-behavior intention-actual behavior* approach, Davis (1989) proposed the Technology Acceptance Model (TAM), which aims to predict information system acceptance and diagnose design problems before users experience the system or just after short interaction with the system. The TAM is the most widely cited model in the Management Information System (MIS) field. According to the TAM, user acceptance of any technology, measured by a person's intention to utilize an information system, is determined by two beliefs, namely, perceived ease of use and perceived usefulness. Moreover, the TAM proposed that the effects of external variables on usage intention are mediated by perceived ease of use and perceived usefulness. In addition, perceived ease of use will also influence perceived usefulness. The easier it is for a user to interact with a system, the more likely he or she will find it useful and will intend to use it again. The causal relationships of the TAM's variables are depicted in Figure 2.7.

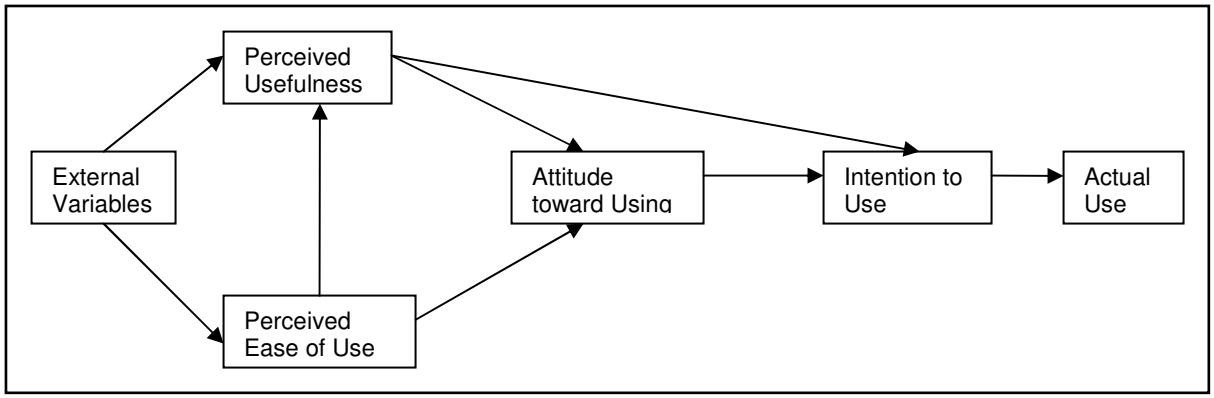

Figure 2.7. Technology Acceptance Model (TAM)

The significant difference between the TRA and the TAM is that the TRA does not specify the exact behavior beliefs, which are defined as perceived consequences of performing a behavior, while the TAM specifies the TRA's behavior belief construct with two individual belief items, perceived usefulness and perceived ease of use. Dissecting the belief structure "enables one to compare the relative influence of different beliefs in determining attitude toward performing a behavior" (Davis, 1986, p. 27). In addition, representing each belief separately provides greater diagnostic and explanatory information regarding the effect of external variables on each belief than it would be normally possible if beliefs were handled in aggregate as the Fishbein model does (Davis, 1986). Davis (1989a) analyzed the theoretical foundations of perceived usefulness and perceived ease of use as determinants of user behavior and also tested the reliability and validity of these two beliefs constructs. Behavior beliefs identification and measurement development in the TAM was used to identify and develop the measurement of belief items in this study.

In conclusion, the TRA and the TAM provides a useful framework to identify the specific belief items of public health students as well as investigate the influential importance of different beliefs on user information resource selection and how the

external variables (e.g., individual differences, medical library environment, and information resource characteristics) affect resource selection through affecting public health student's beliefs. Based on the TRA and the TAM, the findings from reviewed literature, and the results of the focus groups, a model on information resource selection and use (see Figure 2.8) was proposed and tested with the SEM and path analysis, which will be discussed in detail in Chapter III.

Cost-Benefit Model and the Principle of Least Effort (PLE)

The Cost-Benefit Model and the Principle of Least Effort (PLE) have been found in studies about information resource selection as early as the 1960s to the present. Both perspectives possess similar views as the TRA in terms of information resource selection and use behavior.

The Cost-Benefit Model proposes that information seekers assess both costs and benefits when they select and use information resources (Hardy, 1982). In other words, a decision on selecting an information resource is actually a judgment process between perceived "cost", in terms of physical and intellectual effort or time expended, and perceived "benefit", the likelihood that the information obtained is the information needed or wanted (Allen, 1977; Orr, 1970; Pinelli, et al, 1991b). Under this model, the resource selection decision during information seeking is highly rational. Taylor (1986, p.53) defines "value as an assessment of the anticipated consequences of an action." The consequences take the form of cost savings and improved operated performance (King & Schrems, 1978, p. 21). If we take "action" as "making a choice of using an information resource", then users' subjective estimates of anticipated consequences, which might include cost savings, improved performance, or time consuming, etc., will determine

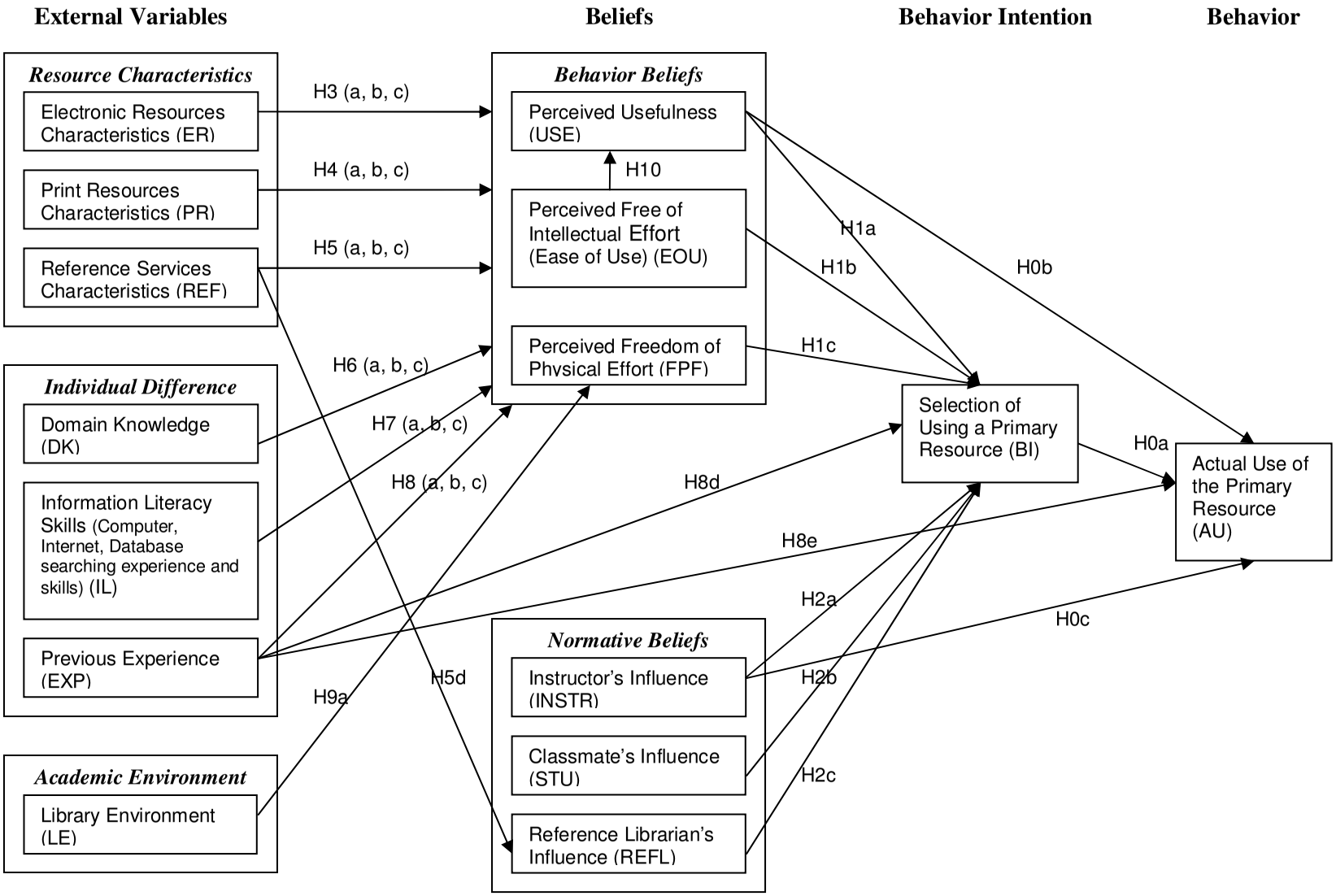

Figure 2.8. Proposed Information Resource Selection and Use Model (IRSUM)
(* H denotes hypothesis)

whether they will use this resource. The perceived "cost" and perceived "benefit" of using an information resource are the same concepts as the behavior belief constructs in the TRA. Behavior beliefs are beliefs about the advantages and disadvantages of performing a behavior, and are the beliefs about the consequences of an action. Therefore, in this study, the "benefit" or "value" that users perceive after using an information resource is the behavior belief regarding advantages of using that information resource. The perceived "cost" or "effort" that users need to spend while using an information resource is the behavior belief regarding disadvantages of using that information resource. Davis (1989a) took the Cost-Benefit Model as the framework to identify two specific beliefs to develop the TAM. They are perceived usefulness and perceived ease of use. Therefore, the Cost-Benefit Model can also be used as a framework to guide the identification of behavior belief variables in this study.

Zipf's Principle of Least Effort states that each individual will adopt a course of action that will involve the "probably least average rate of his work expenditure" (Zipf, 1949, p.6) ("least effort"). "Least effort" has been restated in library literature as Mooers' Law: "An information retrieval system will tend not to be used whenever it is more painful and troublesome for a customer to have information than for him not to have it" (Mooers, 1990). These laws do not imply laziness or lack of interest, but instead applauds the foresight of the individual for achieving the objective while saving time and energy. In terms of information resource selection, PLE maintains that information seekers' selection of information resources is based on minimizing effort or cost in obtaining information, including physical and psychological effort and financial cost regardless of the quality of the information they expect to obtain (Hardy, 1982; Orr, 1970). Effort that

information seekers intend to minimize according to PLE echoes behavior beliefs on the disadvantages of using an information resource in the TRA.

Zipf's PLE is "the primary principle that governs our entire behavior of all sorts" (Zipf, 1949) and has been applied at all levels of information seeking from selecting an information resource to specific steps of query modification in a successive search in countless studies (Bates, 2002; Buzikashvili, 2005). However, it is known as a conceptual principle rather than an operational one and it lacks specificity and tends to reduce the complexity of human behavior into one explanation that ignores the effects of context and individual differences (Case, 2005). To elaborate on an operational model, we need to specify this principle. In other words, we need to identify the user's effort. In this study, effort is defined as public health students' behavior beliefs on disadvantages of using an information resource, which is the same as the scope of perceived cost.

Description of Information Seeking Behavior of Public Health Students

Information Resources Used by Public Health Students

Previous studies on students' information seeking behavior were mostly descriptive and they reported that students usually used information resources for their coursework and other academic activities. However, among students in different majors in health sciences disciplines, few studies examined public health students' information seeking behavior. Therefore, information seeking behavior of health science students with different majors, especially the programs at the graduate level, is reported together.

The studies found that the most frequently used information resources by health science students are textbooks and course handouts, especially about disease diagnosis

(Adedibu & Adio, 1997; Nweke, 1993; Pelzer & Leysen, 1988; Northup, et al, 1983; DaRosa, et al, 1983; Cogdill & Moore, 1997). However, when students were faced with a question related to treatment, they were more likely to perform searches in MEDLINE rather than depending solely on medical textbooks (Cogdill & Moore, 1997). However, with more and more information resources available electronically or online, a major shift has also been made from using print resources to using computerized resources. Pelzer, et al (1998) reported that although textbooks and handouts were still the first choice for students, a significant increase in using computerized indexes and abstracts rather than print indexes was found. The findings showed a dramatic shift from using print indexes to computerized counterparts from 1987 to 1997, as well as an overall increase in using indexes due to being able to access them electronically. In addition, more than half of the students also reported they used the Web or the Internet to find more current information, which was not possible in 1987 when the worldwide network connection had not been developed. Tannery et al (2002) found third-year medical students valued full-text articles most, followed by other websites and e-books. De Groote, et al (2003) reported that 93% of medical faculty, residents and students prefer searching on their own, rather than through a librarian, a technician, an assistant or a student. Fifty-three percent searched MEDLINE at least once a week and 71% indicated that they preferred to access journals online when possible. Peterson et al (2004) also concluded that the majority of medical students preferred electronic sources as primary resources, and especially electronic textbooks with rapid searching capabilities, such as UpToDate and Harrison's Online, as well as online databases such as MEDLINE, MD Consult, and others with practical clinical information; although, they continued to

recognize the important role of paper textbooks. Other resources used by health sciences students also include reference collections, reviews, pamphlets, newsletters, and conference proceedings (Adedibu & Adio, 1997).

Regarding uses of human resources, Pelzer et al (1998) found that all people resources, including classmates, instructors, library staffs, and others, were sought last while students are seeking information. Among them, library staff were the last resource to seek (Pelzer, et al, 1998). The number of librarian-mediated searches performed in libraries was found dramatically declining as most of end-users prefer searching information on their own (De Groote et al, 2007; Curtis et al, 1997). Jenkins (2001) investigated undergraduate students' perceptions on reference services and reference collections. She found that most students can identify reference librarians' functions, such as directing patrons to resources, answering research questions, directing patrons to other areas, assisting with using resources, suggesting where to find a topic in reference, etc. When asking reasons why students do not use reference services, more than half of the students answered that no assistance was needed. Other reasons included no one was at the reference desk; they were uncomfortable asking questions or uncertain how to ask for help; they did not know the reference librarians were there for help; they did not know if the reference librarian would take the time to help, etc.

Information Sources/Channels Used by Public Health Students

Boyce, et al (2004) reported that faculty, students and scientists access journal articles through personal subscriptions, library subscriptions, preprints, archives, colleagues, database searches, interlibrary loan, the author's website, and browsing the library shelves, etc. Another study concluded that third-year medical students access e-

journals, e-books, online databases (MEDLINE), and online information through the library's website (Tannery et al, 2002). De Groote, et al (2003) found that medical faculty accessed resources from their office more often than from libraries while medical students are more likely to use libraries (De Groote, et al, 2003). Previous education, practicing activities, life experience, observation, library orientation, tests, and dissection practice were reported as information channels as well (Shershneva et al, 2005).

Factors Influencing Students Selection and Use of Information Resources

Based on the TRA and the reviewed literature, five categories of influential factors have been classified. They are beliefs on advantages and disadvantages of using information resources (behavior beliefs), normative beliefs on a specific referent's influence on using information resources, resource characteristics, individual differences and, library environment (See Figure 2.8, p. 44) with several variables in each factor category. In addition, some variables can be classified into more than one factor category, such as the variable "time". Therefore, the cluster of variables into these five factor categories is relative and not at all absolute. This part of the literature review reports how each factor category and factor variables influence users' information resource selection separately and in combination. Since just few articles introduced how influential factors affect public health students' information resource selection, studies about other user group's information resource selection and use are also included.

Behavior Beliefs and Resource Characteristics

As mentioned above, perceived "cost" is the belief about the disadvantages of using an information resource while perceived "benefit" is the beliefs about the

advantages of using an information resource. However, there has been a debate on the rules on which information seekers use while selecting and using information resources and channels. Do they consider both cost and benefit factors equally or put more weight on one side over another? Do they intend to not maximize the benefit, but rather minimize the cost, or take the reverse direction? Do they choose information resources with easier access while sacrificing quality and sufficiency of the information received? Some studies found that cost factor is the exclusive consideration while some found that the benefit factor is only considered. Some scholars argued that both cost and benefit factors are considered when information seekers use information resources. Although the information seeking context somehow accounts for the inconsistent findings, the root reason is the mix-up of the definition and measurement for perceived "cost", perceived "benefit", and resource characteristics constructs in previous studies.

Based on the TRA, the TAM, the Cost-Benefit model, and the PLE, the present study defines perceived cost and perceived benefit as behavior belief constructs while resource characteristics are external variables. Perceived accessibility of using information resources is equivalent to the perceived "cost" while perceived usefulness of using information resources equals the perceived "benefit" construct. Resource accessibility and quality are two aspects of resource characteristics. The following section provides distinctions and relatedness of these concepts and is followed by how perceived accessibility and perceived usefulness influence users' selection of information resources. Because most studies on public health students' information seeking were descriptive without systematically examining why they select one resource over others and what factors influence their selection, a comprehensive report is provided below by

synthesizing the findings of previous studies conducted with different user groups in different settings. Besides public health students and faculty in education and clinical settings, students and scholars in other majors in academic settings, scientists and engineers in research and development (R&D) settings, executives in administration and business settings, and professionals in other settings are also included.

Perceived Accessibility of Using Information Resources and Perceived Resource Accessibility

Associated with information resource characteristics, accessibility is a cost variable that has been investigated most thus far. Due to the complicated connotation of this concept, accessibility has been defined from different perspectives. Allen defined accessibility as "the degree to which one can attain meaningful contact with the channel without giving consideration to the reliability or quality of the information expected." (Allen, 1977, p. 182) It was also defined as the "expected level of effort required to use a particular information source", (Culnan, 1985, p. 302) or time and effort needed to approach, contact or locate the source (Marton & Choo, 2002). Rosenberg (1967) used *ease of use* interchangeably with *ease of access*. Gerstberger and Allen (1968), Allen (1977), and Culnan (1983a) used the general word "*accessibility*" to indicate the concept. The meaning of accessibility in their studies is "how easy it is to approach, obtain, or contact the channel without giving consideration to the reliability of quality of the information expected" (Allen, 1977, p.182), which is same as ease of use or ease of access. Hardy (1982) used *ease of use* (how easily the channel can be used to access information you want), *timing saving ability* (how much a channel can save you time by providing you needed information), and *promptness* (how much time it takes to deliver the information) to indicate the concept of accessibility. O'Reilly (1982, p. 762-763)

measured resource accessibility with three questions of "time, expense, or difficulty in obtaining information from the resources", "how easy is it to get at the information", and "how difficult is it to get information from the resource". Pinelli et al, (1991a & 1991b) defined accessibility as ease of getting to an information source and ease of use as ease of understanding, comprehending, or utilizing information sources. Auster and Choo (1993, p. 196) used "*time and effort* needed to approach, contact, or locate an information resource" and "how *easy* it is to get the desired information from that resource" to indicate the concept. In the preliminary review of Fidel and Green's study (2004), *saving time, saving mental efforts, convenience of use of format, and maximum physical proximity* were all described as accessibility.

From the various understandings for the concept of accessibility reported above, it is evident to observe a mix-up of definition and measurement. For example, both "perceived ease of use" and "promptness" were used to define and measure resource accessibility. Although both measure users' perceptions, the perceived targets are not quite the same. "Promptness" is the user's perception on a resource's characteristic while "Perceived ease of use" is the users' perception on using this resource. One target is the information resource itself (behavior target) and the other target is using the resource (behavior). Perceived prompt system response (perceived resource characteristics) makes users perceive the system to be easy to use (behavior belief). Therefore, these two measures echo the differentiations and relations made by Fishbein and Azjen in the TRA between attitude toward performing a behavior (A_{act}) and attitude toward the behavior target (A_o). The situation of using different types of perceptions to measure the same concept of accessibility in previous studies resulted in inconsistent findings about the

effect that accessibility had on information resource selection. Therefore, it is necessary to differentiate two different kinds of perceptions: perceptions on using an information resource (behavior beliefs) and perceptions on the resource itself (perceived resource characteristics).

In order to clarify the distinctions and relationships between these two types of perceptions, answers for the following two questions are needed: 1) What is the borderline between perceived accessibility for using an information resource and perceived resource accessibility? 2) What does information resource accessibility really mean and how is it related to information access? Does it mean we just physically "touch" or connect to an information resource, or, does it also mean we obtain the needed information easily from an information resource? Does it include ease of understanding what is presented on a page/screen of print/electronic resources?

Many scholars in information science have noticed the multidimensional nature of accessibility. They proposed that accessibility has three dimensions: physical effort, cognitive/intellectual/mental effort, and psychological/emotional effort (Culnan, 1985; Curley, Connelly, & Rich, 1990; Connelly, et al., 1990; Choo, Detlor, & Turnbull, 2000; Savolainen & Kari, 2004; Fidel & Green, 2004). Curley, Connelly & Rich (1990) defined three aspects of accessibility from the system's perspective. Physical accessibility relates to the *proximity* of the resource with respect to potential users, functional accessibility refers to the ease with which information can be obtained (*searched*) from a resource once it is at hand, and intellectual accessibility means the ease with which the knowledge is *understood* once the desired knowledge is located. Choo, Detlor, & Turnbull (2000) used *physical, cognitive and psychological efforts* required to contact a resource and *time*

required to extract information from the resource to interpret the concept of accessibility. Fidel & Green (2004) used *physical, intellectual and psychological efforts* to categorize multiple dimensions of accessibility from the system's perspective as well. What are *physical, intellectual and psychological efforts* and how can these efforts get involved in information access? Take an information retrieval system as an example.

If a user wants to use an information retrieval (IR) system to find information, the first step is that he/she physically gets to either the print or electronic version of the system (physical effort), and needs the system to be available and usable. The second step is that he/she uses any retrieval tools (i.e. index) or methods provided by the system to find relevant information (intellectual effort). In order to do that, the system needs to possess reasonable structure, flexible navigation, an easy-to-use search interface, good index files, effective search algorithm, an easy-to-learn "help" feature, and other features to help users with retrieving relevant records from the system. The third step is that the user reads, evaluates and interprets obtained information to determine if the information meets his/her information needs. Identifying and selecting useful information from the retrieved records is a to-do task after the information retrieval task is done. But in order to provide convenience for users, the system should represent information with neat organization and clarity. If the user goes through all three steps very smoothly, he/she will feel very comfortable with using the system (emotional effort), which produces a positive feedback loop of using this system again. Thus, if we define information access as identifying useful information, users need to go through all three steps and experience the three types of effort in the process. The less effort users perceive to take while using an IR system, the easier users would perceive it is to access the system, and the easier it is

for users to access information. However, in order for users to perceive less effort during accessing an IR system, the system must possess accessibility with *physical availability and usability, searchability, information representability,* and other characteristics that can *bring users ready-to-identify/select information*. Therefore, accessing information is the outcome of accessing IR systems. Based on the above statement, it is concluded that IR system accessibility can be interpreted from both users' perceptions of using an IR system and users' perceptions on the IR system itself. Users' perception about accessibility of using an IR system (perceived accessibility of using a resource) is represented by three types of perceived effort: physical effort, cognitive effort, and psychological effort. These perceived efforts are formed and shaped through evaluating the IR system's accessibility (perceived resource accessibility). Figure 2.9 illustrates the relationship between the steps users go through, and the corresponding system characteristics and the perceived effort in each step.

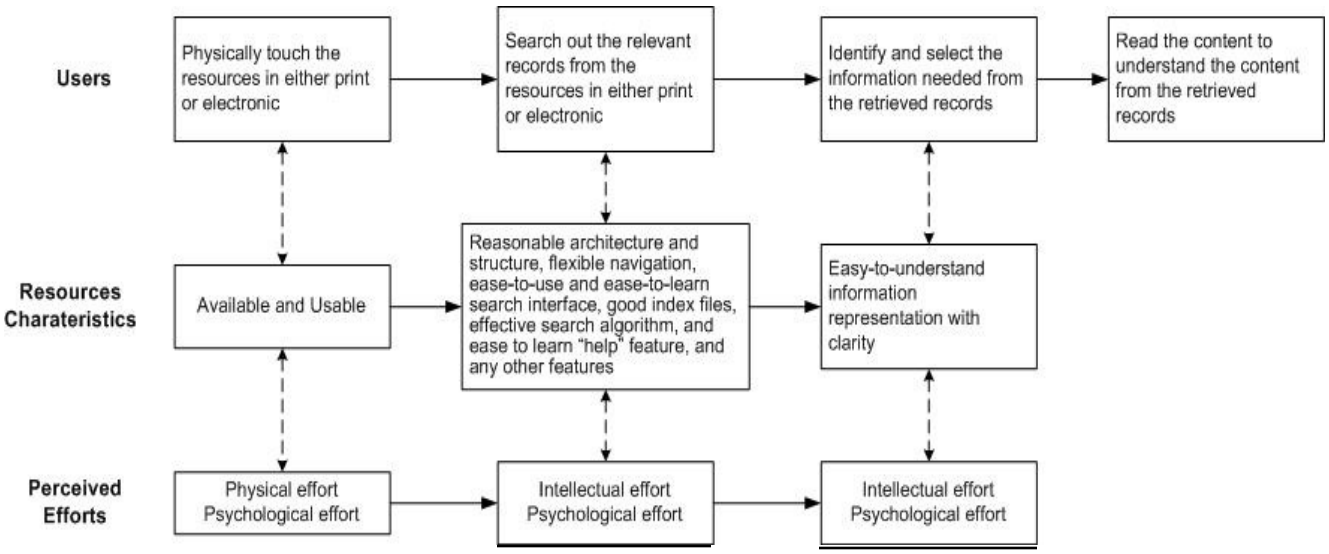

Figure 2.9. User's access of information and the accessibility of IR systems

Human information resources possess their distinct characteristics. The criteria for assessing abilities possessed by a human information resource to bring users with ready-to-use information are different from documentary information resources in both print and electronic format. Take the reference librarian as an example. The reference librarian's responsibility includes identifying resources and/or providing relevant information for users. Therefore, reference librarians' professional behavior and professional expertise to reduce information seekers' time and effort required for seeking information significantly affects users' access of knowledge. Thus, users' perception about the reference librarians' professional behavior and expertise would affect their perceived accessibility of using a reference librarian (Curley, Connelly, & Rich, 1990; Culnan, 1985; Fidel & Green, 2004). During the reference service process, a reference interview is the key when reference librarians play a leading role in the process. Radford (1998) investigated the role of nonverbal communication in the students' interaction with a reference librarian and found that initiation, availability, proximity, familiarity and gender play roles in students' selection of reference services. Eckwright et al (1998) also found that appropriate behavior of reference librarians alleviated anxiety and allowed for a positive library experience. Reference and User Services Association (RUSA) (2004) publicized the revised RUSA Guidelines for Behavioral Performance of Reference and Information Service Provider, which can be used as assessment criteria to measure reference librarians' professional behavior. The criteria include being approachable, showing interest, listening/inquiring, searching, and follow-up. Availability (physical effort) and making users comfortable (emotional effort) will be assured if a reference librarian follows the guidelines to provide reference services. While RUSA's guideline

directs reference librarians to reduce a user's physical and emotional effort, the reference librarian's professional expertise on the question negotiation level (Taylor, 1968), the ability of providing accurate answers quickly, and effective literature search instructions will effectively reduce users' time and intellectual effort spent on finding information, which affects users' perceptions on using reference services (see Figure 2.10). Therefore, users' perceptions about the reference librarians' professional behavior and professional expertise (perceived resource accessibility) form and shape the users' perceptions of using reference services (perceived accessibility of using resources).

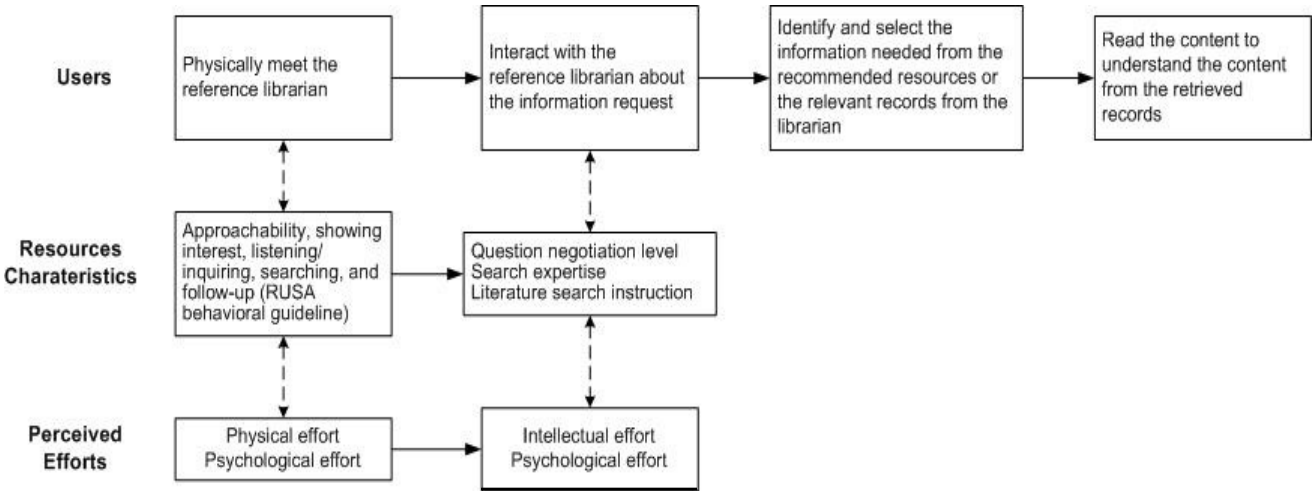

Figure 2.10. User's access of information and the accessibility of reference librarians

In conclusion, accessibility is a multidimensional concept and can be interpreted with two aspects of a user's perceptions: perceived accessibility of using information resources as a behavior belief and perceptions on resource accessibility as a resource characteristic belief. In the present study, the concept of perceived accessibility of using an information resource breaks down to three types of perceived efforts: *physical, intellectual and psychological efforts*. These efforts are the concepts stated in the Zipf's PLE and cost variables in the Cost-Benefit Model. Resource accessibility, one aspect of

resource characteristics, is indicated as *physical availability and usability, searchability, information representability,* and other system functionality types of characteristics that can *bring users ready-to-identify/select information*. Based on the TRA, perceived physical effort, perceived intellectual effort, and perceived psychological effort are three behavior beliefs while resource accessibility is one aspect of the resource characteristics, which is an external variable.

Perceived Usefulness of Using Information Resources and Perceived Resource Quality

As mentioned before, the Zipf's Principle of Least Effort (PLE) chooses the solution that minimizes the effort from among a set of solutions giving the same profit. The efforts in Zipf's PLE can be understood as cost or effort that needs to be consumed during the search for information. However, as Hertzum (2002, p. 15) stated: "By attributing engineers' choice of close-by information success solely to cost, the least-effort principle wrongly neglects the importance of trust. This bias towards cost has been carried over into numerous systems development efforts." This statement indicates that benefits obtained by information seekers during information seeking should also be considered. In this sense, the cost-benefit paradigm from behavioral theory suggests that a resource selection decision is actually a judgment process between perceived "cost", in terms of physical and intellectual efforts or time expended, and perceived "benefit", the likelihood that the information obtained is useful (Allen, 1977; Orr, 1970; Pinelli, et al, 1991b). Therefore, the judgment that is made during the decision-making process is a comparison of alternatives based on the perceived cost and benefit of each alternative, which produces the decision result. Benefits can take many forms, such as profitability, access to useful information, or more broadly, public good externalities and ancillary

social value (McCreadie & Rice, 1999a & 1999b). In terms of information resource selection and use, the final goal is to be able to efficiently find useful and reliable information that can meet an information seeker's information needs. Therefore, the concept of "benefit" equals one of the behavior belief constructs in this study, which is "perceived usefulness" of using a resource. "Perceived usefulness" in this study indicates the advantages of using an information resource. However, how is this perception associated with the resource quality, another aspect of resource characteristics?

As is the concept of resource accessibility, resource quality also has many faces. Information resources are composed of three components: information contained in the resources, organization and retrieval of the information contained, and representation of the information contained. Among them, information organization, effective information retrieval, clear layout, and easy-to-understand information representation of an information resource indicate resource accessibility characteristics. Effective resource accessibility aids users to easily find information and reduces the cost of their seeking information. Resource quality in this study means the quality of the information contained in the resource (print and electronic) or transferred from human resources to users (human). Therefore, resource quality and information quality in this study are interchangeable.

From the resource components point of view, information content, information format, and accurate information representation are main focuses to assess resource quality as suggested by Rieh and Belkin (1998). Rosenberg (1967) used *amount of information* expected to embody the concept of resource quality. Allen (1977) believed that the *value* of a given information channel represents its quality. Gerstberger and Allen

(1968) thought *technical quality or reliability* of the information obtainable from a channel was the channel payoff or value. Hardy (1982) defined quality as *relevancy* (how much useful information the channel provides) and *selectivity* (How precise the channel is in weeding out exactly the information you want). Curley, Connelly, & Rich (1990) and Connelly et al (1990) suggested the concept of quality with *extensiveness*, *relevance*, *credibility*, and *clinical applicability*. The more extensive, relevant, credible and applicable information a resource contains, the better the quality of that resource and the more value the resource holds. In addition, *trust in resources, reliability, objectivity, currency of content, accuracy, comprehensiveness, and breath, depth and scope of information* have been used in many empirical studies as criteria to evaluate the quality of information resources (Pelzer & Leysen, 1988; De Groote, et al, 2003; Boyce, et al, 2004; Peterson et al, 2004; Zach, 2005). Furthermore, *the format of information* in information resources is also included for assessing the quality of a resource. For example, electronic resources with Portable Document Format (PDF) full text articles provide clearer copies with graphics, tables and charts than a photocopy of print counterparts (De Groote, et al, 2003). In terms of human as information resource, quality is related to the quality of information human resources provide.

From the assessment criteria point of view, Moenaert et al (1992) studied the communication between marketing and R&D personnel in 80 planning or development projects and found that *credibility and relevance* are the most important determinants of perceived utility of information resources among four factors of credibility, relevance, novelty, and comprehensibility. Marton & Choo (2002) took relevance and credibility as two dimensions of resource quality. An information resource with accurate, current,

relevant, reliable, and applicable information is surely a high quality information resource. In addition, an information resource presenting its content in a different format from its counterparts and assuring accuracy, currency, relevancy, reliability, and applicability of the content is a resource with a high quality level. In this study, relevance and credibility are used as two dimensions of information resource quality.

In 1982, O'Reilly (1982) determined that relevance is a main dimension of perceived resource quality. Hardy (1982) defined relevance as how much useful information the channel provides; Curley, Connelly, & Rich (1990) defined it as when one or more of a resource's domains of coverage has a close logical relationship to the problem under consideration. Consistency of the information with the user's prior beliefs or knowledge was another understanding about relevance (Liu, 2004; Fidel & Green, 2004). From user's perspective, all definitions can be summarized as the relevance, usefulness or utility of information objects in relation to the fulfillment of goals, interests, work tasks, or problematic situations intrinsic to the user (Schamber, Eisenberg & Nilan, 1990; Saracevic, 1996; Borlund, 2003). Relevance from the user's perspective has a high correlation with content that information resources contain. Vakkari & Hakala (2000) used Barry's 26 relevant criteria (1994) that were categorized in 5 groups to study how relevance criteria changed with the development of the information needs and found that the criterion of topicality of information content accounted for more than 40% in each stage of information seeking among 26 criteria. Maglaughlin and Sonnenwald (2002) also found that relevance was the most frequently mentioned criterion. Therefore, relevance will be one dimension of resource quality and can be measured with usefulness, meeting

information needs, and other measurements based on the developed criteria (Barry, 1994; Schamber, 1994; Barry & Schamber, 1998).

Even though information is relevant, it does not mean it will be used eventually. Is it accurate, current, and reliable? In other words, is the information credible? Credibility is a complex concept. Taylor (1986, p. 64) stated that the system or source is "consistent in maintaining its accepted level of accuracy, of currency, of comprehensiveness, and it can be relied upon to do so in the future." According to Rieh (2002), credibility is almost inseparable and closely related to trustfulness, reliability, accuracy, authority, and quality. Operationally, credibility is also referred to as the extent to which users perceive information as being truthful, unbiased, accurate, reputable, competent, and current (Liu, 2004). Tseng & Fogg (1999) identified four types of credibility. They were presumed credibility (i.e., information hosted in a well-respected website or database), reputed credibility (i.e., the author's affiliation with a prestigious institution), surface credibility (i.e., layout of electronic articles), and experienced credibility (i.e., publication of the same document in a printed journal). Based on these four types of credibility, Liu (2004) added another two, which were verifiable credibility (i.e., documents that include references) and cost-effect credibility (i.e., subscription fee implies information is more credible). Therefore, resource credibility can be assessed through the following aspects: information content (trustworthiness, accuracy, and currency), authorship (author's affiliation), the resource's layout and structure (includes references, has no typos, and has links that are workable, etc.), and resource linkage (also published in a printed journal, etc.).

In conclusion, resource quality in this study is defined as a two-dimensional concept, which includes relevance and credibility. The more relevant and credible the information contained in an information resource or transferred from an information resource is, the more likely users can find useful information from that resource, and the more useful users would perceive the resource to be. Therefore, perceived usefulness is the user's perception on using an information resource, which contains perceived relevant and credible information. Perceived usefulness of using an information resource is formed by evaluating relevance and credibility of information contained in the resource or transferred from the resource to users.

In this study, perceived usefulness, perceived physical effort, perceived intellectual effort, and perceived psychological effort are four identified behavior belief constructs and the first three are included in the proposed model. Resource characteristics, one of the external variables in the proposed model, are composed of two aspects: resource accessibility (resource functionality type of characteristics) and resource quality (resource content type of characteristics). Users' perceptions on resource characteristics (behavior target beliefs) form a user's perceptions on using information resources (behavior beliefs).

Influences of Perceived Accessibility and Resource Accessibility on Information Resource Selection and Use

Researchers in previous studies did not differentiate perceived accessibility of using an information resource and perceived resource accessibility. Furthermore, researchers connected these two types of perceptions directly to information resource uses and tried to find how they affect uses of information resources. In light of this

situation, the influence of perceived accessibility of using information resources and perceived resource accessibility on selection and use of information resources were reported together in the following section.

In education settings, information resources were used mainly in university libraries, including health sciences libraries. Online information retrieval systems (e.g., online catalogs, online databases, electronic journals, and electronic books, etc.) and reference services are used frequently among all library resources and services. Many previous studies just listed reasons or factors affecting using or not using an information resource rather than investigating how those factors impact resource use behavior. Chrzastowski (1995) investigated uses of library workstations, including a local online catalog and online journal indexes, and their effects on the changing nature of library research. The study found that students' behavior followed the PLE and the Mooers' Law regardless of quality or appropriateness of the workstations/retrieval systems. Workstations were used due to ease, availability, and circumstance. De Groote et al. (2003) found that convenience and full-text availability played major roles in selecting online resources. Medical faculty, residents, and students prefer using online resources, especially databases with full text and online journal collections that are linked through bibliographic databases. Twenty-four hour access, access to e-journals from any location, effective integrated information systems, easy navigation, and other advantages of online resources were also listed to address the important role of resource accessibility played in information resource selection and use behavior. Boyce et al (2004) also concluded that faculty and students took ease of use, including physical and intellectual effort required, as one of the most important factors in selecting electronic journals over other resources.

Radford (1998) observed 155 students who interacted with 34 librarians at the reference desk and interviewed those students as to why they approached a particular librarian over another, or why they avoided the encounter altogether. The study found that initiation (librarian initiates the encounter through multiple signals that include eye contact, body orientation, movement toward the user, and/or verbal enforcement), availability (same as initiation except with verbal enforcement), proximity (physical distance), familiarity (a previous encounter with the librarian), and gender significantly affected students using reference services. The more a librarian initiates an encounter, the closer a librarian is to a student's location, the more familiar students are with a librarian, the more possible it is that students would approach that librarian. Jenkins (2001) found "no one at the reference desk" particularly affects students' using reference services. Barnett, Cmor, and Morgan (2000) surveyed 1500 faculty, staff, and students on the health sciences campus at Memorial University of Newfoundland about the uses of librarian-mediated computer search services. The study found that a librarian's expertise and time saving were the main reasons for using the service while "preferring to do searches on their own" and "not being aware of the service" were two main reasons for not using the service.

There are also many studies investigating resource selection and uses by scientists, engineers, administrators, and health professionals. Prior research in organization communication reported how perceived resource accessibility affects selection of an information resource. For example, in a research and development setting, Rosenberg (1967), Gerstberger & Allen (1968), and Allen (1977) found that perceived resource accessibility exclusively determines the selection and use of information channels by engineers rather than the expected quality or amount of information. Engineers attempted

to minimize effort in terms of work required to gain access to an information channel. They appeared to be governed or influenced by a principle closely related to Zipf's law. While Zipf's law emphasizes the least average rate of probable work, Gersteberger & Allen (1968) and Allen (1977) found that engineers did not consider future effort into account in making their decision on selecting channels. Instead, they behaved according to a simplified version of Zipf's law in which they took only their immediate predictable effort into account and minimized that parameter in making their decision. Simply speaking, they did not consider what other resources they may still need to use to find desired information when they made a decision to use a certain information resource. Similarly, O' Reilly (1982) found source accessibility independent of perceived quality, task, and individual variables, was significantly associated with the frequency of source use by caseworkers in a county welfare agency.

In the field of MIS and administration settings, accessibility is often viewed as a delivery system issue which is related to the success of a computer-based information system. In order for a system to be used, system accessibility has at least the same importance as the ability of providing timely, accurate, and relevant information. Empirical studies supported that use of a single information system was positively related to its perceived resource accessibility (Lucas, 1978; Maish, 1979; Swanson, 1982).

Similarly, in a clinical practice setting, Curley, et al found cost variables-*availability*, *searchability*, and *clinical applicability* had significant association with reported frequency of use of nine knowledge resources while neither of the two benefit-associated variables –extensiveness and credibility-were related to reported resource use (Curley, Connelly, & Rich, 1990; Connelly, et al, 1990). Ely, Levy, and Hartz (1999)

claimed that physicians valued rapid access and understandability more than quality or currency of information, and they were more likely to get this information from their personal subscriptions.

Savolainen and Kari (2004) used Sonnenwald's Information Horizon as a theoretical framework to investigate the ways in which information resources and channels are valued and prioritized in the context of everyday life information seeking. They interviewed 18 self-developers and especially examined the effect that their perceived source accessibility and perceived source quality had on one's judgment of information resource selection. The study found human sources: friends, colleagues, experts, and others were the first source preference that was positioned closest to the information seekers (Zone 1); followed by print media: books, literature, magazines, dictionaries, and others placed in Zone 2; and networked sources: the Internet, computer, WWW, E-email, others positioned in Zone 3 (the least preferred resources). More interestingly, the study found that people placed more weight on perceived accessibility than perceived quality for those sources positioned in Zone 1, equal weight on two factors for those sources in Zone 2, while rating perceived quality more than perceived accessibility for those sources in Zone 3, which also easily interpret why networked sources were positioned in Zone 1 but not Zone 3. Thus, perceived accessibility and perceived quality were weighted differently on different types of information resources for different user groups.

In summary, most of the previous studies found that users' perceptions on resource accessibility (behavior target) rather than their perceptions on using a resource (behavior beliefs) had a direct influence on using information resources. In other words,

using an information resource was because users perceived resource accessibility positively but not because using an easy-access resource saved their physical and intellectual effort. None of the previous studies cited here follow any theories to conclude this causal effect. No theory base and different understandings and measurements for accessibility led to inconsistent findings. It seems plausible that resources with high accessibility cause users to spend less effort in using resources and it may be the case in the information seeking process. However, no systematic investigation has been done to support this self-evident proposition. The present study, based on the TRA and the TAM, hypothesizes that perceived physical effort and perceived intellectual effort have a direct effect on information resource selection while the influences of resource accessibility on information resource selection are mediated through affecting perceived physical effort and perceived intellectual effort.

The Influence of Perceived Usefulness and Resource Quality on Information Resource Selection and Use

As with accessibility, previous studies did not differentiate perceived usefulness and resource quality and used "quality" to indicate two types of perceptions: perceptions of using a resource (perceived usefulness) and perceptions on a resource itself (resource quality). Therefore, the influences of perceived usefulness and perceived resource quality on information resource selection were reported together in the following paragraphs.

Orr (1970) first questioned the findings that information seekers only consider the cost variables associated with information resource characteristics for their selection decision of using an information resource. Because perceived benefits were equal for all channel types and information seekers just need "good enough" information, these

undemanding needs can be satisfied by any of those resources being investigated. Under this circumstance, perceived cost (accessibility) will be the only considered factor as information seekers pursue minimizing the cost (effort) of obtaining information. This behavior complies with the assumption of the PLE, which is that users choose the solution that minimizes the efforts from among a set of solutions giving the same profit. Therefore, each individual adopts a course of action that will minimize the involved cost to achieve his goal. In this sense, effort conceptually equals cost. However, would information seekers only want to find "good enough" information in any situation? If they also want to find the best information to meet their information needs, would they also take perceived benefits into consideration when selecting and using an information resource?

Orr (1970) addressed that selection of information channels depends upon the scientist's "subjective estimate, or perception of the relative likelihood of success in acquiring the desired information from these two alternatives within an acceptable time, and on their perception of the relative 'cost' of these alternatives" (p.146). He stated that quality of information was the most important consideration in selecting an information product, service, or source. Although his proposition has not been subjected to empirical verification, the following evidence supports Orr's position.

Hardy (1982) proposed that information seekers place different weights on the costs and benefits of an information source. He found that scientists and engineers do evaluate information resources on the basis of speed (cost) and *content* (benefits), not cost alone. The speed factor included the variables of ease of use, time-saving ability, and promptness while content factor contained concepts of relevance and selectivity.

Information seekers do not seek to minimize cost. Instead, they just weight cost as being the most important criterion in selecting an information resource. Kaufman (as cited in Pinelli, et al, 1991b) reported that engineers identified technical quality/reliability, followed by relevance, accessibility, familiarity /experience, comprehensiveness, ease of use, and expense as the criteria for selecting the most useful information source. However, accessibility appears to be the most frequently used factor in selecting an information source even if that source proved to be the least useful. Among six factors that affect engineers' choices of information resources, Chakrabarti, Feineman, and Fuentevilla (1983) found that utility of resources has been considered along with accessibility, ease of use, and cost factors for resource selection although accessibility and ease of use had the stronger impact on frequency of use. Pinelli, et al (1991b) investigated the extent to which the seven selected sociometric variables influence the use of conference papers, journal articles, in-house technical reports, and U.S. government technical reports by U.S. aerospace engineers and scientists. He found that accessibility was not the single most important determinant to the use of those four information resources, but *relevance*, accessibility, and *technical quality* were all important variables varying in influential importance depending on a specific product and the setting in which study subjects work. Similarly, Marton & Choo (2002) also found there was a strong relationship between perceived source quality and source usage by women information technology (IT) professionals in their day-to-day activities. Hertzum (2002) found that assessment and choice of people sources was dominated by quality-related factors whereas quality-related factors (e.g., technical quality, up-to-dateness, and representability) and cost-related factors (e.g., accessibility, ease of use, and cost to use) were both considered for

using document sources. These findings run contrary to earlier user studies, which concluded that perceived resource accessibility was the overwhelming factor in resource selection.

Swanson (1987) investigated the use of ten management reports by 186 users in four organizations and found that attributed information quality largely determines an individual's attitude or disposition towards a channel, which subsequently influences the use of that channel. Auster & Choo (1993) found that between environmental uncertainty, source accessibility, and *source quality*, source quality is the most important factor in explaining source use in environmental scanning by CEOs in two industries. Zach (2005) found that art administrators took *trust in source*, *credibility*, *reliability*, and *objectivity* as important criteria for their resource selection while ease of access could be a consideration, but only in combination with a belief in the authority of the source.

Shershneva et al (2005) interviewed 17 medical students and 28 residents about use of learning resources and found that their first time use of a new learning resource was crucial in deciding whether to use that resource again. A third year medical student's statement is a good example, "I generally don't go back to anything that I didn't think was a help… the first time." *Current usefulness* had significant correlation with likelihood to use it in the future (Peterson et al, 2004). Kerin, et al. (2004) found engineer students seem to have a preference for resources and channels that require the least effort by considering the resource's accessibility, speed and ease of use, including accessible language. In the meantime, they also worry about the *reliability* of the information and use key library resources, such as books, technical handbooks and journals, to validate the information they found from the Internet. Dee & Stanley (2005) found that nursing

students and clinical nurses use human and print resources more than electronic resources. The reason for this preference is because human and print resources were easy to use and can provide immediate access to *trusted* resources of health information. Boyce et al (2004) found that although faculty and students took ease of use, including physical and intellectual effort required, as one of the most important factors in selecting electronic journals rather than other resources, when two resources are equally accessible, the "trusted" resource, the referred journal will be selected over the un-referred journal.

Reliability of information obtained from the Internet has been considered as the more important criterion to assess it as an information resource. With easy access, currency, and a broad repertoire of information provided by the Internet, most wants to find information with high quality. With the Internet, information quality beats accessibility as a primary consideration factor. Kerins, Madden, & Fulton (2004) found engineer students who considered the Internet as the best information source for their project also listed it as the worst source. Information reliability, disorganization and overload were three of the biggest concerns about information found from the Internet. Engineer students even used traditional resources to validate the information they located on the Internet.

Based on the studies reported above, resource quality had a direct impact on information resource selection and use while the influence of perceived usefulness of a resource on the resource selection and use had not been investigated much. In different settings, contexts, and situations, users weigh resource accessibility and quality differently in selection of resources. However, using perceptions on resources (resource characteristics) rather than perceptions about using resources (behavior beliefs) to predict

uses of resources produced inconsistent findings in previous studies. Therefore, based on the TRA and the TAM, the present study hypothesizes that perceived usefulness, perceived physical effort, and perceived intellectual effort (three behavior belief variables) have direct effects on the information resource selection. Influences of perceived resource characteristics (resource quality and resource accessibility) on resource selection are mediated through behavior beliefs' influences on the selection of using resources.

Referents Influences and Normative Beliefs

Based on the TRA, besides the influence of behavior beliefs, behavior intention is also affected by normative beliefs, which are the beliefs that specific referents think the user should or should not perform a behavior. In the academic environment, students' decision on using or not using an information resource to finish assignments may be influenced by instructors, experts in the fields, fellow students, medical librarians, and the like. The reviewed literature provides empirical evidence about the effects instructors and medical librarians had on students' use of information resources.

For students, *instructor's expectations*, *recommendations, or requirement of using an information resource* influence students' selection and use of a resource. In the study conducted by Kerins and colleagues (2004), they found law students appeared to be strongly influenced by their lectures, which shaped the students' impressions of how information seeking and research should be approached. Similarly, engineer students were encouraged by their lecturers to consult engineers and specialists in the field. Reznich & Werner (2004) studied the effect of facilitators' encouragement of using online resources on public health students' actual use of those resources. The study found a statistically significant difference in students' use of online information resources given

their perceptions about the facilitators' encouragement of using resources (P<0.0001). Dee & Stanley (2005) examined the information seeking behavior of nursing students and clinical nurses and found that nursing students used electronic resources more than clinical nurses because nursing students were assigned papers and projects for class that required them to use electronic databases.

Librarians play an important role in education. They not only facilitate and cooperate with degree programs in their main organization, but also provide bibliographic instructions to strengthen the student's skills of using all kinds of information resources and services. Many studies in library and information science investigated the effects of *bibliographic instruction* on student's searching skills and information resource usage. In her comparative study on changes of veterinary students' information seeking behavior over 10 years, Pelzer (Pelzer & Leysen, 1988; Pelzer, et al, 1998) reported that no differences were found between students with formal non-course related instruction and those without in their approaches to seeking information or to library use. However, one exception was that sophomore students who had library instruction for a specific course in which they were required to write a topical paper indicated significantly greater use of library materials for course work (P<0.01). The same finding from the study conducted by MacNeil and colleagues (1985) demonstrated that a computer literacy course taken by sophomore veterinary students increased computer search requests, with some students subsequently performing their own searches. Minchow (1996) investigated the effects of bibliographic instruction on second-year public health students' searching skills, changes in using library resources, and the order of resources that were consulted. The study found students' specific searching techniques, such as using controlled vocabulary,

searching with limits features; Boolean logic, quality filtering, etc., were significantly improved after the class. There was also a clear indication of an increase in using online catalogs, online databases, interlibrary loan and other electronic resources and services. The priority of students' using resources was also given to indexes, abstracts, and e-journals under the influence of bibliographic instruction. Based on the aforementioned findings, instructors, fellow students (e.g., classmates), and reference librarians are three referent groups of interest and their influence on public health students' using or not using an information resource was investigated in this study.

Effects of External Variables

Although inconsistent measures for accessibility and quality in previous studies caused inconsistent findings about their influence on information resources and channel selection and use, previous studies also raise a question: Why have different user groups viewed accessibility and quality differently, and why would resource accessibility and quality be weighted differently in different environments? Carlson & Davis (1998) pointed out the possible reasons based on a media selection study. They found that in a media selection process, both directors and managers took ease of use/access and relationship building into consideration. But these two criteria only accounted for about 70% of variance in explaining media selection behavior, which indicates there must be other factors that also play roles in resource selection and use. Carlson & Davis (1998) hypothesized that the information seekers' characteristics, different format of media, and situation-related variables, such as job categories, time pressure, task requirements, and others, may be associated with the judgment of the importance of accessibility and quality factors. Do environmental factors directly affect resource selection decisions or

do they indirectly have their impact through affecting information seekers' perception of using an information resource? Based on Fishbein and Ajzen's TRA model, the formation of a person's beliefs is affected by the environment that he interacts with.

Culnan (1983a) adapted from previous studies and came up with a list of eleven environmental elements, of which it includes a firm's customers, competitors, raw materials supply, labor supply, public opinion, and technology, and so on. She used complexity to measure task environment and found both complexity of task environment and perceived accessibility influence professionals' information resource selection in two large commercial organizations. In her other study on dimensions of perceived accessibility (1985), she also found different work environments caused selection of different information resources. For example, consultants and students chose different people as information resources due to their nature of work. Consultants viewed coworkers as a reliable information resource since their daily work was often performed by a project team rather than single individuals. However, course assignments were generally completed on an individual basis. Therefore, students would not view their peers as dependable information resources, but intended to find knowledgeable individuals to help with a course-related problem. Savolainen & Kari (2004) also stated that information source preference indicates that selection of information sources is based on the judgment of source accessibility and quality within a perceived information environment and information seekers' information needs.

Information seeking behavior is not isolated from the context within which the information seeker works. Taylor (1986, p. 3) stated that "The environment essentially (a) establishes the conditions of information flows into, within, and out of any particular

entity; and (b) determines the criteria by which the value of information messages will be judged. ” Thus, environment and context in which information seekers work and study influence information seekers' decision on information resource selection. Taylor (1991) defined information use environments with four elements: characteristics of a particular set of people, characteristics of the organization or setting, characteristics of the problems endemic to that class or set of people, and characteristics of the solution. The environment can also be defined broadly as an abstract environment (such as existing norm and value, organizational structures, routines, goals, etc.) and as a concrete environment (such as available resources, personnel, communication media, etc.) (Bystrom & Hansen, 2005). The environmental factors in the present study focus on information resource characteristics, individual differences, and library environment, which represent three environmental elements according to Taylor (1991), and all of them are concrete environment elements. Since this study was conducted in the context of public health students' completion of their research paper or project assignments, the tasks and purpose of seeking information are similar. So the influences of tasks and purposes of information seeking on resource selection and use (Wildemuth et al, 1994; Vakkari, 1999 & 2000) are controlled. As the resource characteristics factor has already been discussed with perceived accessibility and perceived usefulness of using an information resource, individual differences and library environment factors and their influence on information resource selection and use are elaborated below.

Effects of Individual Differences Factors

Individual differences is a broad concept with a diverse range of aspects. It includes demographics such as age, gender, ethnicity, education level, and the like as

well as non-demographics, such as personality, motivation, cognitive style, learning style, information literacy skills, domain knowledge, previous experience, and others (Zmud, 1979; Bostrom, et al, 1990). In this study, domain knowledge, information literacy skills, and previous experience of using the selected primary resource are three main focuses.

Demographic Variables Demographic factors like age, gender, education level, etc. have been "taken-for-granted" variables with which to study their relationship with a certain information behavior. For example, Pelzer & Leysen (1988) studied the impact of different education levels on the selection of information sources and reported that freshmen used textbooks extensively and that seniors used indexes/abstracts most among four grades. They also found that veterinary students who held advanced degrees or were concurrently enrolled in a graduate program demonstrated significantly greater use of print and computerized indexes/abstracts for finding information than general students ($P<0.01$) (Pelzer & Leysen, 1988; Pelzer, et al, 1998).

Domain Knowledge Familiarity of domain knowledge is related to education level. But is it also affected by previous experience, including professional preparation, work experience, life experience, and so on. Pinelli et al (1991a) found that the more years of professional work experience researchers have the more frequent government technical reports will be used. Liu & Yang (2004) also found that the field of study has significant influence on the student selection of primary resources and also uses of online databases provided by the library. Marchionini, Lin & Dwiggins (1990) studied information seeking behavior in a hypertext environment and found that domain experts could conduct faster and more focused searches than did the novices. This might be because domain knowledge can help users easily identify if the content contained in the resources

is relevant and choose appropriated search terms either provided by an IR system or created by themselves (Thong, Hong, & Tam, 2002). Therefore, domain knowledge will affect both perceived accessibility and perceived usefulness of using information resources.

In this study, years of work /study experience related to public health before starting a public health program and self-reported familiarity of domain knowledge were used to measure the variable of domain knowledge and it is hypothesized that domain knowledge indirectly influences users' selection and use of information resources by directly affecting their behavior beliefs.

Information Literacy Skills As early as 1974, the concept of information literacy was introduced (Eisenberg, Lowe, & Spitzer, 2004). In 1989, the American Library Association (ALA) Presidential Committee on Information Literacy (1989) defined that "to be information literate, a person must be able to recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information." In 1992, Doyle expanded the ALA's definition and defined the information literate person as one who:

- Recognizes that accurate and complete information is the basis for intelligent decision making
- Recognizes the need for information
- Formulates questions based on information needs
- Identifies potential sources of information
- Develops successful search strategies

- Accesses sources of information including computer-based and other technologies
- Evaluates information
- Organizes information for practical application
- Integrates new information into an existing body of knowledge
- Uses information in critical thinking and problem solving. (p.8)

Based on these definitions, Eisenberg and his colleague (1997) developed Big6™ Skills in 1997 and the Association of College & Research Libraries (ACRL) (2000) also developed information literacy standards and guidelines for higher education in 2000. All definitions and standards contain the indicators about ability to determine range of sources, identify sources, prioritize sources, locate sources, and use sources to find information with skills of computer literacy, online searching literacy, and Internet literacy.

In this study, computer experience and skills, searching experience and skills, and Internet experience and skills were used to indicate the concept of information literacy. De Groote, et al (2003) used easy access to a computer connecting the Internet from home, work, or school and frequency of computer use to measure the computer literacy level and no correlations were found between computer literacy level and use of MEDLINE or online journals. Romanov & Aarnio (2006) investigated the effects of search skills and computer skills on medical and dental students searching MEDLINE and use of full text articles. They used 7 items indicating “Basic PC skills” (word processing, e-mail, use of the Web, presentation graphics, use of spreadsheets, statistic software, and use of printers) and 9 items indicating “Information searching skills”

(searching MEDLINE, use of EBM databases, Cochrane library, full-text articles, e-books, use of WWW search engines, etc.) They found that both search skills ($P<0.01$) and PC skills ($P<0.05$) have positive effects on searching MEDLINE for studies and research as well as uses of full-text articles while only search skills had significantly positive effect on uses of full-text articles ($P=0.000$). In order to verify this finding, they also found that non-users of MEDLINE and full-text articles had significantly lower scores of PC and search skills compared to students who utilized those resources ($P<0.001$). Lazonder, Biemans, & Wopereis (2000) investigated the effect of a user's World Wide Web (WWW) experience on locating an appropriate website and retrieving relevant information from that site. The study found that subjects with more WWW experience were more proficient in locating websites.

Information seekers selection and use of information resources is an interactive process and both users and information resources play roles in forming perceptions about resource accessibility. In the paragraph introducing the multi-dimensional nature of the concept of accessibility, Curley, Connelly & Rich (1990) defined three aspects of accessibility from the *system*'s perspective, while Culnan (1985) identified three dimensions of accessibility from the *user*'s perspective: gaining physical access to the information resources (physical dimension); translating an information need or request into a language that is understood by the resources (interface dimension); and being able to physically retrieve the potentially relevant information (information dimension). Among three of Culnan's dimensions, interface dimension is a key to successfully find information. Even though an IR system provides all possible tools and features to users, users with different levels of computer and search experience and skills will perceive

ease of use of the system differently. A user with a higher level of database or Internet searching skills may figure out searching functionalities provided by the system more quickly than those with lower level skills, so that user would perceive the system is easier to use. Therefore, users' searching experience and skills would definitely affect their perceptions of using an information resource, which include perceived usefulness, perceived physical effort, and perceived intellectual effort.

Previous Experience with Information Resources Previous experience with an information resource covers all the impressions, knowledge, and skills that information seekers have acquired by using it (Orr, 1970). It is expected that the degree of experience that an information seeker has had with a given information resource would influence his perception of both costs and benefits associated with using that resource.

A number of empirical studies found that humans tend to return to the resource that they have used in the past with a stronger preference than trying out a new resource (Case, 2005). Gerstberger & Allen (1968) and Allen (1977) found that an engineer's previous experience of using an information resource lowered their perception about the associated cost of using that resource. As engineers gain more experience with an information resource, his perception of it has been modified and see it to be more accessible and easy to use. Similar findings supported that information seekers are unable to evaluate an information resource or even to form accurate perceptions about a resource until they have had some experience with that resource (Culnan, 1983b, 1985; Hiltz & Turoff, 1981). Muha et al (1998) reported that satisfaction with used information resources may cause a person to stop using other resources and continue using the same resource later. Shershneva, et al (2005) also reported that the first use of a resource will

affect its later use and if a resource did not bring any negative outcome and was not in conflict with what was provided, it will be used later. Similarly, successful use of familiar resources will result in resistance to considering other resources (Shershneva, et al, 2005). Jenkins (2001) found that more than half of students think that they never needed assistance (64.1%). Being uncomfortable in asking reference librarians questions and not being sure if the reference librarian will take time to help were also reasons why students did not ask reference questions. Gorman and Helfand (1995) found that the physician's *expectation that an answer is available* through the Internet is one of the factors that influence physicians' use of computer-based resources. However, Peterson and colleagues (2004) found that there was no difference between choosing electronic resources and paper resources due to perceived differences in the probability of finding an answer because even those students who chose paper textbooks as their third choice still reported a very high success rate at finding an answer.

Based on Poole's study (1985, cited in Case, 2005), "information channel use is a function of user awareness." Resource awareness seems to be related to previous experience in using information resources. Many studies reported that unawareness of available information resources within the approachable area largely influences users selecting and using those resources. For example, lack of awareness of the database/online journal availability, not knowing resources are available, and lack of knowledge regarding the scope of the databases blocked public health students using information resources (De Groote, et al, 2003; Boyce, et al, 2004). Pelzer & Leysen (1988) also interpreted that one of the reasons for many students not using indexes or abstracts is students did not gain sufficient exposure to the literature. Kerins et al (2004)

analyzed that engineering and law students' unawareness of available resources in the library made them misperceive the library as an information source, and they were unable to fully use the library's resources and services. Awareness does not only indicate knowing information resources are available, but also includes knowing the basic functions of resources. Jenkins (2001) found that students know reference librarians are sitting at the reference desk, but don't know they are there for help, which prevents students from asking questions to reference librarians.

Reflection on previous experience of using a resource changes users' knowledge about this resource and skills of using this resource. If users encountered unsatisfactory results from a resource in the past (De Groote, et al, 2003), they will have a poor perception on this resource, which will lead them to not use this resource again and the poor perception will be left in the user's mind and will not change until they use this resource again and find useful information. Oppositely, successful experience with an information resource will result in repeating use of this resource. Repeating use of a resource and getting a more successful experience will positively reinforce the use next time. Obviously, the more users use an information resource, the more experience users will gain with it, and the more familiar users will be with it.

The studies reported above seem to pass on a message that previous experience with using an information resource will not directly influence the selection of this resource, but influence information seekers' perception on using the resource, which then affects their selection and use of the resource. Few systematic studies have been found to investigate whether or not previous experience has direct or indirect or both impact on

information resource selection and how it affects information resource selection solely and/or combined with other environmental factors, but is discovered in this study.

Effect of the Library Environment Factor

The main academic activities of public health students is to take courses, finish assignments, take exams, and other activities that lead them to finally obtain the degree. Therefore, the setup of public health degree programs and curricula, the setting of the School of Public Health, and the Medical Center Library's services are closely related to public health students' degree pursuing, which constitutes an academic environment. Among them, the library as an important information resource repository is a main component of the academic environment in which students use various information resources. Many studies reported that library facilities, services, and resources play major roles in students' use of libraries. These factors include: library location and parking, library opening hours, size and format of library collections, availability and ease of access to computers connected to the Internet at the library, availability of remote access of e-resources of the library, ease of access and ease of use of the library's website, availability and convenience of photocopying and printing, etc. (Adedibu & Adio, 1997; Tannery et al, 2002; De Groote, et al, 2003; Boyce, 2004, et al).

Physical distance or proximity of the library was reported to be related to information seekers' selection of information resources from the library. For example, Allen (1969) reported that increasing physical distance from an industrial library had negative influence on use of the library by technologists. Buckland (1988) also stated in

his work that use of libraries is generally viewed as a function of the costs of using the library, including travel time (Palmer, 1981) or waiting time (Van House, 1983). By surveying all 147 academic medical school libraries in the United States and Canada, Heaton (1997) found that close proximity of a hospital may not affect the number of reference questions received at a medical library. However, the number of students may affect the level of reference service required. Heaton (1997) suggested that other academic environmental factors affecting use of reference services or other resources should also be considered and the combined effects of factors on reference services should be investigated. The possible factors included existence of classrooms and labs in the same building with the library, public access, curriculum type, and computer-aided instruction.

Library opening hours have also been investigated (Boyce, et al, 2004; Adedibu & Adio, 1997). Kerins, Madden, and Fulton (2004) found that physical distance of a resource and opening hours were key factors in library use or lack of use. Nursing students made minimum use of the health sciences library because they thought the library was too far and was not accessible due to parking challenges (Dee & Stanley, 2005)

Availability of computer terminals or technical support is another factor. What would students do if they have limited physical access to computer terminals in the university library or their academic department, but are required to use an online database to complete an assignment? Not many studies have been done to examine the direct effects of library environment on the information resources selection and uses. However, Taylor & Todd (1995a) and Lin (2005) found that both resource facilitating conditions

and technology facilitating conditions had direct effects on students' using technologies provided by a resource center and a distant learning facility. The findings from their studies indirectly verified the effect that resource and technology facilitation have on use of technologies and services provided by physical facilities.

Based on the findings reported above, the library environment factor contains various aspects of library facilities, as well as resources and supports in both personnel and technologies. The library environment factor mainly influences users' use of information resources collected in libraries, in both print and electronic format. Especially, the library environment affects users physically coming or not coming to the library to use print resources and reference services. Therefore, the study hypothesizes that the effect of library environment on selection and use of information resources is mediated through its influence on the perceived physical effort behavior belief construct.

Other Environmental Factors

Time factor Time, as one of the main contextual factors of information seeking has been receiving more attention with the popularity of Web resources. However, the conceptual issue of time has rarely been discussed systematically in information studies (Savolainen, 2006). "What is ultimately meant by time"? (Savolainen, 2006, pp.111). Like accessibility, quality and other fundamental factors in information studies, time has many faces.

According to Savolaninen (2006), time as a temporal factor can be understood objectively and subjectively. The objective construction of time is determined by an absolute deadline set for completing a work task, such as a due day to submit a term paper for students, a diagnosis that must be made by doctors within a couple of minutes

to save patient's life, a quick decision that needs to be made by a business person to catch the money making opportunity, to name a few. Therefore, *time availability* is an external factor to information seeking and can be seen as how much time information seekers have to seek information.

Time available for information seeking does affect the perceptions of resource accessibility. Bystrom (1999) found that if municipal officials have less time, general-purpose resources such as experts and articles available in a local newspaper were avoided while task-oriented resources such as people would be preferred. Choo (2002) also found that a manager's use of information resources tends to become narrower during environment scanning when time pressure becomes more severe. Peterson et al (2004) found third-year medical students use less time to find information from their primary information resources while they use more time from second or tertiary resources. This finding indirectly supported that the time required for finding an answer influences students' resource choices. When time is limited during clinical encountering, third-year medical students will choose their primary resource for information because they perceived that they could use less time to search their primary resource. In his study on nurse practitioners' (NPs) information seeking behaviors, Cogdill (2003) examined effects of five factors on seeking information and found that a perceived answer's generalization beyond the care of a single patient, the urgency, patient expectation, and existence of an answer had either positive or negative influence on pursuing or not pursuing answers for questions. The unique finding is that in three different occasions of pursuing answers (pursued during patient encounters, pursued during the last half of the day following a patient encounter, and pursued in the following week after a patient

encounter), NPs gave different rates to the same factors, and the same factors may or may not significantly positively or negatively affect pursuing or not pursuing information needs. The results can be explained by three different occasions of pursuing answers providing different available lengths of time for NPs to pursue answers, which affects them weighing the same factors differently. When there is less time available, lack of time or no time to access becomes a big barrier in considering choosing information resources (Shershneva et al, 2005; Dee & Stanley, 2005).

Many studies have found that people like to choose those resources that can save their time (De Groote, et al, 2003; Fidel & Green, 2004; Savolainen & Kari, 2004; Savolainen, 2006). However, what does "saving time" really mean? Why do some information seekers think that an IR system saves their time while some do not? How much time do they expect to take to find needed information? Some IR systems run fast technically while some do not at all; some system's interfaces are easy to figure out while others are not. Would these system differences associated with the time issue affect users' perception about the time saving ability of the system? All these subjective constructions on time saving can be explained from both user and system perspectives. From the user's perspective, when an information seeker possesses higher information searching skills, he/she has ability to learn the IR system's structure, functions, and interfaces quickly, which allows them to find information quickly. Therefore, they think this system saves their time, and not much time will be taken to find useful information. On the other side, when good index files, retrieval algorithm, an easy-to-learn search interface, and comprehensive "help" documents are developed in an IR system, as well as fast Internet or Intranet connection being set up, the system is able to respond quickly, which also

make users think the system saves their time while they are using it. Therefore, saving time has at least two dimensions, users and systems. In this study, the users' dimension is related to the user's information literacy skills, which is classified into individual differences factor while the system dimension is related to system features and has been categorized into resource accessibility in the resource characteristics factor.

Due to the multi-dimensional features of time, time saving also has a close relationship with other factors. For example, when a resource "is physically close" so it can be quickly and easily accessed, it does save users' time. As stated above, when information seekers have a higher level of information literacy skills and the IR system's utility and usability meet their needs, they will use less time to find the information they need and save intellectual effort accordingly.

In this study, each dimension of the concept of time was classified into the corresponding influential factors of behavior beliefs, resource characteristics, library environment and individual differences factors. For example, resource time saving ability was classified as one of the resource characteristics. The dimension of time availability is a specific environmental factor that is not related to any environmental factors focused on this study, but is related to the task and goal of the information seeking. Time constraints, time pressures, lack of time, and urgency of information needed have equal implications on time availability. Although there is a lack of empirical studies about how time pressures affect resource preferences and perceptions of resource accessibility, it is believed that information studies can be enhanced by investigating the effect of time on the order of information resources used together with other factors, such as the information seeker's perceptions about the accessibility of alternative resources and their

perceived usefulness (Savolainen, 2006). The time availability variable is not included in the proposed model as the task and purpose of students' seeking information has been controlled and all students were given about one and a half months to finish their research papers and projects.

Monetary factor The economic factor will also affect an information seeker's selection of information resources. De Groote, et al (2003) found that medical students think using online resources is cheaper, with a cheaper photocopy price, free printing, and use of less paper. Liu (2004) found that students would rather believe that online information that is paid for is more credible than free information. However, if using an information resource requires spending money, information seekers may turn away to seek other resources with similar accessibility and quality but are free of charge.

In this study, students use electronic resources provided by the Medical Center Library for free and need to pay for printing and photocopying themselves. The University implemented a new print and photocopy payment system, which may affect public health students' coming to the library to use the library's resources.

Combined Influence of Three External Factor Categories

The studies reported above confirm that resource characteristics, individual differences, and environmental factors influence information seekers' resource selection and use respectively. Several studies also investigated the combined influences of any two of the factor categories on the resource selection and use with correlation and regression analysis (Rosenberg, 1967; Gerstberger & Allen, 1968; Hardy, 1982; Chakrabarti, Feineman, & Fuentevilla, 1983; Culnan, 1984; Curley, Donald & Connelly, 1990; Auster & Choo, 1993; Marton & Choo, 2002; Thong, Hong, & Tam, 2002).

However, there are different propositions on how these factors affect resource selection and use and whether they have the direct impact or the indirect impact through affecting perceived accessibility and usefulness of using that resource.

Orr (1970) proposed a global conceptual framework on information channel selection. The framework suggested that a given input or output activity is "characterized by the nature of needs it serves (i.e., type of information, complexity, urgency, etc.), placed in the context of the work engendering the need and of the work environment, and associated with the personal variables of the scientist (i.e., previous training and work experience, etc.) whose behavior is being studied." (p. 158)

Pinelli (1991a) placed six institutional and seven sociometric variables into one model to investigate their influence on the use of U.S. government technical reports by U.S. aerospace engineers and scientists. Pinelli used organization affiliation and primary professional duties as two variables to represent the environmental factor and use seven sociemetric variables as the information resource characteristic variable. The study found that a dependent relationship exists between three variables: academic preparations, the type of organization, and professional duties; and use of conference papers, journal articles, and U.S. government technical reports. In addition, years of professional aerospace work experience were also correlated to the use of U.S. government technical reports. The relationship between the use of U.S. government technical reports and any sociometric variables were not found. Therefore, Pinelli concluded that the institutional, not the sociometric variables best explained U.S. government technical reports use behavior.

Carlson and Davis (1998) listed 22 variables that were considered to be important in media selection by directors and managers, which included individual differences, media experience, information quality, access quality, relevance, ease of use, time, task requirements, job pressure, environmental task complexity, feedback, and other social and organizational variables. Based on media trait theories and social interaction theory, they examined the importance of these variables in the selection of media by directors and managers. The study found that accessibility, convenience, and ease of use are the most important considerations while the situation-related factors, such as distance, time pressure, accessibility, and connection of communication partners, has the least important influence on director and managers' media selection decision.

It is an individual's perception of situations that determine his behavior (Orr, 1970). Some empirical studies verify this statement. The studies concluded that environmental and personal variables affect information seekers' perceived accessibility and usefulness of information resources, which directly affect the decision on the resource selection. Culnan (1985) conceptually suggested that perceived accessibility is likely to be influenced both by the information seeking context and prior experience in using an information resource, but did not provide a quantitative model about how various dimensions of accessibility affect the selection decision and how this decision is moderated by situational variables. Thong et al (2002) found the effects of interface characteristics (terminology, screen design, navigation), organizational context (relevance, system accessibility, system visibility), and individual differences (computer self-efficacy, computer experience, domain knowledge) had on the distance education student's use of

digital libraries were mediated by perceived ease of use and perceived usefulness of using digital libraries.

All the findings from the empirical studies corroborated that the TRA is an appropriate choice of a theory base for this study. The TRA states that people's behavior is determined by their intention to perform this behavior, which is jointly affected by behavior beliefs and normative beliefs, which, in turn, are influenced by environmental factors. Therefore, based on the TRA, TAM, and the findings of the empirical studies, a proposed research model was developed and will be discussed in Chapter III in detail.

Summary of the Review of the Literature

While researchers in library and information science have conducted many studies on uses of information resources, few studies, in a systematic way, have investigated the reasons why users choose a particular resource over others, and what factors, and how those factors influence users' choices. This study tends to integrate previous findings, yielding a more complete specification than previous approaches. Although several studies have examined the resource selection based on the Cost-Benefit Model, most of them only focused the view on resource characteristics rather than taking information seekers' characteristics and environmental factors into consideration for developing a model. Most of the previous studies examined resource selection by engineers, scientists, and administrators. How students, especially public health students, select information resources to finish their research paper or project assignments, and what factors, and how those factors influence their decision on information resource selection remain unknown.

Chapter III

Proposed Research Model, Hypotheses and Methodology

Overview

This chapter is composed of two main sections. The first section describes in detail the proposed research model, the theoretical rationale for the proposed model, and the hypothesized causal paths in this study. The second section provides an overall introduction of the research design and the rationale of the design, as well as the detailed reports on instruments and measures, data collection procedures, and the data analysis methods and process.

Proposed Research Model- Information Resource Selection and Use Model (IRSUM)

Brief Introduction of the Proposed Research Model

Based on the Theory of Reasoned Action (TRA), the Technology Acceptance Model (TAM), and the reviewed literature, the proposed Information Resource Selection and Use Model (IRSUM) is depicted in Figure 3.1, with arrows representing causal relationships. According to the model, "selection of using a primary resource" was the behavior intention (BI) construct and "actual use of the selected primary resource" (AU) was a construct representing behavior itself. It was hypothesized that selection of using a primary resource was a major determinant of actual use of the selected primary resource. Selection of a primary resource, in turn, was a function of two types of beliefs: behavior beliefs and normative beliefs. Behavior beliefs were specified with perceived usefulness (USE), perceived free of intellectual effort (ease of use) (EOU), and perceived freedom of physical effort (FPE) of using the primary resource. Normative beliefs were specified

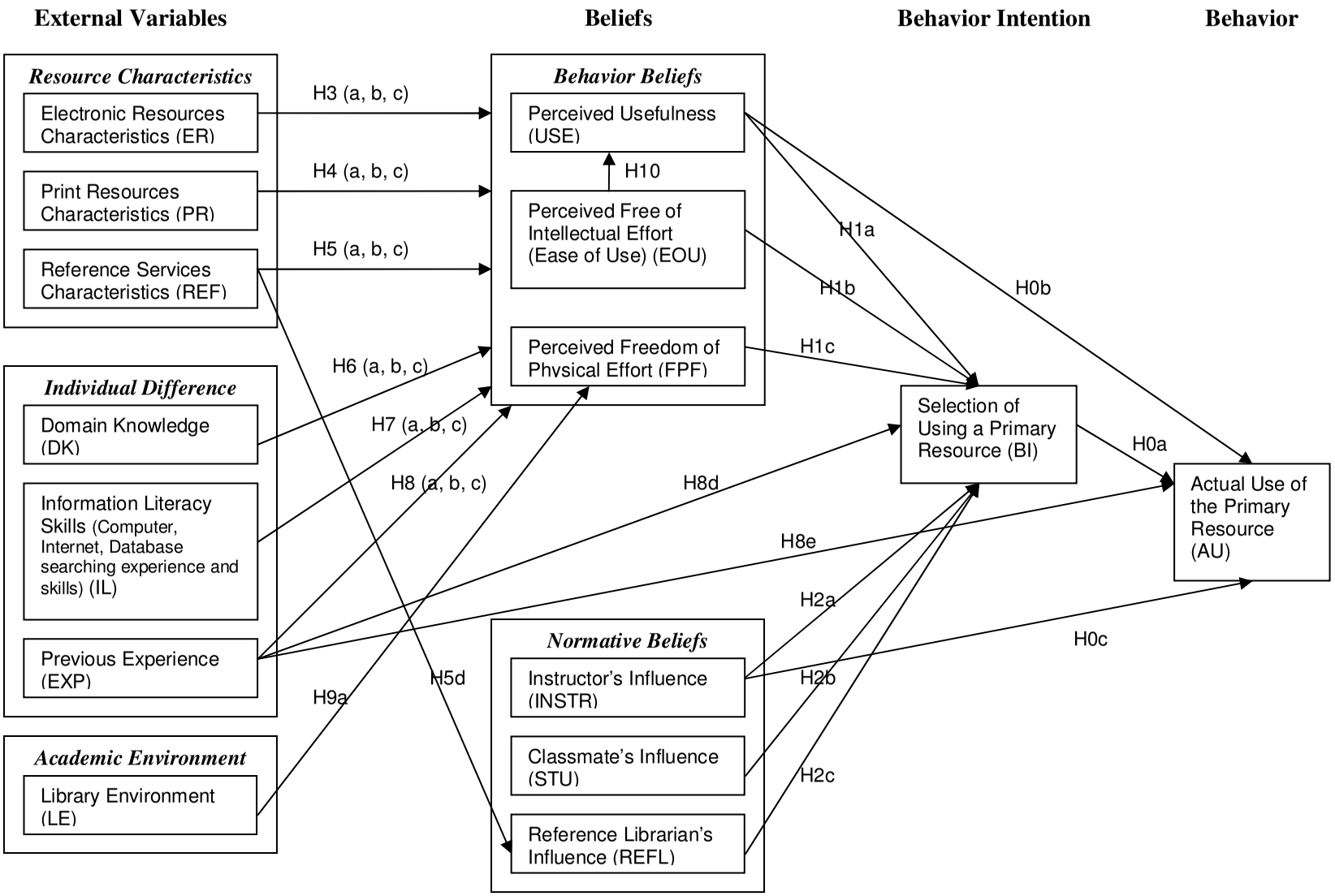

Figure 3.1. Proposed Information Resource Selection and Use Model (IRSUM)
(* H denotes hypothesis)

with perceived instructors' influence (INSTR), perceived classmates' influence (STU), and perceived reference librarians' influence (REFL) on using the primary information resource. Electronic resource characteristics (ER), print resource characteristics (PR), reference service characteristics (REF), library environment (LE), domain knowledge (DK), information literacy skills (IL), and previous experience (EXP) served as external variables that indirectly affect behavior intention through directly influencing behavior beliefs. The possible relationships among external variables were excluded from the model.

The Rationale of the Development of the Proposed Research Model

This section discusses a variety of theoretical foundations on which the proposed model was based. The inclusion and exclusion of the constructs as well as identification of beliefs and external variables are also explained.

Why is the "Attitude" Construct Omitted from the Proposed Model?

Fishbein & Ajzen theorized a tight relationship between beliefs and attitude: "beliefs are generally formed rapidly in response to stimuli" and "as a person forms beliefs about an object, he automatically and simultaneously acquires an attitude toward that object (A_o)." (As cited in Davis, 1986, p. 39) The object can include a behavior, a person, an institution, or an event. Similarly, when a person forms a belief about the consequence of performing a behavior, he would automatically and simultaneously acquire an attitude toward performing the behavior (A_{act}). In this sense, attitude toward performing a behavior can be taken as an appendix of the beliefs about the outcome of performing that behavior.

In the TRA, attitude toward performing a behavior predicts the behavior intention. "Intention reflects a decision that the person has made about whether to perform a behavior or not, and as such gets formed through a process of mental deliberation, conflict and commitment that may span a significant time period" (Davis, 1986, p. 38). Therefore, intention indicates a more stable mental status than the attitude of an individual regarding performance of a behavior. From this point of view, intention is a better predictor of behavior than attitude when an intention has been formed. In addition, Davis et al (1989) suggested revising the original TAM by removing the "Attitude" construct and the study findings supported the statement that the revised model was "a powerful [model] for predicting and explaining user behavior based on only three theoretical constructs: intention, perceived usefulness, and perceived ease of use."(p. 997) Many empirical studies also used simplified TAM as their theoretical framework and found significant causal relationship between behavior beliefs and behavior intention (Davis, et al, 1992; Klobas, 1995; Szajna, 1996; Venkatesh & Davis, 2000; Venkatesh et al, 2002; Thong, Hong, & Tam, 2002; Lee et al, 2007)

Based on the aforementioned reasons, the proposed model used beliefs as direct determinants of the intention to use the primary information resource (selection of using a primary resource), which was used to predict the actual use of that primary resource.

Identification of Variables of the "Belief" Constructs

The TRA does not specify the exact behavior beliefs, which were defined as perceived consequences of performing a behavior. The relationship between behavior beliefs and attitude toward performing a behavior is generally assessed by computing the summation of multiplication of perceived consequences of performing a behavior and

evaluations of each consequence. However, the TAM specifies the TRA's behavior belief construct with two individual belief items, perceived usefulness and perceived ease of use. Although Ajzen and Fishbein (1980) recommended using a qualitative free-response elicitation procedure to identify the salient beliefs of a subject population on perceived consequences of performing a behavior, Davis (1986) did not take this approach to identify belief items in the TAM due to the uncertainty of the validity of this approach. Instead, two belief items in the TAM were specified based on considerable previously published theoretical and empirical articles that span a wide range of user populations, systems and usage contexts. Davis (1986) believed that referring to previous theoretical and empirical studies to specify behavior belief items could reduce the risk of identifying idiosyncratic beliefs of a subject population, a specific system, or usage context, and increased the probability of a generation of general beliefs that can be applied to any population, any system, and any usage context. Through those empirical studies, Davis concluded that "perceived usefulness and perceived ease of use have been repeatedly identified as important issues governing the user acceptance processes." (Davis, 1986, p. 34) Following the TAM's approach, this study also specified the belief items based on the large amount of previous empirical studies. In addition, the behavior target in the TAM is information systems, which is similar to electronic resources defined in this study. The researcher proposed that perceived usefulness and perceived ease of use can be taken directly from the TAM and used in this study with some concept justifications and extension to comply with the context and purpose of this study. The reasons are explained as follows.

The TAM investigates human decision making in the context of accepting or resisting technology. In this context, generally a system has not been completely implemented within the organization or the system is still in the development process. Therefore, users are asked about their future use of the target system after they have a short interaction with the system. In other words, the TAM can tell system designers and developers who would be the system's potential users and what their expectations of the system are. However, this study aims to investigate public health students' selection and use of information resources provided by libraries and other sources. The researcher's interest was not about the students' purchase decision on those resources but their decision about using or not using an information resource that has already been around them. Therefore, those resources were not new resources in terms of consideration for purchase or implementation. Similarly, the target users are current users, not potential users, either.

In addition to the differences in new/current users and the study context between the TAM and the current study, accessibility and availability of systems/information resources is an additional difference. In the TAM context, users have no problem with accessing systems. The TAM is more about investigating whether users will use the system in the future after they have a short interaction with the system (e.g., watching the system demonstration, completing the usability testing tasks by using the system, etc.). Therefore, the system's physical access and availability is not the problem for them. However, in this study, there was no such a precondition. Resource accessibility and availability play a role in the users' selection of information resources, and resource

accessibility encompasses broader meanings than the "perceived ease of use" construct in the TAM.

Behavior beliefs are defined as a person's subjective probability that performing a behavior will result in salient consequences. The consequences of performing a behavior are the advantages and disadvantages of performing the behavior (Ajzen & Feishbein, 1980). In the case of this study, the biggest advantage for information seekers to select and use a primary information resource is that they can find useful information from that resource, while the biggest disadvantage may be that accessing the selected primary resource takes time, effort, and even money. Based on the multiple dimensions of information resource accessibility explored from the previous studies and defined in this study, perceived accessibility encompasses broader meaning in this study than perceived ease of use identified in the TAM. Perceived accessibility in this study means the perception of three types of effort: perceived physical effort, perceived intellectual effort, and perceived psychological effort. The perceived psychological effort is formed along with the formation of the other two types of effort and it indicates the user's attitude. Since the proposed model did not include the attitude construct, perceived psychological effort was not included as one of the behavior belief variables in this study. Therefore, "perceived usefulness" indicates the advantage of using an information resource, which is same as "perceived usefulness" identified in the TAM. "Perceived intellectual effort" and "perceived physical effort" are the disadvantages of using an information resource. In order to keep the direction of the influence of behavior beliefs on the selection of information resources consistent, "perceived free of intellectual effort" and "perceived freedom of physical effort" replaced "perceived intellectual effort" and "perceived

physical effort" as two behavior belief variables in this study. Among them, "perceived free of intellectual effort" is the variable that is same as "perceived ease of use" identified in the TAM, while "perceived freedom of physical effort" is a new construct developed by the researcher based on the context of the present study.

The possibility remains, of course, that perceived usefulness, perceived free of intellectual effort (ease of use), and perceived freedom of physical effort do not represent a complete specification of the beliefs which are salient in a given situation. Rather than assuming that these perceptions represent complete salient beliefs, the researcher views this as a hypothesis to be tested. Perceived usefulness, perceived free of intellectual effort (ease of use), and perceived freedom of physical effort are regarded salient to the extent that they exert a causal influence on intention to use of an information resource. In addition, failure of finding the causal relationship between the external variables and these behavior beliefs may indicate that there are other salient beliefs that are omitted.

The process of verification of these three belief variables and the development of the corresponding measures for each variable followed the development process in the TAM and are discussed in detail in the following sections.

By the same token, three normative belief items were proposed. They were perceived instructors' influence, perceived classmates' influence, and perceived reference librarian's influence on using an information resource. Similarly, the process of verification of these three belief items followed the belief items development process in the TAM and is discussed in detail in the following sections.

Identification of External Variables

P. Wilson (1977) stated that an individual's information-gathering behavior was a function of the availability of information, the ability to use information based on effort, and the usefulness of information based on experience. Payne (1982) also stated that the selection decision, like most practical decisions of interest, required the consideration of environment as well as individual factors. Zmud (1979) suggested that future studies should investigate the impact of both individual and contextual variables on information use. The literature review reported that resource characteristics, library environment, and individual differences do affect information seeker's selection of information resources. They were also the variables that influence the formation of behavior beliefs. Especially, the resource characteristics factor included three variables: electronic resource characteristics, print resource characteristics, and reference services characteristics. The characteristics of each type of resource included both aspects of information quality and resource accessibility.

Walster (1994) stated that TRA can be used in many areas in library and information science. Among them, "to create profiles of library users' beliefs and attitude toward library services and materials" and "to provide information for the development of instruction" (p.170) explicate the theoretical and practical significance of the current study. So far, few studies in library and information Science have used this theory to study user information seeking behavior and information resource selection and use. Thus, the proposed model in this study could be a touchstone to develop a theory about information resource selection and use.

Hypotheses

This study focused on three types of information resources in terms of format: print, electronic, and human. Print and electronic resources can be any collections and resources subscribed in the Medical Center Library or outside of the library, while human resources could be reference librarians in the Medical Center Library and also could be other human resources outside of the library, including instructors, classmates, and public health professionals, etc. All three types of information resources can be accessed through the library or outside of the library. The behavior target of interest in this study was the primary resource used by public health students. The unit of analysis for the dependent variable was the incident of a primary information resource being selected and actually used.

The following 32 hypotheses proposed the influence that perceived usefulness, perceived free of intellectual effort (ease of use), perceived freedom of physical effort, social influences, resource characteristics, library environment, and individual differences have on the selection and use of a primary information resource.

H0: Factors that directly affect the actual use of the primary information resource

- H0a: The selected primary resource is eventually used.
- H0b: Perceived usefulness has a positive effect on the actual use of the primary information resource.
- H0c: Perceived expectation from instructors has a positive effect on the actual use of the primary information resource.

H1: The impact of behavior beliefs on the selection of the primary information resource

H1a: Perceived usefulness has a positive effect on the selection of the primary information resource.

H1b: Perceived free of intellectual effort has a positive effect on the selection of the primary information resource.

H1c: Perceived freedom of physical effort has a positive effect on the selection of the primary information resource.

H2: The impact of normative beliefs on the selection of the primary information resource

H2a: Perceived expectation from instructors has a positive effect on the selection of the primary information resource.

H2b: Perceived expectation from classmates has a positive effect on the selection of the primary information resource.

H2c: Perceived expectation from reference librarians has a positive effect on the selection of the primary information resource.

H3: The impact of electronic resource characteristics on behavior beliefs provided that the selected and used primary resource is an electronic resource

H3a: Electronic resource characteristics have a positive effect on the perceived usefulness of using the primary information resource.

H3b: Electronic resource characteristics have a positive effect on the perceived free of intellectual effort of using the primary information resource.

H3c: Electronic resource characteristics have a positive effect on the perceived freedom of physical effort of using the primary information resource.

H4: The impact of print resource characteristics on behavior beliefs provided that the selected and used primary resource is a print resource

H4a: Print resource characteristics have a positive effect on the perceived usefulness of using the primary information resource.

H4b: Print resource characteristics have a positive effect on the perceived free of intellectual effort of using the primary information resource.

H4c: Print resource characteristics have a positive effect on the perceived freedom of physical effort of using the primary information resource.

H5: The impact of reference service characteristics on behavior beliefs regardless of the format of the selected primary resources

H5a: Reference service characteristics have a positive effect on the perceived usefulness of using the primary information resource.

H5b: Reference service characteristics have a positive effect on the perceived free of intellectual effort of using the primary information resource.

H5c: Reference service characteristics have a positive effect on the perceived freedom of physical effort of using the primary information resource.

H5d: Reference service characteristics have a positive effect on the perceived expectation from reference librarians to select the primary information resource.

H6: The impact of domain knowledge on behavior beliefs

H6a: Domain knowledge has a positive effect on the perceived usefulness of using the primary information resource.

H6b: Domain knowledge has a positive effect on the perceived free of intellectual effort of using the primary information resource.

H6c: Domain knowledge has a positive effect on the perceived freedom of physical effort of using the primary information resource.

H7: The impact of information literacy skills on behavior beliefs

H7a: Information literacy skills have a positive effect on the perceived usefulness of using the primary information resource.

H7b: Information literacy skills have a positive effect on the perceived free of intellectual effort of using the primary information resource.

H7c: Information literacy skills have a positive effect on the perceived freedom of physical effort of using the primary information resource.

H8: The impact of previous experience with the primary information resource on behavior beliefs, resource selection, and actual use of the primary information resource

H8a: Previous experience of using a primary resource has a positive effect on the perceived usefulness of using the primary information resource.

H8b: Previous experience of using a primary resource has a positive effect on the perceived free of intellectual effort of using the primary information resource.

H8c: Previous experience of using a primary resource has a positive effect on the perceived freedom of physical effort of using the primary information resource.

H8d: Previous experience of using a primary resource has a positive effect on the selection of the primary information resource.

H8e: Previous experience of using a primary resource has a positive effect on the actual use of the primary information resource.

H9a: Library environment has a positive effect on the perceived freedom of physical effort of using the primary information resource.

H10: Perceived free of intellectual effort has a positive effect on perceived usefulness.

Overall Research Design

A paradigm shift from the system-centered to the user-centered approach to study information behavior has also caused a paradigm shift of research methodologies in user studies. Qualitative research methods have been prevalent since the 1980s. Fidel (1993) stated that qualitative research is open and flexible. Through interview and observation, information behaviors can be observed in natural settings and interpreted within that context. Qualitative research is good for describing, identifying, and exploring the phenomena of human behavior. However, it is difficult to identify the relationship among the variables as well as the strengths of the relationships. It is also difficult to apply findings from real users testing a real system to explain users' behaviors on a different type of system because qualitative research focuses on exploration instead of generalization (Erdelez, 1996). Quantitative research is good at tackling these problems because the purpose of quantitative research is to test the cause-effect relationship and generalization. The different strengths and weaknesses of qualitative and quantitative research are also embodied in the studies of information seeking and use.

The early adoption of quantitative methods brought us an understanding of information needs and uses at a macro level, but ignored the effects that context has on information seeking and use. The adaptation of qualitative methods in the 1970s has contributed to the understanding of information seeking and use in various contexts at a

micro level. Neither research diagram alone provides a complete understanding of users' behavior. Many researchers advocate paradigm combinations to take advantage of the strengths of each approach and let them complement one another in user studies (Wang, 1999). The new research methods, such as cognitive work analysis, the critical incident technique, the Research Activity Timeline (RAT) (Barry, 1997) have been developed to meet this goal. It has been a trend in library and information science research that a researcher may use a predominant approach in the research but may also adopt methods or techniques from another approach.

Since this study aimed to test the cause-effect relationships between influential factors and the resource selection, quantitative methods (questionnaire and Structural Equation Modeling) were used as the predominant approach while focus group interview was an adopted technique from the qualitative approach. A focus group helped to identify, confirm, and explore the phenomena of resource selection and the influential factors synthesized from the previous studies while questionnaires were used to test the cause-effect relationships between the influential factors and resource selection behavior.

The survey method is a quantitative design that uses structured questionnaires as instruments to measure users' perceptions, attitudes, opinions, and self-reported behavior in order to test a hypothesis or simply describe a user group's behavior in general. Originally developed in the social sciences, the survey method is now widely used in library and information science studies. Nour (1985) reported that the survey was the most frequently used method (over 40%) in the research articles published in core library and information science journals in 1980. Julie (1996) found that 56% of research studies used survey method from a sample of user studies published between 1990 and 1994.

Among the reviewed literature for this study, the fact that about 95% of studies used a survey method (questionnaire and/or interview) also confirms this finding. The present study also used the questionnaire survey method to collect the data.

The reasons to use a questionnaire to collect the data are (Burton, 1990; Case, 2002; Fowler, 2002; Peterson, 2000; Patten, 2001):

1) It can generalize about a population based on a small sample;
2) It can collect both descriptive and relational information;
3) It can address numerous research questions and hypotheses;
4) The researcher's own opinion will not influence the respondent to answer questions;
5) The researcher can control the direction of the answers for questions;
6) It is administered anonymously so that the respondents are more likely to be candid;
7) It allows sophisticated statistical analysis;
8) It can be implemented in a timely fashion;
9) It is perceived to be relatively low in cost;
10) It could be used to gather data for a similar study.

However, the challenges of using a questionnaire method include: low response rate, slow response time, difficulty in identifying the validity of the answers, and so on. Among them, low response rate is the biggest barrier for any successful questionnaire survey. In this study, multiple methods that can reach people who are inaccessible via a single mode or prefer another mode were used to increase the response rate. These methods included the Internet survey, mailed survey, face-to-face distribution, and

sending reminder emails, etc. In addition, an incentive was also used to promote students to answer the questionnaire.

Study Setting and Study Subjects

Study Setting

Saint Louis University (SLU) Saint Louis University is a Jesuit, Catholic university ranked among the top research institutions in the nation with 11, 800 students on campuses in St. Louis and Madrid, Spain. Founded in 1818, it is the oldest university west of the Mississippi and the second oldest Jesuit University in the United States.

School of Public Health (SPH) The School of Public Health is one of 38 schools of public health in the United States. The school offers Master's and PhD degrees in broad concentrations in the field of public health, which include Behavioral Science/Health Education, Biostatistics, Environmental and Occupational Health, Epidemiology, Health Management and Policy, and Health Services Research. The school has nine research centers that focus on research areas in disease prevention, tobacco control, obesity, health policy, health management, biosecurity, environmental health, and health communication. In addition, the School is involved with many community agencies and health care organizations in local, state and national levels for purposes of research, student practice experience, service, education of various types, and peer collaboration. As of Fall 2006, there are a total of 45 primary faculty and 36 adjunct faculty, and 282 full-time and part-time students (Saint Louis University, 2007).

The Medical Center Library (MCL) The Medical Center Library is located in the center of the medical campus and is usually open from 7:00am to 11:30pm except holidays. There is a parking garage within a walk distance of 10 minutes.

The primary user groups served by the Medical Center Library include students, faculty, researchers, residents and staff in the School of Medicine, the Doisy College of Health Sciences, and the School of Public Health, as well as the Center for Advanced Dental Education, and the Center for Health Care Ethics. Secondary library users are health professionals and individuals in the Greater St. Louis Metropolitan Area and the Mid-continental Region of the National Library of Medicine's Regional Library Network.

As of June 2007, the Medical Center Library holds 125,801 books, serials back files, and other paper materials (including government documents); 23,472 microforms-units, 6,471 current serial subscriptions, 75 online databases, 700 electronic biomedical journals and 261 electronic biomedical textbooks. The shared electronic resources portal by the Pius XII Memorial Library and the Medical Center Library provides campus wide and remote access to more than 24,000 full-text electronic holdings in all disciplines. Remote access to online resources is managed through a Proxy server and validated by a current SLU Net ID username and password. In addition, the Medical Center Library also holds 1,714 reference volumes, 548 resource items on traditional reserve, and materials on electronic reserve for 101 courses.

The Medical Center Library provides reference services, Interlibrary Loan services, course reserve services, and circulation services. Except for daily reference services, since 2005, The Library developed the Liaison Program, which links the reference subject specialists with each medical department and program. The liaison

librarians work with their assigned liaison departments for general references, class-related instructions, library tours and orientations, and collections of journals, books, and databases in the related field. A dedicated reference service to the School of Public Health-Mobile Reference Services was launched in Fall 2006. The liaison librarian to the School of Public Health provides two hours of on-site reference services every Thursday.

Interlibrary loan (ILL) service is available for materials not held in the Medical Center Library collection. In addition, pre-1975 journals located in the storage of the library can be accessible by requesting them through ILL. Users can request and download articles online through an online information system called Illiad. There is no charge to SLU-affiliated faculty, students, or staff for ILLs. Students can access course materials online through an electronic reserve (E-res) system. Books, print articles, 24 laptops, and media materials are available on traditional reserve at the Circulation Desk at the Library. The loan period for books collected in the SLU libraries and libraries in University of Missouri is 120 days; 21 days for other libraries in the MOBIUS consortia; Journal volumes (over 10 years old) are loaned out for three days, and reserve items for two hours.

Regarding the library's technical support and facilities, secure and wireless network connectivity for laptop computers is available in the Library at no charge to SLU students, faculty, and staff. There is one flatbed scanner and a total of 26 public access workstations with an Internet connection, the basic Windows Office software package, some medical courses tutorial applications, and basic computer-based tools installed. SLU ID badges, encoded with Billiken Bucks, are used to make photocopies and printing at the library. $0.09 is charged for one page printing and $0.12 is charged for one page

photocopying with Billiken Bucks. The charge for copying on the coin operated machine is $0.15 per page. The library has 32,000 square feet with 45 large study tables, 184 study carrels, and 6 study rooms. The use of study rooms is based on a first-come first-serve basis. The east end of the library is reserved as a quiet-study-only area, which has been created based on the patrons' request.

Population and the Sample

The population of this study is all public health students who were enrolled in the School of Public Health at Saint Louis University during the academic year 2006-2007. The potential sample is the same as the study population, which turns out to be a total of 282 students. All students were given the option of participating in this study. Students who voluntarily answered questionnaires were counted into the final sample pool.

There are three reasons for selecting public health students as the study subjects:

1) Public health is a multi-disciplinary field, which encompasses community health, business, legislation and policy, communication, social science, ethics, and other fields and disciplines. Therefore, students in public health programs are often asked to write papers. Almost all of the courses, except the ones in biostatistics, a term paper or research project will be assigned to students. Some papers define the topics and some only provide a scope and students can identify a specific health problem as the paper topic. Usually, students will be given one or two months to identify the topic, search the literature or collect data, review the literature, and write the paper. Therefore, students will need to use different information resources to search the literature. In completing a research paper or project assignment, students have similar tasks with similar requirements as well as similar purpose and goal of seeking information although the

paper topics are various. Thus, the impact of tasks and purposes of information seeking is eliminated in this study.

2) The majority of the public health students are young, which helps to eliminate the effect of age on the information seeking behavior.

3) Usually, it takes about two years to receive a Master's degree in public health. For the first-year students, spring semester is the second semester in their program study. They have been familiarized with the educational resources, including the library resources and services, the environment of the School, and requirements of the degree programs. Second year students have already been aware of and used library resources and services. Therefore, spring semester is a good semester to collect data from the public health students.

Data Collection

Instruments

Because the present study tested if some of the influential factors that determine the selection of a primary resource can also be used as determinants to explain and predict actual use of the resource, two self-administered questionnaires were distributed over the course of the study. The questionnaire that is distributed before students start or when students just start their assignment is pre-questionnaire while the one that is distributed just before or right after students finish their assignment is post-questionnaire.

The pre-questionnaire (See Appendix D) focused on the intention to use a primary resource and asked about previous experience of using the intend-to-use primary resource, behavior beliefs, normative beliefs, and perceptions about resource characteristics and

library environment. The post-questionnaire (See Appendix F) focused on the actual use of the primary resource and asked about student's information literacy skills, and basic demographic information. Considering the complexity of information seeking behavior, both questionnaires asked about the channel through which students accessed the intend-to-use and actually-used information resource, and the geographical locations of using the primary resource. The post-questionnaire also included questions about information resources encountered except the actually-used primary resource during completion of assignments. Current and future tenses were used in the pre-questionnaire while the past tense was used in the post-questionnaire. Multiple items were used to measure 15 variables in the proposed model. All the items were measured on a 7-point Likert scale, ranging from 1 (strongly disagree) to 7 (strongly agree). The items measured for each variable were randomly sequenced in the electronic questionnaires.

Research Procedure

The student participants completed questionnaire instruments during the spring 2007 semester. By reviewing the course schedule and course syllabi in the spring semester 2007, research paper or project assignments started as early as right after the Spring Break, which was around middle to the end of March (March 26, 2007), and needed to be submitted by the end of the second week of May (May 11, 2007). Based on the course schedule, the pre-questionnaire was distributed in the first week after the Spring Break and the post-questionnaire was distributed since the last week of April. In order to develop valid instruments, a focus group for confirming the information resource list and variables identified in the proposed model and a pilot-test of the questionnaires

were conducted before formally distributing the pre-questionnaire. Table 3.1 shows the time period for the data collection.

Table 3.1

The Time Frame of the Data Collection

Time Period	Tasks
February - mid March, 2007	Focus Group & Questionnaires Pilot Test
March 26- April 20, 2007	Pre-Questionnaire Distribution
April 21 - May 18, 2007	Post-Questionnaire Distribution

Focus Group

In order to ensure questionnaires' face validity and content validity, two focus group discussions with five public health students in each group were conducted. The draft questionnaire question items were developed by the researcher through scanning the previous theoretical and empirical studies. The consistency of variable measures with students' information resource selection and use context were discussed. Comments and suggestions about the question items' sequence and wordings were also solicited.

The focus group recruitment email (see Appendix A) was sent out to all the Public Health students asking volunteers to participate in focus group discussions until 10 students were recruited. In order to exclude the focus group student participants from the formal questionnaire distributions, students were asked to write down the last four digits of their student ID numbers. During the focus group discussion, the researcher explained the purpose and process of the focus group. The focus group was conducted in a public area for the convenience of all participants and took about 1 hour.

In the focus group, students were asked to do three things:

1) Brainstorming. Asked students to list all the information resources they had used for finishing their paper or project assignments since they enrolled into the public health program, where they usually accessed those resources, and from which approaches they heard about those resources. People who may influence their selection and use of information resources were also asked. The researcher took notes on the answers.

2) On the answer sheet (see Appendix B), students were asked to cross out the information resources they had never used before and add what they had used but were not listed on the questionnaire. They were also asked to identify the sources from which they accessed the resources and the approaches through which they heard about the resources.

3) Card sorting. Card sorts suggested by Moore and Benbasat (1991) were then performed to assess construct validity. 70 question items in the instruments were printed on 3 x 5 inch index cards, which were shuffled randomly and then presented to the public health students individually. Each student was asked to sort the cards into 11 appropriate construct categories that represented the respective variables. Comments and suggestions on question item sequence and wording choices were also solicited. The items kept in the questionnaires for a variable were based on the frequency of being sorted into the same category by students.

On the basis of these results, some items were modified, and some were deleted. For example, “Scholars, experts, and professionals outside SLU” was suggested to be added into the human information resources/sources lists. The ambiguous wordings of some of the question items were revised to clarify the meaning. Pre- and post-questionnaires were then developed and subjected to pilot testing.

Pilot-Test of the Questionnaires

The pilot test of the questionnaires was conducted to further improve the content validity, to determine problems in completion of the questionnaire and to estimate the time needed to complete each questionnaire.

20 students in addition to the 10 focus group students were recruited through emailing to all the Public Health students. At the end of each questionnaire, students were asked to write down the last four digits of their student ID number so that they were excluded from the formal questionnaire distribution. At the same time, students were also asked to write down their comments and suggestions about the wording and the item sequence at the end of each questionnaire. In order to evaluate the reliability of the items for each variable, Cronbach's α coefficient was calculated with SPSS for Windows 15.0. The target value of Cronbach's α coefficient was 0.70 in this study. Among 15 variables in the proposed model, Cronbach's α of 14 variables met the criterion except the previous experience construct, which was 0.695, close to 0.70. The pilot test was voluntary and no incentive was provided.

Based on the result of the pilot test, item wordings and sequences were revised for the formal data collection.

Administration of the Questionnaires

In order to increase the response rate, three methods were used to distribute the questionnaires, which included electronic questionnaires, face-to-face in class distribution, and campus mail.

1) Electronic questionnaire. A commercial service for online questionnaire design and distribution called SurveyMonkey (http://www.surveymonkey.com), was used for

this study. By using this service, a URL linked to each questionnaire was obtained. An email recruitment letter (Appendix C) for the pre-questionnaire and a letter (Appendix E) for the post-questionnaire were sent to all the public health students for participation in the study. The letter included the information about the study overview, what they needed to do, incentive information, and other relevant information. The letter also included the URL of each questionnaire. The email letter was sent again after 8 days and 16 days of the first distribution to remind students to fill out the questionnaire.

2) Questionnaire in print distributed in class. With the instructor's permission, the researcher made a short presentation about the study at the beginning or during the break in a total of 15 classes. A package with the return address labeled on the campus-mail envelop, which included the cover letter that describes the study's purpose, intended use and management of the data, the IRB approval number, and the hard copy of the questionnaire, was distributed to each student in the class.

3) Questionnaire in print distributed by campus mail. A hardcopy of the pre- and post-questionnaire with the recruitment letter was also dropped into the students' mailboxes at the department.

The same distribution process was applied to both pre- and post-questionnaires. In the pre-questionnaire recruitment letter (Appendix C) and at the end of the pre-questionnaire (Appendix D), the information about the upcoming post-questionnaire was emphasized to make students aware of it. Since the questionnaires were distributed twice, in order to match students' answers in the pre- and post-questionnaire, students were asked to write down the last four digits of their student ID number at the end of both the pre- and post-questionnaires. Other than the number, no other identifying information

was collected. In order to motivate students to participate, an $8 Barnes & Noble bookstore gift card or an $8 Billiken Bucks on-campus printing gift certificate was provided to each student participant after they finish both the pre- and post-questionnaires. As both questionnaires were sent to all public health students, some of the students who participated in the focus groups and the questionnaire pilot test also filled out both questionnaires. Although the incentive was also provided to the participants among the 30 students, their questionnaire answers were excluded from the data analysis.

Operational Measures of Variables

Demographic Variables

Gender

Participants were asked about their gender with 1) male and 2) female.

Age

Participants were asked to select their age from the following eight choices: 1) under 20, 2) 21-25, 3) 26-30, 4) 31-35, 5) 36-40, 6) 41-45, 7) 46-50, and 8) over 51.

Academic Status

Participants were asked to select their highest level of education or degree before they were enrolled into their current public health program from the following seven choices: 1) Undergraduate course work, 2) Specialist, 3) Certificate, 4) B.S./B.A., 5) M.S./M.A., 6) Ph.D., and 7) Others. In addition, participants were also asked to report the major of their highest degree completed. Because the School of Public Health also offers dual degree programs, the questions about what the other degree programs and in which level except the public health degree programs the students also pursued.

Behavior Belief and Normative Belief Variables

Use Belief Strength to Measure the Behavior Beliefs and Normative Beliefs Variables

In the TRA, each behavior belief (perceived consequences of performing a behavior) is multiplied by its corresponding evaluation of each consequence based on the expectancy-value attitude model. However, no evaluation term is employed in Davis' TAM. In his dissertation in 1986 (Davis, 1986), Davis stated that Fishbein and Ajzen contend that several studies have shown that

> "Attitudes can be estimated more accurately by considering both belief strength and evaluation of associated attributes than by using the sum of the beliefs or the sum of the evaluations… One exception occurs when the evaluations are either all positive or all negative. In this case, the sum of beliefs alone will tend to be highly correlated with the attitude. " (Fishen and Azjen, 1975, p. 227,)

In the TAM, both specific belief items, which are perceived usefulness and perceived ease of use, are positively valenced with respect to the evaluative orientation, which is also the case in this study. In addition, Davis stated that even though there are a set of beliefs with mixed positive and negative orientation, any set of salient beliefs may be transformed to "all positive" or "all negative" beliefs by reversing the data coding scheme. "Hence we could not expect a moderating role for the evaluation term even according to Fishbein and Ajzen's logic." (Davis, 1986, p. 33) Therefore, only belief strength was used to measure each belief variable and its corresponding measured items in this study.

Behavior Belief Variables

As has been discussed above, behavior beliefs in this study included perceived usefulness (advantage), and perceived free of intellectual effort (ease of use) and perceived freedom of physical effort (disadvantages) of using an information resource. As perceived usefulness and perceived free of intellectual effort (ease of use) indicated

the same conception as they did in the TAM, the question items measuring these two variables developed and validated by Davis (1989a) were directly adopted with wording changed to fit the context of the present study. Question items measuring perceived freedom of physical effort were adapted from studies of Culnan (1985), Fidel (2004), and McCreadie & Rice (1999a & b), as well as focus group discussions (see Table 3.2).

Table 3.2

Items Measuring Behavior Beliefs toward Using a Primary Resource (BB)

Question Items (12 items)	Source	Scheduled Administration
Perceived Usefulness (USE) • Using the Primary Resource helps me to be a productive student • Using the Primary Resource enhances my effectiveness on the coursework • Using the Primary Resource improves my academic performance • I find the Primary Resource a useful tool for me to finish the assignment	Davis (1989a)	Pre-Questionnaire
Perceived Free of Intellectual Effort (Ease of Use) (EOU) • Learning to use the Primary Resource is easy for me • I find it is easy to get the Primary Resource to do what I want to do • It is easy for me to become skillful at using the Primary Resource • The Primary Resource is easy to use	Davis (1989a)	Pre-Questionnaire
Perceived Freedom of Physical Effort (FPE) • I find I don't need to take too much physical effort to find or approach the Primary Resource • I find the Primary Resource is always available whenever I need to use it • Accessing the Primary Resource is convenient • Overall, using the Primary Resource will save me a lot of physical effort	Culnan (1985), Fidel (2004), McCreadie & Rice (1999a & b), & Focus Group	Pre-Questionnaire

Normative Belief Variables

In the TRA, Ajzen & Fishbein (1980) stated that other peoples' behavior and perceptions have impact on an individual's behavior intention. In an attempt to develop a model with a better predictive power, Taylor and Todd (1995a) decomposed the TRA's subjective norm beliefs into two different referent groups, peers and supervisors (α = .92 and α = .80, respectively). Similarly, this study decomposed referent groups into instructors, classmates, and reference librarians based on the focus group discussions, and the items used in the Taylor and Todd's (1995a) instrument (see Table 3.3)

Table 3.3

Items Measuring Normative Belief Variables (NB)

Question Items (9 items)	Source	Scheduled Administration
Instructor's Influence (INSTR) • My Instructors expect me to use the Primary Resource that I intend to use • My Instructors want me to frequently use the primary resource that I intend to use • Generally speaking I try to do what Instructors think I should do	Ajzen & Fishbein (1980), Taylor & Todd (1995a), & Focus Group	Pre-Questionnaire
Classmates' Influence (STU) • My Classmates expect me to use the primary resource that I intend to use • My Classmates want me to frequently use the primary resource that I intend to use • Generally speaking I try to do what Classmates think I should do	Ajzen & Fishbein (1980), Taylor & Todd (1995a), & Focus Group	Pre-Questionnaire
Reference Librarians' Influence (REFL) • The health sciences Reference Librarians expect me to use the primary resource that I intend to use • The health sciences Reference Librarians want me to frequently use the primary resource that I intend to use • Generally speaking I try to do what health sciences Reference Librarians think I should do	Ajzen & Fishbein (1980), Taylor & Todd (1995a), & Focus Group	Pre-Questionnaire

Behavior Intention and Actual Use Variables

Behavior Intention Variable

The behavior intention construct was represented by the "selection of a primary information resource" variable in this study and was measured through a 4-item 7-point Likert scale adapted from Ajzen & Fishbein (1980) and Taylor & Todd (1995a) with a reliability coefficient of .91. Table 3.4 lists the items measuring students' selection of the primary information resource.

Table 3.4

Items Measuring Selection of a Primary Information Resource (BI)

Question Items (4 items)	Source	Scheduled Administration
Behavior Intention (BI) • I intend to use the primary resource to finish my assignment • I intend to use the primary resource at every opportunity while completing the assignment • To the extent possible, I would use the primary resource to find information for finishing my assignment • I intend to increase my use of the primary resource in the future	Ajzen & Fishbein (1980) and Taylor & Todd (1995a)	Pre-Questionnaire

Actual Use Variable

The TRA and the TAM have been applied to investigate human behavior, including technology usage. However, "despite the number of studies targeted at explaining technology usage, there are crucial differences in the way the variable has been conceptualized and operationalized." (Straub, et al., 1995, p. 1328) Many of the studies used subjective self-reported usage (Davis 1985 & 1989b) while some of them used objective measures (Taylor & Todd, 1995a), such as computer logs or an actual

count, to measure actual use of a technology. Both Straub, et al. (1995) and Szajna (1996) compared both subjective and objective measures of technology usage with Davis' (1986) TAM, and found that while subjective self-report technology usage was related to perceived usefulness and perceived ease of use, objective computer recorded technology usage showed distinctly weaker links. However, Davis (1989b) also pointed out that in cases where objective usage logs are not available, self-reported usage measures can be used to represent system usage although "they should not be regarded as precise measures of actual usage frequency." (p. 991)

In this study, it is very difficult to acquire objective usage data about students' actual use of the primary resources. Therefore, self-reported usage measures were used in this study. Based on Davis (1989b) and Lederer, et al. (2000), the frequency and the duration of usage is typical of the kind of self-reported measures, two items with 7 points Likert scale were adapted to measure the variable of "actual use" in this study (Table 3.5).

Table 3.5

Items Measuring Actual Use of a Primary Information Resource (AU)

Question Items (2 items)	Source	Scheduled Administration
Actual Use (AU) • Please estimate how many total hours you have used the primary resource for completing the assignment • How often have you accessed the primary resource that you used for completing your assignment	Davis (1986, 1989b), Lederer, et al. (2000)	Post-Questionnaire

External Variables: Resource Characteristics

Three types of information resources were the main focuses of the present study. They are electronic resources (e.g., online databases, e-journals, e-books, and the Web, etc.), print resources (e.g., books in print, and journals in print, etc.), and human (e.g., reference librarian). Human resources, in this study, were mainly focused on reference services. Three different types of information resources all possess similar characteristics, which include resource accessibility (resource functionality type of characteristics) and resource quality (resource content type of characteristics). Resource quality means the quality of information that is contained or transferred by a resource and same six items were used to measure resource quality for each type of resources. Resource accessibility indicates the resource utility and usability criteria and different items were used to measure resource accessibility for each type of resources. For electronic resources, resource accessibility was evaluated based on system functionalities, navigation, layout and information representation, and response time (Chang, et al., 2005; Wixom & Todd, 2005; Thong, Hong, & Tam, 2002) (6 question items) (see Table 3.6). Print resource accessibility was evaluated through its index system, reference system, organization of information, layout of information, and other criteria to make it easy to navigate and understand (Taylor, 1986) (6 question items) (see Table 3.7). Reference services' accessibility is mainly represented through reference librarians' attitude to patrons (RUSA, 2004) (3 question items), question negotiation level (Taylor, 1968) (3 question items), literature search instructions (Gross & Saxton, 2002; Minchow, 1996) (3 question items) (see Table 3.8).

Table 3.6

Items Measuring Perception on Electronic Resources Characteristics (ER)

Question Items (12 items)	Source	Scheduled Administration
Resources Quality • E-resource(s) contains relevant information to the topic of the assignment • E-resource(s) contains current, latest, and up-to-date information • E-resource(s) contains reliable information • E-resource(s) contains accurate and valid information • E-resource(s) contains information in a wide scope and depth • E-resource(s) contains enough information for me to finish the assignment	Chang, et al.(2005), Taylor (1986), Marton & Choo (2002), Wixom & Todd (2005), Thong, Hong, & Tam (2002)	Pre-Questionnaire
Resource Accessibility • E-resource(s) provides searching functions that I can use to finish my assignment • E-resource(s) provides assistance to help me identify the search terms • The information on the web pages of E-resources is presented in a clear and well-organized manner • The E-resource(s) is easy to navigate • The E-resource(s) responds quickly when I am doing a search on it • The E-resource(s) allows me to manage the search results in different ways (display, export, print, save, email, etc.) based on my personal preference		

Table 3.7

Items Measuring Perception on Print Resources Characteristics (PR)

Question Items (12 items)	Source	Scheduled Administration
Resources Quality • Print resource(s) contains relevant information to the topic of the assignment • Print resource(s) contains current, latest, and up-to-date information • Print resource(s) contains reliable information • Print resource(s) contains accurate and valid information • Print resource(s) contains information in a wide scope and depth • Print resource(s) contains enough information for me to finish the assignment	Chang, et al.(2005), Taylor (1986), Marton & Choo (2002)	Pre-Questionnaire
Resource Accessibility • Print-resource(s) provides an easy to understand reference system (such as "see", "see also", etc.) • Print-resource(s) provides clear user instructions • The information on each page of the Print-resource(s) is presented in a clear and well-organized manner • Print-resource(s) is organized well to make it easy to go to other pages to find the information and return to the previous page • Print-resource(s) uses consistent terms		

Table 3.8

Items Measuring Perception on Reference Services Characteristics (REF)

Question Items (16 items)	Source	Scheduled Administration
Resources Quality • Reference librarians provide the information that is related to the topic of the assignment. • Reference librarians give the current, latest, and up-to-date information • Reference librarians provide reliable information • Reference librarians provide accurate and valid information • Reference librarians provide information in a wide scope and depth • Reference librarians provide enough information for me to finish the assignment	Chang, et al.(2005), Gross & Saxton (2002), Marton & Choo (2002), Minchow (1996), RUSA (2004), Taylor (1968), Taylor (1986)	Pre-Questionnaire
Resource Accessibility 1) Attitude to Patrons: • Reference librarians are ready to help me whenever I approach them • Reference librarians acknowledge me waiting for services when he/she is serving other users • Reference librarians show interest in my question 2) Question Negotiation Level • Reference librarians understand my question • Reference librarians help me to articulate ambiguous question • Reference librarians make sure I find what I want 3) Literature Search Instructions • Reference librarians' literature search instruction and/or library orientation gives me awareness of information resources and services provided by the library • Reference librarians' literature search instruction and/or library orientation gets me to use information resources and services provided by the library • Reference librarians' literature search instruction and/or library orientation makes me skillful at searching online databases		

External Variable: Individual Differences

Domain Knowledge

Years of work /study experience related to public health before starting a public health program and self-reported familiarity of domain knowledge were used to measure the variable of domain knowledge in this study. By adapting the question items from studies conducted by Thong, Hong, & Tam (2002) and Curley, Connelly, & Rich (1990), two items were used to measure the participants' domain knowledge variable (Table 3.9).

Table 3.9

Items Measuring Domain Knowledge (DK)

Question Items (2 items)	Source	Scheduled Administration
Domain Knowledge (DK) • How many total years of previous and/or current work experience do you have that is relevant to the public health field? • Before you started the graduate program in public health, how much do you think you knew about public health?	Thong, Hong, & Tam (2002), Curley, Connelly, & Rich (1990),	Post-Questionnaire

Information Literacy Skills

Based on Eisenberg et al. (1997) Big6^{TM} Skills and the Association of College & Research Libraries (ACRL) (2000) information literacy standards and guidelines for higher education, information literacy contains the indicators about the ability to determine a range of sources, identify sources, prioritize sources, locate sources, and use sources to find information. In order to be information literate, a person needs to possess the experience and skills of using computers, online databases, and the Internet. Duration and frequency of searching online databases have been used to indicate experience in many studies (Hsieh-Yee, 1993; Palmquist & Kim, 2000) and they are also used to

indicate experience of using computers, online databases, and the Internet in this study. Self-reported proficiency in a set of specific skills in using computers (Romanov & Aarnio, 2006; Lee et al, 2003), searching online databases (Monoi et al, 2005; Hsieh-Yee, 1993; Lawrence & Levy, 2004; Palmquist & Kim, 2000), and searching the Internet (Lazonder et al, 2000) were adapted from the surveys in the previous studies (Table 3.10)

Table 3.10

Items Measuring Information Literacy Skills (IL)

Question Items (10 items)	Source	Scheduled Administration
Information Literacy Skills (IL) 1) Computer Experience and Skills • How long have you been using a personal computer? • On average, how many hours a week do you use a computer for the purposes of studying and working? • How would you rate your proficiency in using the following software/computer program? • How would you rate your proficiency in the following general computer skills? 2) Database Experience and Skills • How long have you been using online databases available in the libraries or any other places? • How often do you use online databases? • How would you rate your proficiency in the following database searching skills? 3) Internet Experience and Skills • How long have you been using the Internet? • How many hours per week do you spend on the Internet? • How would you rate your proficiency in the following Internet activities?	ACRL(2000),Eisenberg, et al (1997), Hsieh-Yee (1993), Lawrence & Levy (2004), Lazonder et al (2000), Lee et al (2003), Monoi et al (2005), Palmquist & Kim (2000), Romanov & Aarnio (2006)	Post-Questionnaire

Previous Experience of Using the Primary Resource

As discussed in Chapter 2, previous experience has been found to either directly or indirectly affect the selection and use of an information resource affecting the users' behavior belief on using an information resource. Duration and frequency of using the primary resource, awareness of the primary resource availability, and knowledge about the scope and functions of the primary resource were used to measure the previous experience of using the primary resource in this study. Except two question items measuring duration and frequency of use of the primary resource adapted from previous studies (Hsieh-Yee, 1993; Palmquist & Kim, 2000), four other items were developed by the researcher for the purpose of this study (see Table 3.11).

Table 3.11

Items Measuring Previous Experience of Using Primary Resources (EXP)

Question Items (6 items)	Source	Scheduled Administration
Previous Experience of Using the Primary Resource (EXP) • How long have you been using the primary resource? • On the average, how often do you use the primary resource? • What probability do you think you could find what you were looking for from the primary resource? • How much do you think you are aware of the availability of the primary resource that you intend to use • How much do you think you know about the scope and content of the primary resource that you intend to use? • How much do you think you know about the functions, features, and tools provided by the primary resource that you intend to use?	Hsieh-Yee (1993), Palmquist & Kim (2000)	Pre-Questionnaire

External Variable: Library Environment

Library environment, in this study, mainly meant the library's physical environment. The library's access, technology resources/facilities, and collections were used in this study to present different aspects of library environment. All the measured items were designed by the researcher by referring to measures used in previous studies (Adedibu & Adio, 1997; Boyce, et al, 2004; De Groote, et al, 2003; Liu & Yang, 2004; Tannery et al, 2002; Taylor & Todd, 1995a). Table 3.12 presents the measured items for different aspects of the library environment, which includes library access, resources/facilities and technology support, library collection, and overall evaluation.

Table 3.12

Items Measuring Library Environment (LE)

Question Items (14 items)	Source	Scheduled Administration
Library Environment (LE) 1) Library Access • The library is close to my home or work • It is easy to find a parking space when I drive to the library • The library's hours are convenient to me 2) Resources/Facilities and Technology Support • I can get on-site assistance from the staff of the circulation, Interlibrary Loan, and reference departments in the library • I can get on-site technical assistance in the library • The library provides easy off-campus access to the library's electronic resources and services • Most of the time, I can find or have a computer/laptop to use in the library • Photocopying is convenient in the library • Printing is convenient in the library	Taylor & Todd (1995a), Liu & Yang (2004), Adedibu & Adio (1997), Tannery et al (2002), De Groote, et al (2003), Boyce, et al (2004)	Pre-Questionnaire

3) Library Collection
- The library has a rich collection of books, journals, reference works, and other hard copy materials
- The library has a rich collection of e-journals, e-books, online databases, and other electronic materials
- It is easy to figure out the arrangement of the materials in the library
- The book shelves in the library are easy to navigate

4) Overall Evaluation
- Overall, the library's environment provides me with easy access of information resources and services

Data Analysis

The analyses of data included descriptive statistics, data screening and Structural Equation Modeling (SEM). Questionnaire responses were entered into SPSS for Windows 15.0. The significant level chosen for this study was .05. In order to ensure that the statistical methods were used validly, statistical consulting and software support services were acquired from the Social Science Statistics Center provided by the University of Missouri. Two staff members of the center were consulted throughout the whole data analysis process. The data analysis process, the statistical parameters used, and the important analysis results reported followed the statistical experts' suggestions and the published literature in which SEM was the main method (Lin, 2005; Lee et al, 2007).

Descriptive Statistics

Descriptive statistics included a demographic description of the study participants and a descriptive analysis about general information resources used, primary resources

used, reasons why students use or not use the primary resources, resource access approaches, and resource awareness channels. Frequencies and percentages were reported.

Data Screening

Data screening was performed to identify data entry errors and to examine how appropriately the data meets the statistical assumptions. Frequency tables were used to find mis-coded entries and missing data. Among many statistical assumptions, special significance to multivariate analyses are the assumptions of normality, linearity, and homoscedasticity. Violating one or more of these assumptions may cause statistical results biased or distorted (Tabachnick & Fidell, 2001). Among them, normality is the most important one. Because outliers may cause data to distribute abnormally, an outlier check was conducted before the normal distribution evaluation.

Outliers

Among 134 full responses, outlier contamination was examined. "An outlier is a case with such an extreme value on one variable (a univariate outlier) or such as strange combination of scores on two or more variables (multivariate outlier) that may distort statistics." (Tabachnick & Fidell, 2001, p.66)

Univariate outliers were detected by box plots for each measured variable. Cases with variable scores inside ±1.5 IQRs (InterQuartile Range = 75^{th} percentile – 25^{th} percentile) on box plots are considered to be within the bounds of the distribution and are therefore not considered outliers (Meyers, Gamst, & Guarino, 2006). Of 98 measured variables in the proposed model, no univariate outliers were detected in the present study.

Multivariate outliers were assessed by calculating each case's Mahalanobis distance. The statistic D^2 measures the Mahalanobis distance, which is "the distance of a

case from the centroid of the remaining cases where the centroid is the point created at the intersection of the means of all the variables." (Tabachnick & Fidell, 2001, p.68). Each case is evaluated using the chi-square distribution with an alpha level of .001 and Degree of Freedom (df) of the number of independent variables. In this study, there are 14 independent variables for each case. The case with D^2 in excess of 36.12 (df =14, $p < .001$) was considered multivariate outliers and possible candidates for elimination. Following the guideline, no multivariate outliers were detected so that all 134 cases were eligible for data analysis.

Normality

A common rule-of-thumb test for normality is to check skewness and kurtosis of each measured variable through SPSS. Researchers use different thresholds as indicative of departures from normality. In this study, ±2.00 was used for interpreting skewness and kurtosis of each measured variable (i.e. 98 item questions in this study).

Multivariate normality means that: 1) all the univariate distributions are normal; 2) the joint distribution of any pair of the variables is bivariate normal; and 3) all bivariate scatterplots are linear and homoscedastic (Kline, 2005, p. 48). It is impractical to examine all aspects of multivariate normality. However, it is more likely that the assumption of multivariate normality is met if all the measured variables are normally distributed (Tabachnick & Fidell, 2001). Therefore, univariate normality was examined only in this study.

After running descriptive analysis through SPSS, the values of skewness and kurtosis of all 98 measured variables in this study fell into ±2.00 range.

Overview of Structural Equation Modeling (SEM)

Structural Equation Modeling (SEM) is a multivariate statistical technique which incorporates and integrates multiple regression/path analysis and factor analysis. SEM takes a confirmatory, rather than exploratory, approach to data analysis, which has several advantages over the traditional regression method of testing directional relationship between variables (Bryne, 2001; Tabachnick & Fidell, 2001; Kline, 2005; Brown, 2006; Meyers, Gamst, & Guarino, 2006). In tradition, multiple regression and path analysis, each variable has only one indicator. Factor analysis is usually performed in a model in which each variable has multiple indicators but there are no causal effects (arrows) connecting the variables. However, the SEM refers to a hybrid model with both multiple indicators or items measuring a variable (called latent variable or construct), and causal paths connecting the latent variables. SEM can simultaneously estimate all path coefficients and test the significance of each causal path, and permitting the evaluation of the model performance as a whole by checking the overall goodness of fit of a hypothesized model rather than only testing coefficients individually as Multiple Regression does (Bagozzi, 1981 & 1982).

According to Bryne (2001, p. 7), SEM can be used in three scenarios to test the proposed model, which include strictly confirmatory, alternative models, and model generating. The alternative models and model generating scenarios were applied more often than strictly confirmatory scenario in the previous studies. In the alternative models case, researchers propose several alternative models and test the goodness of fit of the each alternative model to a single set of sample data, and select one model that best represents the sample data. The alternative models may contain different variables and/or

different causal paths among the same variables. Therefore, the overall goodness of fit of alternative models will be different. Some of the good examples of the previous studies that took alternative models approach include Lin's dissertation study (2005) and Wixon & Tood's study (2005). In the model generating scenario, researchers propose a research model based on the theories and empirical studies and would like to find the relationships among the variables in the proposed model. When the initial model fit is found poor, researchers proceed in an exploratory fashion by adding causal paths to modify and re-estimate the model that better describes the sample data. However, those suggested causal paths can not be taken arbitrarily and need to be substantively meaningful. Therefore, in the model generating scenario, the purpose of testing a model is to find a model that is both substantively meaningful and statistically well-fitting to the sample data. Lin's dissertation study (2005) is a good example to understand this approach as well.

In this study, the SEM was performed to test the psychometric properties of measured items and constructs (measurement model validating), as well as to examine the hypothesized causal relationships between variables in the proposed model (structural model fitting) by taking model generating approach. Therefore, the SEM was decomposed into two steps: Confirmatory factor analysis (CFA) measurement model estimation and SEM structural model analysis, which were reported in detail in the following sections. Both steps were performed by using SPSS for Windows 15.0 and AMOS 7.0.

CFA Measurement Model Estimation

CFA measurement model estimation is the first step of Structural Equation Modeling (SEM). The purpose of the measurement model estimation is to specify the

pattern by which each measure (e.g. indicator or item question in this study) loads on a particular factor (e.g. construct or variable in the proposed model in this study) and to assure the reliability and validity of measures and constructs. The measurement model represents the degree to which the indicator variables (each question item in the case of this study) capture the essence of the latent factor. A valid measurement model is the model which meets the requirements of psychometric soundness: reliability and validity of measures and constructs. The purpose of testing reliability and validity of measures is to assure multiple items measure the hypothesized latent variables but not others. It is accomplished primarily through confirmatory factor analysis. By doing so, measurement error is reduced by having multiple items measuring a latent variable with psychometric soundness. It is critical that measurement of each latent variable is psychometrically sound before testing the causal relationships among latent variables (Byrne, 2001). In this study, squared factor loadings (SFLs) was used to test item reliability and Cronbach's α and the composite reliability ρ were used to test construct reliability. Construct validity, including both convergent and discriminant validity, was assessed by using average variance extracted (AVE) and by examining the correlations between the items of potentially overlapping constructs, respectively.

In the present study, there were a total of 15 variables (also called constructs or latent variables) in the proposed model and multiple items (also called indicators or measured variables) were used to measure each variable. In total, 98 items comprised 15 latent variables (Table 3.13).

Table 3.13

Variables and the Number of Measured Items in the Research Model

	Variable	Abbreviation	Number of Measured Items
1	Selection of a primary information resource	BI	4
2	Actual use of the selected primary information resource	AU	2
3	Perceived usefulness	USE	4
4	Perceived ease of use	EOU	4
5	Perceived freedom of physical effort	FPE	4
6	Instructors' influence	INSTR	3
7	Classmate's influence	STU	3
8	Reference librarian's influence	REFL	3
9	Electronic resources characteristics	ER	12
10	Print resources characteristics	PR	12
11	Reference services characteristics	REF	16
12	Domain knowledge	DM	2
13	Information literacy skills	IL	9
14	Previous experience	EXP	6
15	Library environment	LE	14
	Total	**15**	**98**

Item and Construct Reliabilities

Reliability means that "the numerical results produced by an indicator do not vary because of characteristics of the measurement process or measurement instrument itself." (Neuman, 2006, p. 189). It can be assessed through item reliability and construct reliability.

Item reliability refers to the degree of variance explained by the construct instead of by error. This is typically measured by squared factor loadings (SFLs), which represent the item's ability to capture variance within the construct. The higher an item's

SFL, the higher the correlation between the item and the measured construct is. According to Fornell and Larcker (1981), value more than .50 is acceptable value.

The construct reliability refers to the ability of measured items to tap a similar underlying construct. The construct reliability will be high if the correlation of items is high. It can be assessed through Cronbach's α (Cronbach, 1951) and the composite reliability ρ developed by Wertsm, Linn, and Joreskog (1974). Cronbach's α has been widely used to test internal consistency. However, it assumes each item is equally weighted on the measured latent variable in determining the composite (Perugini & Bagozzi, 2001). In order to take the different weight of each item into account, composite reliability ρ was also used to test the construct reliability. The composite reliability is calculated by use of the formula: $\rho = (\Sigma\lambda i)^2/((\Sigma\lambda i)^2 + \Sigma\theta i)$, where λi refers to the i th factor loading and θi to the i th error variance of measured items. The rule of thumb for both coefficients is .60, which is considered acceptable for exploratory purposes, .70 is adequate for confirmatory purposes, .80 is good for confirmatory purposes, and .90 is excellent for confirmatory purposes (George & Mallery, 2003, p.189; Nunnally & Bernstein, 1994). 0.70 was used in this study as the threshold of the construct reliability.

Table 3.14 lists the item reliability, Conbach's α, and composite reliability for the initial (hypothesized) measurement model. From Table 3.14, all the constructs except domain knowledge (DK) and actual use (AU) exhibited close to or above the accepted level of .070. Although most constructs met the criterion of construct reliability, a few items do not have SFLs greater than the .50 recommended value. In order to ensure each construct is psychometrically sound, most of the items having an SFL below the .50 threshold were removed (Segars & Grover, 1993). The reason for retaining a couple of

items whose SFLs were less than .50 is because they met the recommended value of squared multiple correlation (Taylor & Todd, 1995a) in the parameter estimation of the measurement model, which was discussed in the following section. Considering low item reliabilities of two items measuring the construct domain knowledge (DK), low construct reliability, relative unimportance compared to other variables in the proposed model, and an attempt to reach construct parsimony, domain knowledge (DK) construct was deleted from the measurement model. Although the variable actual use of the selected primary information resource (AU) is not reliable either, considering the importance of this variable in the proposed model, the second item measuring the frequency AU was retained as a single measured item to represent the variable AU in the structural model analysis because it has relatively higher SFL and previous studies used frequency to indicate the construct of resource use (Davis, 1986 & 1989b; Lederer, et al., 2000). The reason for low item reliability and construct reliabilities of these two constructs may be because of the small number of question items used to measure this construct and self-developed measured items without being tested in the previous studies. Table 3.15 lists the retained 56 items measuring 13 constructs and re-computed item reliability and construct reliabilities. All items load highly on the hypothesized constructs. Squared factor loadings range from .432 to .960, Cronbach's α range from .799 to .970, and the composite reliability range from .732 to .958, all close to or exceeding the recommended minimums.

Table 3.14

Initial Test of Item and Construct Reliabilities

Items	Constructs	Standardized Regression Weights (Factor Loadings)	Squared Factor Loadings	Cronbach's α	Composite Reliability ρ	Disposition
Recommended Value		> .7	> .5	> .7	> .7	Retain/Remove
BB1-1	← Perceived usefulness	.859	.738	.887	.927	Retain
BB1-2	← Perceived usefulness	.870	.757			Retain
BB1-3	← Perceived usefulness	.738	.545			Retain
BB1-4	← Perceived usefulness	.792	.627			Retain
BB2-1	← Perceived ease of use	.830	.689	.898	.888	Retain
BB2-2	← Perceived ease of use	.822	.676			Retain
BB2-3	← Perceived ease of use	.870	.757			Retain
BB2-4	← Perceived ease of use	.791	.626			Retain
BB3-1	← Perceived freedom of physical effort	.839	.704	.889	.911	Retain
BB3-2	← Perceived freedom of physical effort	.797	.635			Retain
BB3-3	← Perceived freedom of physical effort	.835	.697			Retain
BB3-4	← Perceived freedom of physical effort	.793	.629			Retain
NB1-1	← Instructor's influence	.830	.689	.691	.693	Retain
NB1-2	← Instructor's influence	.902	.814			Retain
NB1-3	← Instructor's influence	.340	.116			Remove
NB2-1	← Student's influence	.926	.858	.810	.711	Retain
NB2-2	← Student's influence	.863	.699			Retain
NB2-3	← Student's influence	.534	.285			Remove

NB3-1	← Reference librarian's influence	.882	.778	.827	.719	Retain
NB3-2	← Reference librarian's influence	.882	.778			Retain
NB3-3	← Reference librarian's influence	.603	.364			Remove
BI-1	← Selection of primary resource	.832	.692	.846	.796	Retain
BI-2	← Selection of primary resource	.873	.762			Retain
BI-3	← Selection of primary resource	.916	.839			Retain
BI-4	← Selection of primary resource	.452	.204			Remove
AU-1	← Actual use of selected primary information resource	.211	.045	.159	.164	Remove
AU-2	← Actual use of selected primary information resource	.433	.187			Retain
ER-1	← Electronic Resources Characteristics	.566	.320	.911	.903	Remove
ER-2	← Electronic Resources Characteristics	.578	.334			Remove
ER-3	← Electronic Resources Characteristics	.556	.309			Remove
ER-4	← Electronic Resources Characteristics	.601	.361			Remove
ER-5	← Electronic Resources Characteristics	.654	.428			Remove
ER-6	← Electronic Resources Characteristics	.609	.371			Remove
ER-7	← Electronic Resources Characteristics	.779	.607			Retain
ER-8	← Electronic Resources Characteristics	.720	.518			Retain
ER-9	← Electronic Resources Characteristics	.775	.601			Retain
ER-10	← Electronic Resources Characteristics	.728	.530			Retain
ER-11	← Electronic Resources Characteristics	.749	.561			Retain
ER-12	← Electronic Resources Characteristics	.757	.573			Retain
PR-1	← Print Resources Characteristics	.555	.308	.891	.839	Remove
PR-2	← Print Resources Characteristics	.587	.345			Remove
PR-3	← Print Resources Characteristics	.523	.274			Remove

PR-4	← Print Resources Characteristics	.507	.257			Remove
PR-5	← Print Resources Characteristics	.563	.317			Remove
PR-6	← Print Resources Characteristics	.646	.417			Remove
PR-7	← Print Resources Characteristics	.794	.630			Retain
PR-8	← Print Resources Characteristics	.758	.575			Retain
PR-9	← Print Resources Characteristics	.696	.484			Retain
PR-10	← Print Resources Characteristics	.701	.491			Retain
PR-11	← Print Resources Characteristics	.616	.379			Retain
PR-12	← Print Resources Characteristics	.620	.384			Retain
REF-1	← Reference Services Characteristics	.831	0.691	.970	.958	Retain
REF-2	← Reference Services Characteristics	.855	0.731			Retain
REF-3	← Reference Services Characteristics	.862	0.743			Retain
REF-4	← Reference Services Characteristics	.873	0.762			Retain
REF-5	← Reference Services Characteristics	.852	0.726			Retain
REF-6	← Reference Services Characteristics	.695	0.483			Remove
REF-7	← Reference Services Characteristics	.791	0.626			Retain
REF-8	← Reference Services Characteristics	.782	0.612			Retain
REF-9	← Reference Services Characteristics	.846	0.716			Retain
REF-10	← Reference Services Characteristics	.826	0.682			Retain
REF-11	← Reference Services Characteristics	.754	0.569			Retain
REF-12	← Reference Services Characteristics	.835	0.697			Retain
REF-13	← Reference Services Characteristics	.777	0.604			Retain
REF-14	← Reference Services Characteristics	.793	0.629			Retain
REF-15	← Reference Services Characteristics	.801	0.642			Retain
REF-16	← Reference Services Characteristics	.908	0.824			Retain
DM-1	← Domain knowledge	.211	0.045	.519	.489	Remove
DM-2	← Domain knowledge	.433	0.187			Remove
IL-1	← Information Literacy Skills	.421	0.177	.734	.812	Remove

IL-2	← Information Literacy Skills	.369	0.136			Remove
IL-3	← Information Literacy Skills	.842	0.709			Retain
IL-4	← Information Literacy Skills	.163	0.027			Remove
IL-5	← Information Literacy Skills	.520	0.270			Remove
IL-6	← Information Literacy Skills	.756	0.572			Retain
IL-7	← Information Literacy Skills	.409	0.167			Remove
IL-8	← Information Literacy Skills	.391	0.153			Remove
IL-9	← Information Literacy Skills	.793	0.629			Retain
EXP-1	← Previous experience	.311	0.097	.699	.791	Remove
EXP-2	← Previous experience	.272	0.074			Remove
EXP-3	← Previous experience	.322	0.104			Remove
EXP-4	← Previous experience	.629	0.396			Remove
EXP-5	← Previous experience	.898	0.806			Retain
EXP-6	← Previous experience	.779	0.607			Retain
LE-1	← Library Environment	.577	0.333	.870	.743	Remove
LE-2	← Library Environment	.384	0.147			Remove
LE-3	← Library Environment	.627	0.393			Remove
LE-4	← Library Environment	.604	0.365			Remove
LE-5	← Library Environment	.584	0.341			Remove
LE-6	← Library Environment	.761	0.579			Retain
LE-7	← Library Environment	.554	0.307			Remove
LE-8	← Library Environment	.540	0.292			Remove
LE-9	← Library Environment	.364	0.132			Remove
LE-10	← Library Environment	.488	0.238			Remove
LE-11	← Library Environment	.376	0.141			Remove
LE-12	← Library Environment	.707	0.500			Retain
LE-13	← Library Environment	.543	0.295			Remove
LE-14	← Library Environment	.813	0.661			Retain

Table 3.15

The Revised Measurement Model with 56 Reliable Items

Items	Constructs	Standardized Regression Weights (Factor Loadings)	Squared Factor Loadings	Cronbach's α	Composite Reliability ρ	Disposition
Recommended Value		> .7	> .5	> .7	> .7	Retain/Remove
BB1-1	← Perceived usefulness	.859	0.738	.887	.927	Retain
BB1-2	← Perceived usefulness	.873	0.762			Retain
BB1-3	← Perceived usefulness	.732	0.536			Retain
BB1-4	← Perceived usefulness	.794	0.630			Retain
BB2-1	← Perceived ease of use	.826	0.682	.898	.888	Retain
BB2-2	← Perceived ease of use	.822	0.676			Retain
BB2-3	← Perceived ease of use	.875	0.766			Retain
BB2-4	← Perceived ease of use	.790	0.624			Retain
BB3-1	← Perceived freedom of physical effort	.844	0.712	.889	.911	Retain
BB3-2	← Perceived freedom of physical effort	.790	0.624			Retain
BB3-3	← Perceived freedom of physical effort	.835	0.697			Retain
BB3-4	← Perceived freedom of physical effort	.793	0.629			Retain
NB1-1	← Instructor's influence	.870	0.757	.861	.784	Retain
NB1-2	← Instructor's influence	.868	0.753			Retain
NB2-1	← Student's influence	.980	0.960	.889	.823	Retain
NB2-2	← Student's influence	.817	0.667			Retain
NB3-1	← Reference librarian's influence	.970	0.941	.874	.780	Retain

NB3-2	←	Reference librarian's influence	.800	0.640			Retain
BI-1	←	Selection of primary resource	.831	0.691	.905	.909	Retain
BI-2	←	Selection of primary resource	.871	0.759			Retain
BI-3	←	Selection of primary resource	.918	0.843			Retain
ER-7	←	Electronic Resources Characteristics	.768	0.590	.904	.882	Retain
ER-8	←	Electronic Resources Characteristics	.796	0.634			Retain
ER-9	←	Electronic Resources Characteristics	.841	0.707			Retain
ER-10	←	Electronic Resources Characteristics	.806	0.650			Retain
ER-11	←	Electronic Resources Characteristics	.759	0.576			Retain
ER-12	←	Electronic Resources Characteristics	.718	0.516			Retain
PR-7	←	Print Resources Characteristics	.810	0.656	.890	.839	Retain
PR-8	←	Print Resources Characteristics	.802	0.643			Retain
PR-9	←	Print Resources Characteristics	.799	0.638			Retain
PR-10	←	Print Resources Characteristics	.752	0.566			Retain
PR-11	←	Print Resources Characteristics	.711	0.506			Retain
PR-12	←	Print Resources Characteristics	.682	0.465			Retain
REF-1	←	Reference Services Characteristics	.828	0.686	.970	.958	Retain
REF-2	←	Reference Services Characteristics	.849	0.721			Retain
REF-3	←	Reference Services Characteristics	.860	0.740			Retain
REF-4	←	Reference Services Characteristics	.870	0.757			Retain
REF-5	←	Reference Services Characteristics	.849	0.721			Retain
REF-7	←	Reference Services Characteristics	.793	0.629			Retain
REF-8	←	Reference Services Characteristics	.783	0.613			Retain
REF-9	←	Reference Services Characteristics	.852	0.726			Retain
REF-10	←	Reference Services Characteristics	.830	0.689			Retain
REF-11	←	Reference Services Characteristics	.755	0.570			Retain
REF-12	←	Reference Services Characteristics	.838	0.702			Retain

REF-13	← Reference Services Characteristics	.778	0.605			Retain
REF-14	← Reference Services Characteristics	.794	0.630			Retain
REF-15	← Reference Services Characteristics	.802	0.643			Retain
REF-16	← Reference Services Characteristics	.909	0.826			Retain
IL-3	← Information Literacy Skills	.881	0.776	.843	.913	Retain
IL-6	← Information Literacy Skills	.725	0.526			Retain
IL-9	← Information Literacy Skills	.811	0.658			Retain
EXP-5	← Previous experience	.849	0.721	.829	.888	Retain
EXP-6	← Previous experience	.834	0.696			Retain
LE-6	← Library Environment	.657	0.432	.809	.732	Retain
LE-12	← Library Environment	.754	0.569			Retain
LE-14	← Library Environment	.925	0.856			Retain

Construct Validity

A measure may be reliable but not valid, but it cannot be valid without being reliable (Neuman, 2006). However, although 13 variables demonstrate acceptable item reliability and construct reliabilities, the reliability estimates may not be sufficient when unidimensionality is considered. Unidimensionality means "an assumption underlying the calculation of reliability and is demonstrated when the indicators of construct have acceptable fit on a single-factor (one-dimension) model" (Hair et al, 1995). Cronbach's α and composite reliability do not guarantee construct validity. Convergent validity and discriminant validity should therefore be considered.

Convergent validity is when, in the presence of other items for other constructs, the items in a given construct move in the same direction and thus are highly correlated (Campbell & Fiske, 1959). In simple words, items of constructs that theoretically should be related to each other are, in fact, observed to be related to each other. This differs from the reliability test in that the reliability test includes only the items for a single construct and do not compare to other constructs. Convergent validity can be tested through average variance extracted (AVE). AVE refers to the amount of variance captured by the construct versus the amount due to measurement error. It can be calculated with the formula: $AVE = \sum\lambda i^2/(\sum\lambda i^2+\sum\theta i)$, where λi refers to the i th factor loading and θi to the i th error variance of measured items. It has been suggested that AVE should be greater than .50 to justify using a construct (Barclay, Thompson, & Higgines, 1995). Table 3.16 lists AVEs of 13 constructs in the revised measurement model. In this study, AVEs of all the constructs are close or above the recommended value .50.

Table 3.16

Average Variance Extracted (AVE) of 13 Constructs in the Revised Measurement Model

Variable Name	Constructs	Average Variance Extracted (AVE) > 0.5
USE	Perceived usefulness	0.762
EOU	Perceived ease of use	0.665
FPE	Perceived freedom of physical effort	0.719
INSTR	Instructor's influence	0.645
STU	Student's influence	0.701
REFL	Reference librarian's influence	0.642
BI	Selection of primary resource	0.769
ER	Electronic Resources Characteristics	0.555
PR	Print Resources Characteristics	0.466
REF	Reference Services Characteristics	0.607
IL	Information Literacy Skills	0.778
EXP	Previous experience	0.799
LE	Library Environment	0.481

Discriminant validity refers to items of constructs that theoretically should not be related to each other are, in fact, observed to not be related to each other (Campbell & Fiske, 1959). It represents the degree to which items differentiate among constructs or measure distinct concepts. Discriminant validity is assessed by examining the correlations between the items of potentially overlapping constructs. Items should load more strongly on their own constructs but not on other constructs. The average variance shared between a construct and its measured items should be greater than the variance shared between the construct and other constructs (Compeau, Higgins, & Huff, 1999). Fornell and Larcker (1981) suggested that the squared correlations between the constructs should be less than the variance explained by each construct. Table 3.17 provides a shared variance comparison of all 13 constructs. The diagonal row demonstrates the variance of each individual construct extracted from its measured items (Fornell &

Larcker, 1981), which are larger than other values in the corresponding construct column. Therefore, all 13 constructs in this study met the requirement of discriminant validity.

Table 3.17

Discriminant Validity Table

Constructs	USE	EOU	FPE	INSTR	STU	REFL	BI	ER	PR	REF	IL	EXP	LE
USE	**.762**												
EOU	.424	**.665**											
FPE	.462	.543	**.719**										
INSTR	.118	.048	.117	**.645**									
STU	.028	.010	.080	.271	**.701**								
REFL	.075	.013	.093	.291	.240	**.642**							
BI	.278	.086	.195	.030	.035	.061	**.769**						
ER	.259	.412	.176	.108	.001	.044	.092	**.555**					
PR	.013	.045	.011	.021	.004	.005	.008	.060	**.466**				
REF	.094	.046	.031	.080	.012	.098	.102	.123	.088	**.607**			
IL	.004	.077	.016	.076	.061	.024	.002	.116	.002	.010	**.778**		
EXP	.046	.236	.023	.035	.033	.007	.009	.111	.007	.021	.183	**.799**	
LE	.025	.025	.032	.062	.002	.011	.004	.070	.164	.211	.009	.048	**.481**

Standardized Factor Loading and the Squared Multiple Correlation

Although the retained 56 items comprising 13 variables met the requirements of reliability and validity, in order to verify the psychometrical soundness, parameter estimates of the measurement model need to be statistically significant. The two popular parameter estimates are item standardized factor loadings with a significance test (*t* statistic) and squared multiple correlations.

Standardized factor loadings are standardized regression weight of items relating to their purported constructs. The statistical significance is calculated by dividing the unstandardized regression weight by its standard error. At the .05 alpha level (two tailed), parameters (i.e. item factor loadings) associated with *t* values of ±1.96 or greater are statistically significant. Item factor loadings with *t* values less than ±1.96 are statistically nonsignificant and might be considered unnecessary to the measurement model (Brown, 2006, p.125). Squared multiple correlation of each item is the squared standardized factor

loading of each item. It indicates the shared substantial variance with their hypothesized constructs. The recommended criteria for squared multiple correlation is .40 (Taylor & Todd, 1995a). Table 3.18 shows that all of the retained 56 items in the revised model were loaded highly on their corresponding constructs, the *t* values were greater than 2.0, and squared multiple correlations exceeded the recommended value of .40.

Table 3.18

Parameter Estimates for the Revised Measurement Model

Items	Constructs	Standardized Regression Weights (Factor Loadings)	T-values	Squared Multiple Correlation
Recommended Value		> .7	> ±1.96	> .4
BB1-1	← Perceived usefulness	.859**	--*	.737
BB1-2	← Perceived usefulness	.873**	12.704	.761
BB1-3	← Perceived usefulness	.732**	9.733	.536
BB1-4	← Perceived usefulness	.794**	10.988	.630
BB2-1	← Perceived ease of use	.826**	--*	.682
BB2-2	← Perceived ease of use	.822**	11.170	.676
BB2-3	← Perceived ease of use	.875**	12.246	.765
BB2-4	← Perceived ease of use	.790**	10.537	.624
BB3-1	← Perceived freedom of physical effort	.844**	--*	.712
BB3-2	← Perceived freedom of physical effort	.790**	10.660	.624
BB3-3	← Perceived freedom of physical effort	.835**	11.573	.697
BB3-4	← Perceived freedom of physical effort	.793**	10.725	.629
NB1-1	← Instructor's influence	.870**	--*	.757
NB1-2	← Instructor's influence	.868**	9.787	.754
NB2-1	← Student's influence	.980**	--*	.960
NB2-2	← Student's influence	.817**	9.869	.668
NB3-1	← Reference librarian's influence	.970**	--*	.941
NB3-2	← Reference librarian's influence	.800**	9.195	.640
BI-1	← Selection of primary resource	.831**	--*	.691
BI-2	← Selection of primary resource	.871**	12.206	.758
BI-3	← Selection of primary resource	.918**	12.934	.843

ER-7	←	Electronic Resources Characteristics	.768**	--*	.589
ER-8	←	Electronic Resources Characteristics	.796**	8.837	.633
ER-9	←	Electronic Resources Characteristics	.841**	9.327	.706
ER-10	←	Electronic Resources Characteristics	.806**	8.945	.649
ER-11	←	Electronic Resources Characteristics	.759**	8.426	.576
ER-12	←	Electronic Resources Characteristics	.718**	8.525	.516
PR-7	←	Print Resources Characteristics	.810**	--*	.656
PR-8	←	Print Resources Characteristics	.802**	9.270	.644
PR-9	←	Print Resources Characteristics	.799**	9.234	.639
PR-10	←	Print Resources Characteristics	.752**	9.362	.565
PR-11	←	Print Resources Characteristics	.711**	8.140	.506
PR-12	←	Print Resources Characteristics	.682**	7.772	.465
REF-1	←	Reference Services Characteristics	.828**	--*	.685
REF-2	←	Reference Services Characteristics	.849**	12.328	.720
REF-3	←	Reference Services Characteristics	.860**	12.592	.739
REF-4	←	Reference Services Characteristics	.870**	12.859	.758
REF-5	←	Reference Services Characteristics	.849**	12.342	.721
REF-7	←	Reference Services Characteristics	.793**	11.089	.629
REF-8	←	Reference Services Characteristics	.783**	10.887	.614
REF-9	←	Reference Services Characteristics	.852**	12.398	.725
REF-10	←	Reference Services Characteristics	.830**	11.896	.689
REF-11	←	Reference Services Characteristics	.755**	10.302	.569
REF-12	←	Reference Services Characteristics	.838**	12.079	.702
REF-13	←	Reference Services Characteristics	.778**	10.768	.605
REF-14	←	Reference Services Characteristics	.794**	11.117	.631
REF-15	←	Reference Services Characteristics	.802**	11.281	.643
REF-16	←	Reference Services Characteristics	.909**	13.871	.827
IL-3	←	Information Literacy Skills	.881**	--*	.777
IL-6	←	Information Literacy Skills	.725**	8.904	.526
IL-9	←	Information Literacy Skills	.811**	9.943	.658
EXP-5	←	Previous experience	.849**	--*	.721
EXP-6	←	Previous experience	.834**	7.639	.695
LE-6	←	Library Environment	.657**	--*	.432
LE-12	←	Library Environment	.754**	9.189	.568
LE-14	←	Library Environment	.925**	7.909	.855

Note. * First path was set to 1, therefore, no SE or *t*-value are given;
** indicates significant factor loading at $t > \pm 1.96$

Thus far, the measures of each latent variable were psychometrically sound with item and construct reliabilities and validity, as well as the factor loadings statistical

significance testing meeting the criteria. There were a total of 56 items compromising 13 variables in the revised measurement model, which is presented in Table 3.19 and depicted in Figure 3.2.

Table 3.19

Retained Variables and the Number of Measured Items in the Revised Model

	Variable	Abbreviation	Number of Measured Items
1	Selection of a primary information resource	BI	3
2	Perceived usefulness	USE	4
3	Perceived ease of use	EOU	4
4	Perceived freedom of physical effort	FPE	4
5	Instructors' influence	INSTR	2
6	Classmate's influence	STU	2
7	Reference librarian's influence	REFL	2
8	Electronic resources characteristics	ER	6
9	Print resources characteristics	PR	6
10	Reference services characteristics	REF	15
11	Information literacy skills	IL	3
12	Previous experience	EXP	2
13	Library environment	LE	3
	Total	**13**	**56**

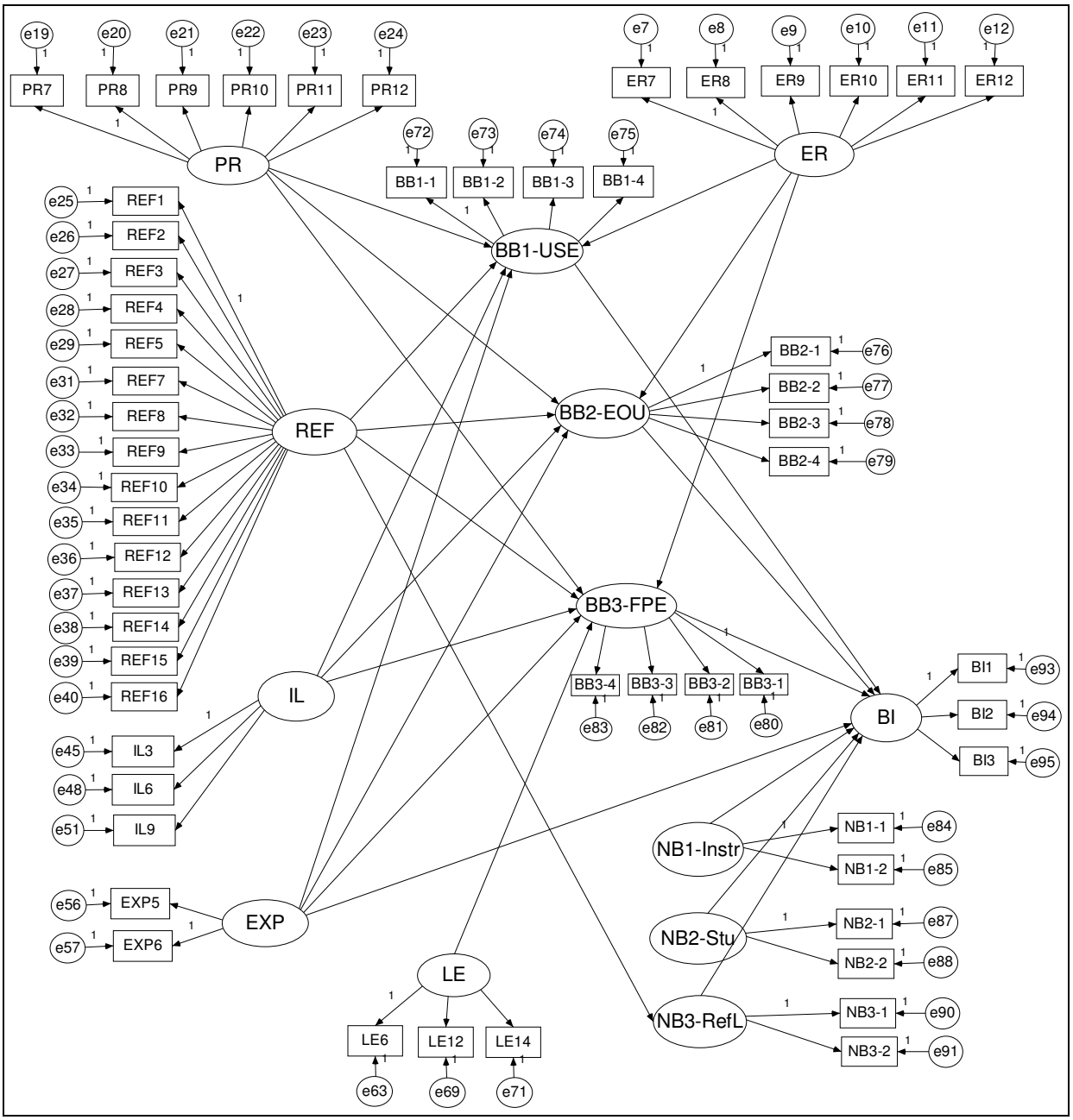

Figure 3.2. Revised measurement model with 56 items comprising 13 latent variables.

SEM Structural Model Analysis

When the requirements of reliability and validity in the measurement model are met, the next step is to estimate the structure model. Bryne (2001) asserts that a measurement model is basically a confirmative factor analysis and deals with the relation

of the indicator variables to the latent constructs while a structure model relates to the causal relationships of the latent variables and any additional observed or manipulated variables. AMOS 7.0 Graphics was used to run the structural model and test the hypothesized relationship between constructs. Maximum likelihood estimation was employed to compute structure coefficients between latent variables. Chi-square (X^2), Chi-square X^2/df, Goodness of Fit (GFI), Adjusted Goodness of Fit (AGFI), Norm Fit Index (NFI), Comparative Fit Index (CFI), Root Mean Square Residual (RMR), and Root Mean Square Error of Approximation (RMSEA) were used to evaluate model fit (Jöreskog & Sörbom, 1996; Meyers, Gamst, & Guarino, 2006). In addition, causal paths were interpreted as standardized coefficients in a regression analysis. Predictive power was examined with squared multiple correlations (R^2) for each endogenous variable.

Overall Goodness-of-Fit Statistics

The SEM is a statistical method to evaluate the plausibility of the proposed model (i.e., the relationships between the variables). The goodness-of-fit of the model is evaluated to compare the proposed model with the relationships existent in the actual or observed data. If the proposed model and the actual or observed relationships are consistent with each other, then the model fits the data and can be considered a credible explanation for the hypothesized relationships. Model fit indices are used as statistic to evaluate model fit. Over the past 20 years, at least 24 fit indexes have been proposed (Klem, 2000) and there is presently no general agreement on which measures are preferred. Researchers therefore recommend the use of multiple fit criteria. The following model fit indices are commonly used as model fit criteria: Chi-square (X^2), Chi-square X^2/df, Goodness of Fit (GFI), Adjusted Goodness of Fit (AGFI), Norm Fit Index (NFI),

Comparative Fit Index (CFI), Root Mean Square Residual (RMR), and Root Mean Square Error of Approximation (RMSEA) (Joreskog & Sorbom, 1993; Meyers, Gamst, & Guarino, 2006). Among them, Chi-square (X^2), Goodness of Fit (GFI), Root Mean Square Residual (RMR), and Root Mean Square Error of Approximation (RMSEA) are classified as absolute fit measures; Index (CFI) and Norm Fit Index (NFI) Comparative Fit relative fit measures; and Adjusted Goodness of Fit (AGFI) parsimonious fit measure (Meyers, Gamst, & Guarino, 2006, p.559).

X^2 value tests the difference between the proposed and the observed relationships. With this index, significant values indicate poor model fit, whereas nonsignificant values indicate good fit. While the X^2 value is easily influenced by the sample size, the ratio of Chi-square to its degree of freedom, X^2/df, is also used to indicate a good fit. It is suggested that a ratio of 3:1 or less indicates an adequate fit (Carmines & Maclver, 1981).

GFI is conceptually similar to the R2 in multiple regression (Kline, 2005). It measures the amount of variances and covariances jointly attributed to the model. The index ranges from 0 to 1, where 1 indicates a perfect fit. GFI should be equal to or greater than .90 as indicative of an acceptable model (Hu, & Bental, 1999).

RMR and RMSEA measure the average residuals between actual/observed covariance and the proposed/expected model covariance. It is suggested that an RMR less than .09 and a RMSEA less than .10 indicates that a mode is acceptable (Hu & Bental, 1999).

CFI and NFI indicate the relative position between the independent model, which assumes that there are no relationships in the data (thus a poor fit), and the saturated

model, which assumes a perfect fit. Both CFI and NFI are suggested to be greater than .90 for an acceptable model (Hu, & Bental, 1999)

AGFI is the parsimonious adjusted goodness of fit and "corresponds to the GFI in replacing the total sum of squares by the mean sum of squares" (Meyers, Gamst, & Guarino, 2006, p.560). Ideally, values greater than .80 indicate an acceptable model (Hu, & Bental, 1999).

The structural model defines causal relationships among the latent variables. It is accomplished primarily through path analysis with latent variables. Overall Goodness-of-Fit indexes were used to compare the proposed model with the relationships existent in the actual or observed data. The results of the analysis, including a standardized coefficient, t-statistic, and p value for each hypothesized causal relationship, and total variance explained for each dependent variable were reported in the following section.

Initial Structure Model

The structure model for this study included all 13 variables from the measurement model and the actual use (AU) variable with a single measured item (see Figure 3.3). In the model, electronic resource characteristics (ER), print resources characteristics (PR), reference services characteristics (REF), information literacy skills (IL), previous experience (EXP), and library environment (LE) are exogenous variables while others are endogenous variables. Again, for the interest of clarity, all double-headed arrows representing correlations among the exogenous variables have been excluded from the figure. Each endogenous variable has an associated residual variance (Res 1 to Res8), which indicates the variance that is not accounted for by its independent variables. Each residual variance was scaled with "1" for the purpose of model identification.

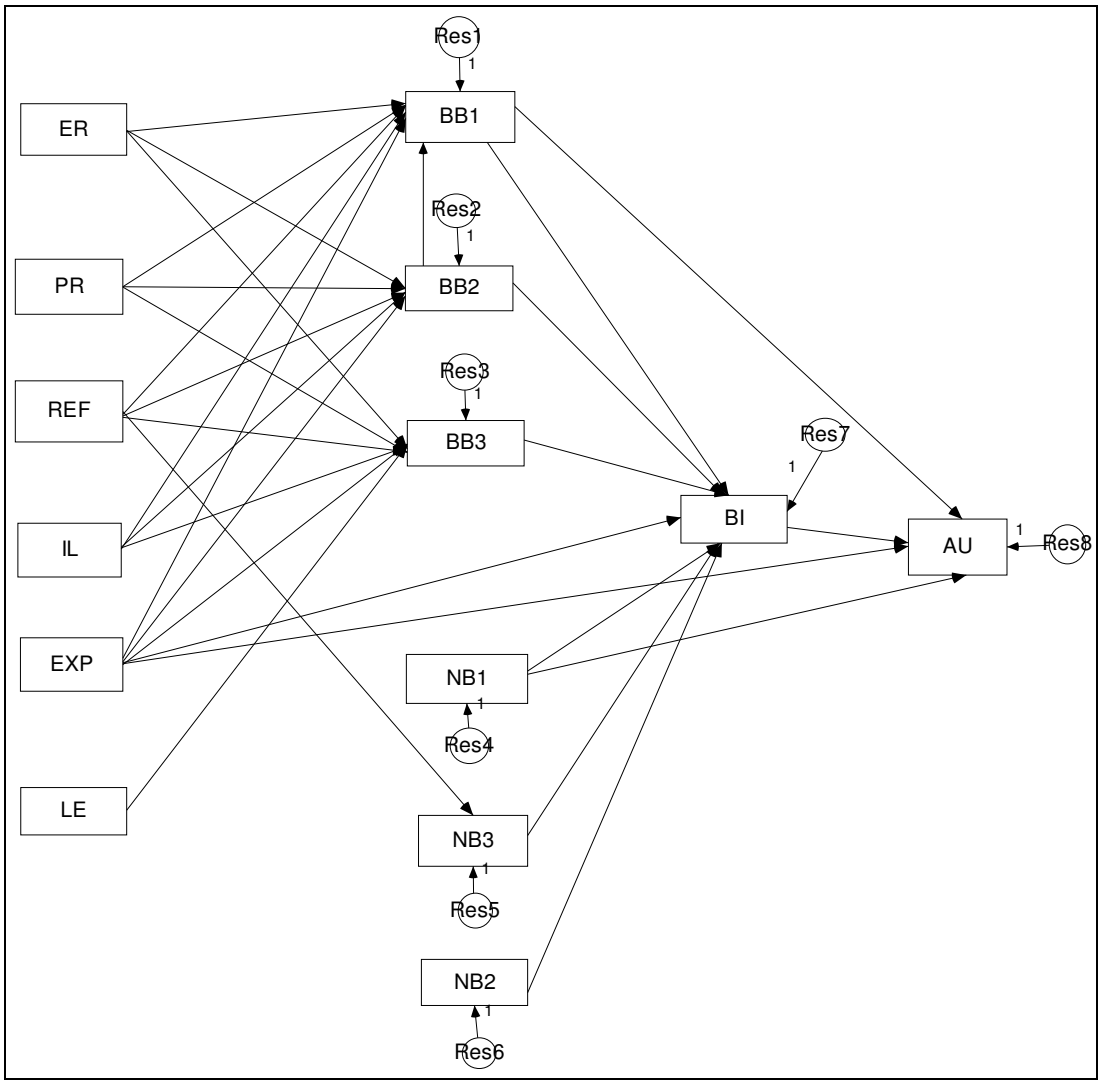

Figure 3.3. Initial structure model of the proposed research model.

In the structural modeling, multiple items for each construct were summed together and then divided by the numbers of the items included. Thus, an index number was created with the mean score of items comprising the corresponding construct. According to Grapentine (2000, p.14), summated scales "help manage multicollinearity's effects on the estimation of regression coefficients and second, they help focus attention on more fundamental dimensions, of which the individual attributes are indicators." Since two constructs, student's influence and reference librarian's influence, have items with

squared factor loading values greater than .90, which may suggest multicollinearity (Kline, 2005), using mean score of items for the structural modeling analysis is reasonable. Although multiple items were averaged, the estimation of measurement errors of observed variables (i.e. items) is included in modeling, and the constructs and their hypothesized relations are tested simultaneously in the SEM (Bryne, 2001).

Overall Goodness-of-Fit of the Initial and the Final Structure Models

Based on the aforementioned guideline and criteria, causal paths among latent variables were examined. An initial test was performed on the initial model depicted in Figure 3.3. The overall X^2 value, with the degree of freedom of 138, was 340.379. Other model fit indices for this initial model were X^2/df = 2.467, GFI = .803, AGFI =.700, NFI = .730, CFI = .811, RMR = .157, and RMSEA = .105. Except X^2/df, all other indices did not meet the required minimums for accepting a model, indicating a poor model fit. A poor model fit can be captured by the modification indices (MI) in AMOS 7.0. Based on the MI values, ten causal paths were suggested to add to improve the model fit and all the suggested paths are substantial and can be explained based on the previous studies and the real-life situation. These ten suggested paths were not detected by the researcher through the literature review process. The suggested paths included: 1) from instructor's influence (INSTR) to student's influence (STU), 2) reference librarian's influences (REFL) to student's influence (STU), 3) reference librarian's influence (REFL) to instructor's influence (INSTR), 4) perceived ease of use (EOU) to perceived least physical effort (FPE), 5) instructor's influence (INSTR) to perceived usefulness (USE), 6) reference librarian's influence (REFL) to perceived freedom of physical effort (FPE), 7) from reference services characteristics (REF) to behavior intention (BI), 8) from library

environment (LE) to behavior intention (BI), 9) from information literacy skills (IL) to instructor's influence (INSTR), and 10) from library environment (LE) to instructor's influence (INSTR). The model was modified and examined again and all the model fit indices evidenced good support for the final structure model of the proposed model with an overall X^2 value of 136.298 with 126 degree of freedom. Table 3.20 presents the summary fitting results for both the initial and final model with the recommended values as reference. Figure 3.4 shows the final structure model with suggested causal paths highlighted in bold. All double-headed arrows representing correlations among the exogenous variables have been excluded from the figure for the purpose of clarity.

Table 3.20

Reported Values of Model Fit for the Structure Model

Model Fit Measures	Recommended Values	Values from Initial Model	Values from Final Model	Conclusion
Chi-square (X^2)	$P \geq 0.05$	P = 0.000	P = .250	Fit
Chi-square (X^2)/df	≤ 3.00	2.467	1.082	Fit
Goodness of Fit (GFI)	≥ 0.90	0.803	0.914	Fit
Adjusted Goodness of Fit (AGFI)	≥ 0.80	0.700	0.856	Fit
Norm Fit Index (NFI)	≥ 0.90	0.730	0.892	Moderately Fit
Comparative Fit Index (CFI)	≥ 0.90	0.811	0.990	Fit
Root Mean Square Residual (RMR)	≤ 0.09	0.157	0.054	Fit
Root Mean Square Error of Approximation (RMSEA)	≤ 0.10	0.105	0.025	Fit

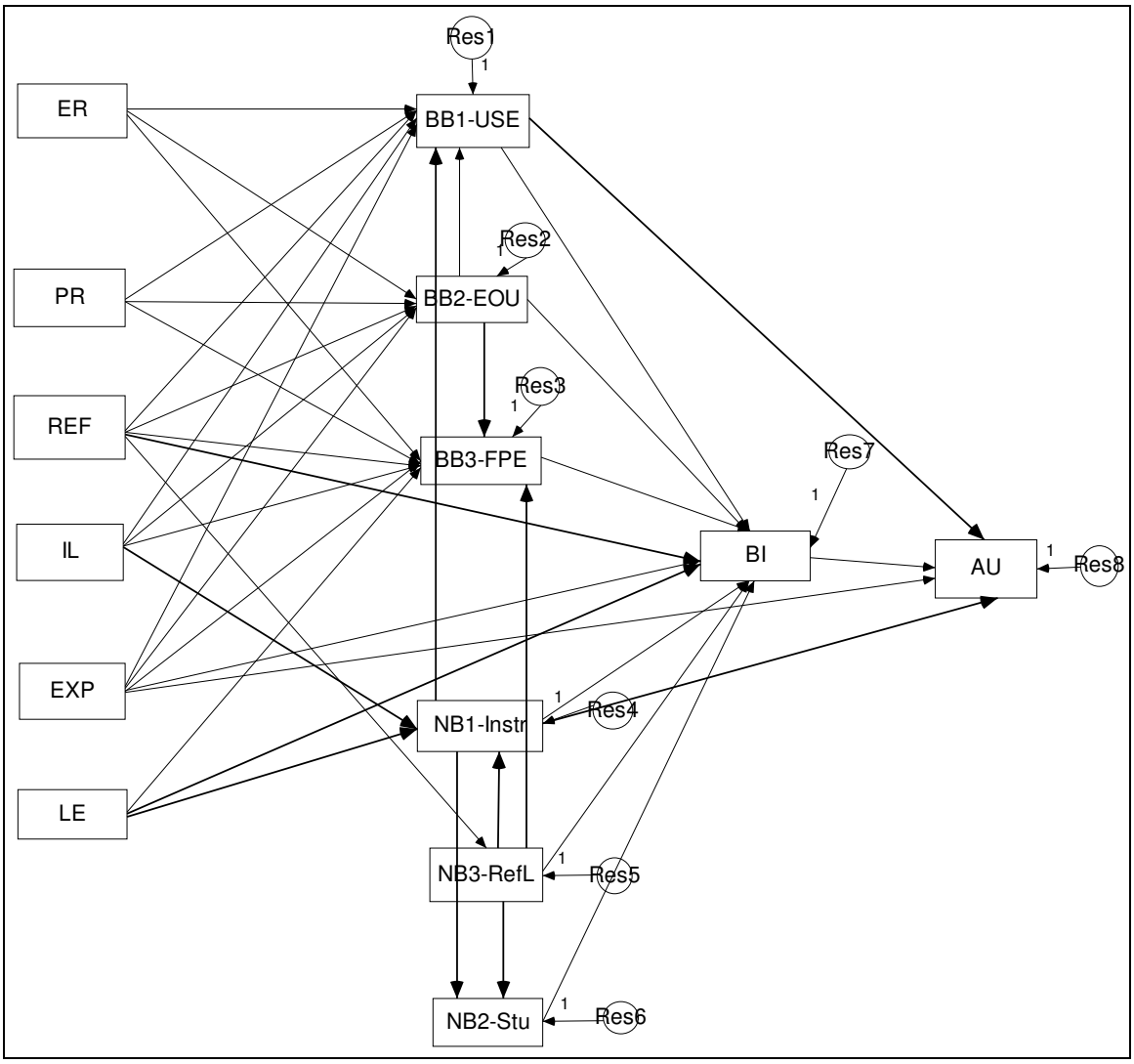

Figure 3.4 Final structure model with all 39 hypothesized causal paths.

Protection of Human Subjects

Reviews by the Campus Institutional Review Board for Human Subject Research from the University of Missouri-Columbia and The Behavioral and Social Science Institutional Review Board from Saint Louis University were completed and approved before conducting the focus group discussions. Participation in this study was completely voluntary. Subjects were informed that they could withdraw from participation at any time without any negative consequences. No direct identifying information was requested

in the focus group discussions, questionnaire pilot testing, and formal questionnaire distribution. There was no treatment and no substantial risks or discomforts that might have occurred as a result of subjects' participation. All records and information collected in this study are confidential.

Chapter Summary

This chapter presented the proposed research model and 32 hypotheses to be tested in this study. In addition, the chapter also described the overall research design, the instruments and measures, and the data collection procedures. The detailed data analysis techniques and procedures, including data screening, CFA measurement model estimation, and SEM structure model analysis, were also reported. After CFA measurement model estimation, there were a total of 56 items retained in the model measuring 13 latent variables. With psychometric soundness of 56 items and 13 variables, the Overall Goodness-of-Fit of the model and the significant causal paths were tested. The following chapter will present the study findings.

Chapter IV
Findings

Overview

This chapter reports findings of the study. Questionnaire response rate and demographic description of the study participants are reported first. The rest of the chapter is organized in the order of seven research questions with the corresponding hypothesis results.

Total Questionnaire Responses and Valid Responses

This study included all students (N=282) enrolling in the School of Public Health during the academic year of 2006-2007. There were 160 (160/282=56.7%) responses to the pre-questionnaire and 135 (135/282=47.9%) to the post-questionnaire. After matching pre- and post-questionnaires and eliminating incomplete questionnaires, a total of 134 (134/282=47.5%) responses to both pre- and post-questionnaires were considered valid and used for the data analysis. The response rates of pre- and post-questionnaires were 83.75% (134/160) and 99.3% (134/135), respectively.

Demographic Description

Gender

Among 134 participants, there were 102 (76.1%) female students and 32 (33.9%) male students. According to the SLU 2006-2007 Fact Book (Saint Louis University, 2007, p. 92), the gender distribution of the School of Public Health in the academic year 2006-2007 is 70.0% female (196/282) and 30.0% male (86/282). The gender ratios of study

participants and all the enrolled students in the School of Public Health in 2006-2007 were close to each other. Therefore, the gender distribution of the sample approximately represents the gender distribution of all the public health students in the school, which is the population of the study.

Age

Most of the student participants were young. As presented in Table 4.1, 58 students' age fell in the range of 21-25, 43 in 26-30, 15 in 31-35, 9 in 36-40, 5 in 41-50, 1 in 46-50, and 2 over 51. There were student representatives in each age range, which reduced the bias of the study findings.

Table 4.1

Age Distributions of the Study Participants

Age Range	Number of Students	Percent (%)	Accumulative (%)
21-25	58	43.3%	43.3%
26-30	43	32.1%	75.4%
31-35	15	11.2%	86.6%
36-40	9	6.7%	93.3%
41-45	5	3.7%	97%
46-50	1	0.8%	97.8%
Over 51	2	1.5%	99.3%
N/A	1	0.7%	100.0%
Total	134	100.0%	100.0%

Education

Of 134 participating students, there were 15 Ph.D. students and 119 Master's students. Twelve students were pursing dual degrees with the Master program in Public Health and degrees provided by other schools, which included M.D., J.D., Ph.D., M.S. in Law, MBA, and Certificate in Law.

Because the SPH only offers graduate level degrees, most of the study participants (90 students) received Bachelor's degrees before enrolling in the public health program and 26 obtained Master's degrees. Ten earned an M.D. degree, one a Ph.D. degree in Molecular Biology, two J.D., one Specialist in Physical Activity & Health, and 4 undergraduate courses (see Table 4.2).

Table 4.2

Highest Degrees Earned before Public Health Program

Degree	Number of Students	Percent (%)	Accumulative (%)
Bachelor's	90	67.2%	67.2%
Master's	26	19.4%	86.6%
Ph.D.	1	0.7%	87.3%
M.D.	10	7.5%	94.8%
J.D.	2	1.5%	96.3%
Specialist	1	0.7%	97.0%
Undergraduate Course	4	3.0%	100.0%
Total	134	100.0%	100.0%

Students possessed a wide variety of health sciences related backgrounds (biology, psychology, nutrition and dietetics, exercise science, preventive medicine, nursing, community health, epidemiology, biochemistry & cellular biology, pharmacy), business background (economics, marketing, business administration, human organizational development), arts and sciences background (social work, political science, religion, American studies, sociology, journalism, organizational studies, health education, bioengineering, health information management, chemistry, and chemical engineering), and the like. Various academic backgrounds reflect the multidisciplinary nature of the Public Health field.

Information Resources Used by Public Health Students

The following section answers the first three research questions (RQ):

RQ1: What information resources are public health students' primary information resources for completing their research papers or projects?

RQ2: Among the following three types of information resources: print, electronic, and human, which type of information resource is primarily used by public health students for completing their research paper or project?

RQ3: Do public health students actually use the resource they initially selected to use for completing their research paper or project assignments?

Primary Information Resource Used

As the present study focused on the format types of information resources (electronic, print, human) instead of publication types of resources (books, journals, etc.), any specific primary resources selected and used by public health students were classified as electronic, print, or human. Based on this classification, the majority of students (114/134 = 85%) selected and used electronic resources as their primary resources. Among electronic resources, online databases, the Internet, and electronic journals were the most popular resources. Print journals, print course materials, and print textbooks or books were mostly used. Faculty in and outside of classes were the only human information resources that were used as the student's primary resources (see Table 4.3). From Table 4.3, there were 121 (121/134 = 90%) students who actually used the same type of primary resources as they intended to use. Of 121 students, 107 used electronic resources, 12 used print, and only 2 used human information resources as their primary information resources. 121 responses were used to test the hypotheses in this study.

Table 4.3

Types of Primary Information Resources Used

Types of Primary Resources	Intend-to-use	Actually Used	No Change from Intend-to-use to Actually Used	Publication Types of Actually Used Primary Resources
Electronic	113	114	107	Online databases, the Internet, E-journals
Print	17	16	12	Print journals, print course materials, print textbooks or books
Human	4	4	2	Faculty in and outside of classes
Total	134	134	121	

Among 13 (134 – 121) students who changed their minds, 7 changed to electronic resources from print and human resources; 4 from electronic to print; 2 from electronic to human (see Table 4.4). The changes of resource types were basically context-based. Depending on the assignment topics and requirements, resource availability, and time constraints, students used the primary resource in a different format. However, the majority of the students still kept their original choice of primary resources.

Table 4.4

Types of Primary Information Resources Change and the Reasons for Change

Resource Types Changes	Number	Reasons
Print -> Electronic	5	Easy to access, contain useful information, full-text articles available, most updated
Human -> Electronic	2	Has a good variety of materials available in one place
Electronic-> Print	4	More relevant to my topic, contains specific information related to the assignment, useful content.
Electronic-> Human	2	No explanations were given
Total	13	

Reasons for Using or Not Using a Primary Information Resource

Students were asked to list three main reasons why they intended to use the primary information resource to finish their assignments. Table 4.5 presents reasons for using or not using electronic, print, and human information resources.

Table 4.5

Reasons for Using or not Using Electronic, Print, and Human Information Resources

Resource Types	Reasons for Use	Reasons for not Use
Electronic	Convenience, ease of access, ease of use, large amount of information, reliable, and quick.	Not always peer-reviewed; not considered acceptable sources of information in a scholarly paper; full-text not always available; and less easy to access
Print	Peer-reviewed publications, convenient, easy to read, and required sources	Inconvenient; need more time; content is outdated; not easy to find relevant information; not easy to access; not readily available; too specific/lack of information, and other cost factors
Human	Easy to access, reliable, and can provide diversity of opinions	Take more time; not have the range and depth of knowledge; not scientifically valid; hard to get a hold of; hard to access; less convenient, and psychological factors

Summary

Electronic information resources were primarily used by public health students to complete their paper assignments and projects. Among the electronic resources, online databases, the Internet, and electronic journals were the most popular resources. Print journals, print course materials, and print textbooks or books were mostly used among print resources. Faculty in and outside of classes were the only human information

resources that were used as the students' primary resources. The majority of students (121/134 = 90%) actually used the primary resources that they intended to use.

Findings on Hypothesized Causal Paths

Overall Results of Hypotheses

There were a total of 39 causal paths in the final structure model with three hypothesized causal paths associated with the domain knowledge construct removed and with 10 suggested causal paths (Figure 3.4, p. 162) added. Among these 39 hypotheses, there are a total of 20 hypotheses (51.3%) were statistically significant. The statistical significance (*t* value) was calculated by dividing the unstandardized regression weight by its standard error. At the .05 alpha level (two tailed), causal path coefficients with *t* values ±1.96 or greater were statistically significant. Table 4.6 presents the hypothesized relationships, standardized coefficient, *t* value, and results. Figure 4.1 presents the structural model with 20 causal paths with statistical significance.

Table 4.6

Results of Hypotheses Testing from the Structure Model

Hypotheses	From	To	Standardized Coefficient	T-value (≥ ±1.96)	Results
H0a	Selection of Resource	Actual Use	0.171	1.548	Unsupported
H0b	Perceived Usefulness	Actual Use	0.265	2.374	Supported
H0c	Instructor's Influence	Actual Use	0.223	2.655	Supported
H1a	Perceived Usefulness	Selection of Using Resource	0.515	3.497***	Supported
H1b	Perceived Ease of Use	Selection of Using Resource	0.432	1.816	Unsupported
H1c	Perceived Freedom of Physical Effort	Selection of Using Resource	0.542	2.389	Supported
H2a	Instructor's Influence	Selection of Using Resource	0.027	0.278	Unsupported
H2b	Student's Influence	Selection of Using Resource	0.033	0.380	Unsupported

H2c	Reference Librarian's Influence	Selection of Using Resource	0.006	0.054	Unsupported
H3a	Electronic Resources Characteristics	Perceived Usefulness	0.053	0.535	Unsupported
H3b	Electronic Resources Characteristics	Perceived Ease of Use	0.519	5.687***	Supported
H3c	Electronic Resources Characteristics	Perceived Freedom of Physical Effort	0.148	1.547	Unsupported
H4a	Print Resources Characteristics	Perceived Usefulness	-0.114	-1.524	Unsupported
H4b	Print Resources Characteristics	Perceived Ease of Use	0.111	1.403	Unsupported
H4c	Print Resources Characteristics	Perceived Freedom of Physical Effort	-0.122	-1.659	Unsupported
H5a	Reference Services Characteristics	Perceived Usefulness	0.162	2.047	Supported
H5b	Reference Services Characteristics	Perceived Ease of Use	-0.028	-0.333	Unsupported
H5c	Reference Services Characteristics	Perceived Freedom of Physical Effort	-0.016	-0.192	Unsupported
H5d	Reference Services Characteristics	Reference Librarian's Influence	0.296	3.577***	Supported
H7a	Information Literacy Skills	Perceived Usefulness	0.118	1.502	Unsupported
H7b	Information Literacy Skills	Perceived Ease of Use	0.024	0.288	Unsupported
H7c	Information Literacy Skills	Perceived Freedom of Physical Effort	0.019	0.264	Unsupported
H8a	Previous Experience	Perceived Usefulness	0.154	1.826	Unsupported
H8b	Previous Experience	Perceived Ease of Use	0.286	3.394***	Supported
H8c	Previous Experience	Perceived Freedom of Physical Effort	0.282	3.408***	Supported
H8d	Previous Experience	Selection of Using Resource	0.087	0.724	Unsupported
H8e	Previous Experience	Actual Use	0.078	0.937	Unsupported
H9a	Library Environment	Perceived Freedom of Physical Effort	0.019	0.254	Unsupported
H10	Perceived Ease of Use	Perceived Usefulness	0.741	6.115***	Supported
Ten Suggested Causal Paths					
H11	Perceived Ease of Use	Perceived Freedom of Physical Effort	0.516	7.748***	Supported
H12	Instructor's Influence	Perceived Usefulness	0.162	2.277	Supported
H13	Instructor's Influence	Student's Influence	0.346	4.060***	Supported
H14	Reference Librarian's Influence	Student's Influence	0.239	2.803	Supported

H15	Reference Librarian's Influence	Instructor's Influence	0.452	6.091***	Supported
H16	Reference Librarian's Influence	Perceived Freedom of Physical Effort	0.213	3.184***	Supported
H5e	Reference Services Characteristics	Selection of Using Resource	0.271	2.756	Supported
H7d	Information Literacy Skills	Instructor's Influence	0.157	2.129	Supported
H9b	Library Environment	Selection of Using Resource	-0.237	-2.612	Supported
H9c	Library Environment	Instructor's Influence	0.158	2.130	Supported

Note. *** $p < .001$

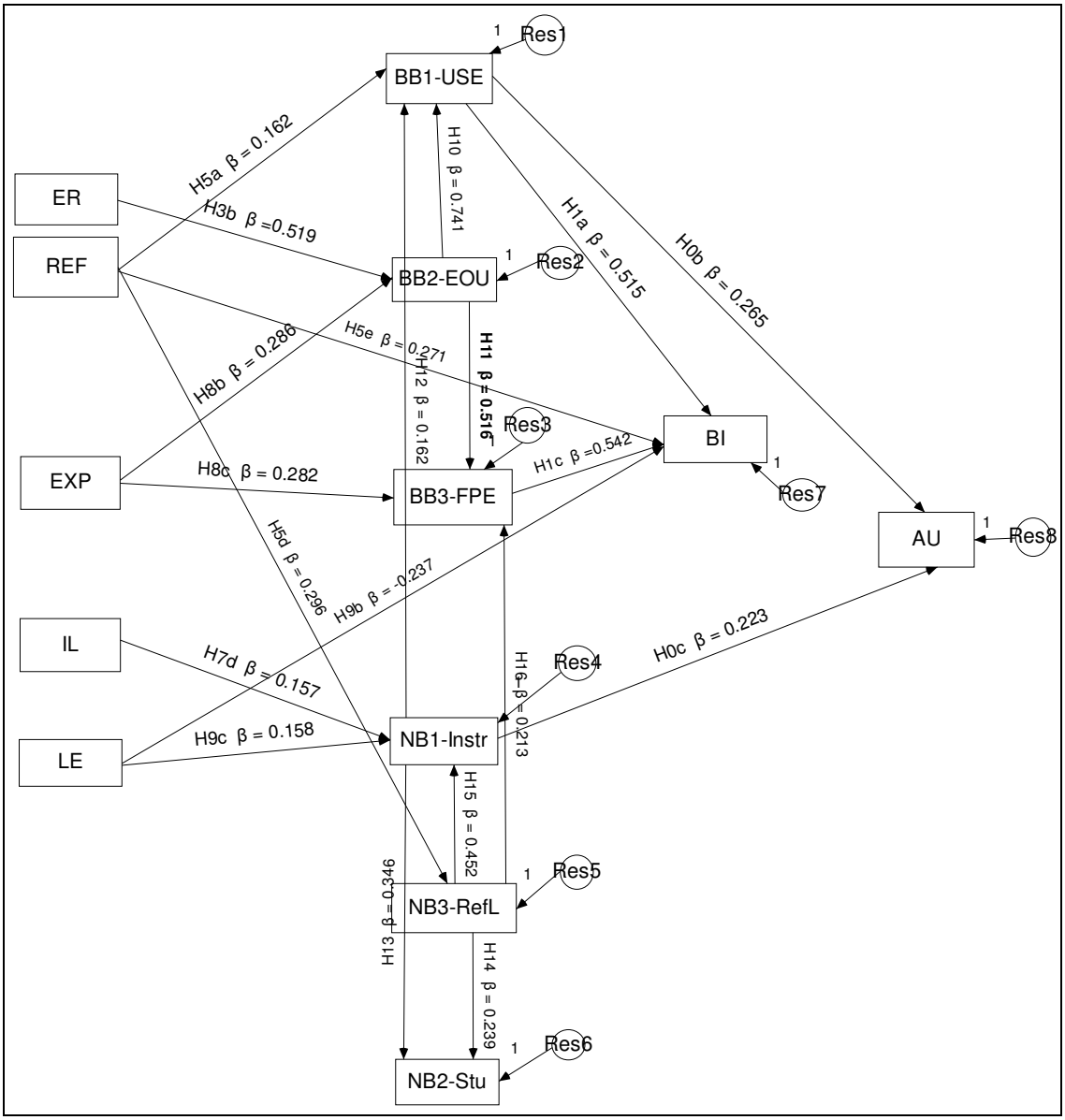

Figure 4.1. Final structural model with 20 significant causal paths.

Predictive Power (R^2)

The coefficient for determination indicated that the model explains 46.1% of the variance associated with selection of a primary resource (BI), 13.1% actual use of the selected primary resource (AU), 58.3% perceived usefulness (USE), 45.6% perceived ease of use (EOU), 77.3% Perceived freedom of physical effort (FPE), 28.1% instructor's influence (INSTR), 25.6% student's influence (STU), and 8.8% reference librarian's influence (REFL).

Behavior Beliefs' Impacts on Behavior Intention

This section answers RQ4.

RQ4: How do public health students' beliefs (behavior beliefs) about the advantages and disadvantages of using a primary information resource (i.e., perceived usefulness, perceived ease of use, and perceived freedom of physical effort of using a primary information resource) influence their selection of using that primary information resource?

In the examination of direct effects on behavior intention (i.e., selection of using the primary resource), as hypothesized, both perceived usefulness (H1a) (β = .515, t = 3.497) and perceived freedom of physical effort (H1c) (β = .542, t = 2.389) were significant predictors on intention of using the primary resource. However, contrary to the formulated hypothesis H1b, perceived ease of use did not significantly impact intention of using the primary resource although it has a moderate coefficient (β = .432, t = 1.816). Although the direct determination of perceived ease of use to behavior intention was not supported in the present study, it had an indirect effect on behavior intention (β = .660) through its two significant direct effects on perceived usefulness (H10) (β = .741,

t = 6.115) and perceived freedom of physical effort (H11, suggested causal path) (β = .516, t = 7.748). Additionally, among three behavior belief constructs, perceived ease of use had the strongest total effect (β = 1.092) on behavior intention, followed by perceived freedom of physical effort (β = .542) and perceived usefulness (β = .515) (see Figure 4.2, Table 4.7).

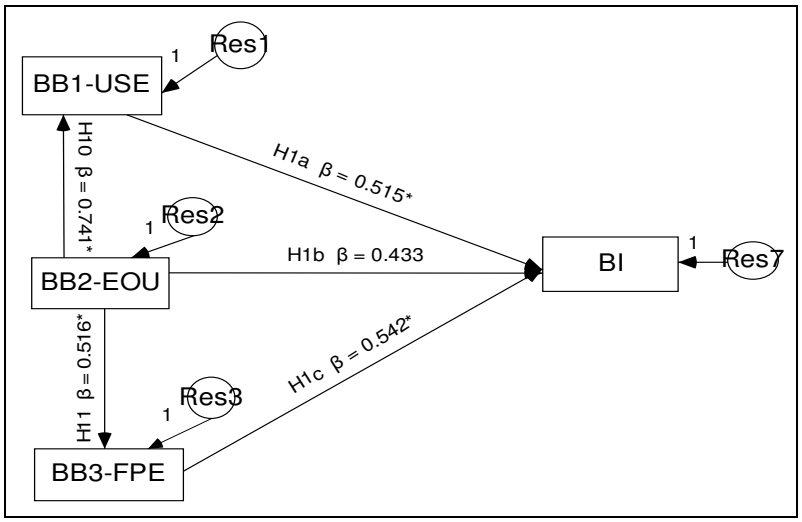

Figure 4.2. Causal paths from behavior beliefs to behavior intention.

Table 4.7

Direct, Indirect, and Total Effects of Three Behavior Beliefs on Behavior Intention

To Behavior Intention (BI)	Direct Effect	Indirect Effect	Total Effect
Perceived Usefulness (USE)	.515*	-	.515*
Perceived Ease of Use (EOU)	.432	.660	1.092*
Perceived Freedom of Physical Effort (FPE)	.542*	-	.542*

Note: * P< 0.05

Normative Beliefs' Impact on specific Behavior Intention

The following section answers RQ5.

RQ5: How do public health students' beliefs (normative beliefs) on specific referent's (e.g., instructors, classmates, and reference librarians) recommendations on

using a primary information resource influence their selection of using that primary information resource?

Contrary to the postulated hypotheses that instructors, classmates, and reference librarians had positive effects on the students' selection of using primary resources (H2a, H2b, and H2c), the present study did not find the direct significant effects of three normative beliefs to behavior intention. However, the study found that the instructor's influence indirectly impacted behavior intention through significantly directly affecting perceived usefulness (H12, suggested causal path) (β = .162, t = 2.277) while the reference librarian's influence impacted by affecting through perceived freedom of physical effort (H16, suggested causal path) (β = .213, t = 3.184) (see Figure 4.3, Table 4.8).

The study also found very interesting significant relationships among three normative beliefs, which are from instructor's influence to students' influence (H13, suggested causal path) (β = .346, t = 4.060), from reference librarian's influence to students' influence (H14, suggested causal path) (β = .239, t = 2.803), and from reference librarian's influence to instructor's influence (H15, suggested causal path) (β = .452, t = 6.091) (see Figure 4.3).

Table 4.8

Direct, Indirect, and Total Effects of Three Normative Beliefs on Behavior Intention

To Behavior Intention (BI)	Direct Effect	Indirect Effect	Total Effect
Instructor's Influence (INSTR)	.027	.095	.122
Student's Influence (STU)	.033	-	.033
Reference Librarian's Influence (REFL)	.006	.161	.167*

Note: * P<0.05

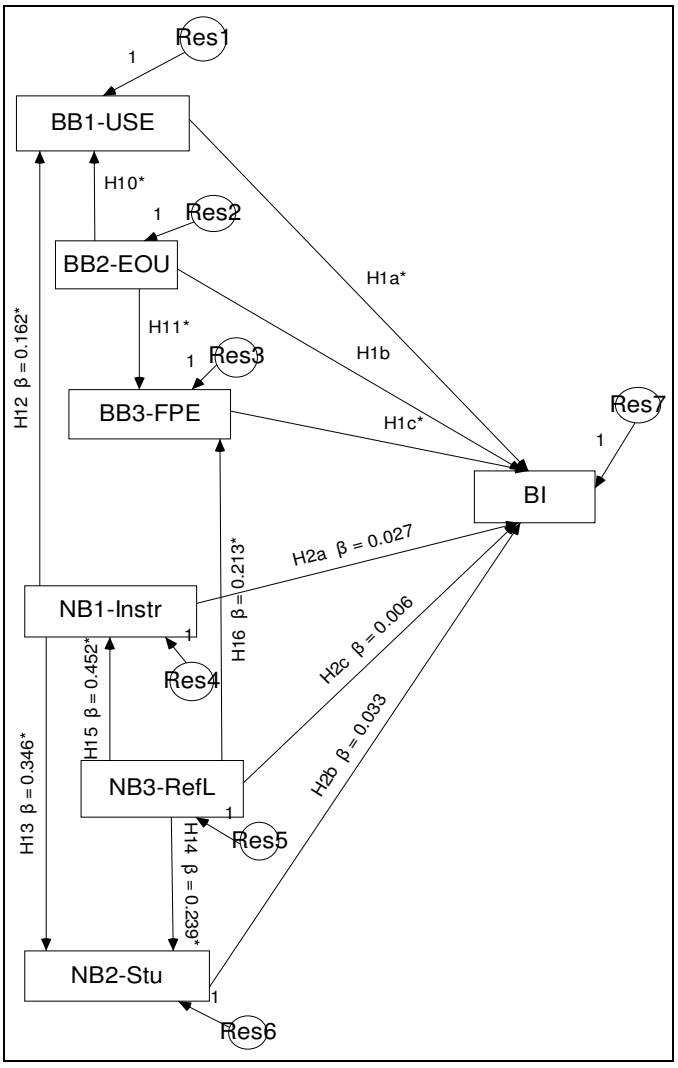

Figure 4.3. Causal paths from normative beliefs to behavior intention.

External Variables' Impacts on Behavior Intention

This section answers RQ6.

RQ6: How do primary information resource characteristics, library environment, and individual differences influence the public health students' selection of using a primary information resource through affecting their behavior beliefs and normative beliefs?

The present study focused on the information resources in three types of format: electronic, print, and human. As one of the purposes of the study was to improve library

collection and services, reference services were classified as one of the human information resources of interest in the present study. Therefore, resource characteristics included the characteristics of electronic resources, print resources, and reference services. The following section reported the findings about the impact of resource characteristics on behavior intention.

Resource Characteristics' Impact

Electronic resources, in the present study, included the resources subscribed by the library (online databases, e-journals, and e-books, etc.) and the resources outside of the library (the Internet resources, such as search engines, Web sites, blogs, and online forum, etc.). It was postulated in the proposed model that perceived electronic resource characteristics (ER) had a positive effect on perceived usefulness (H3a), perceived ease of use (H3b), and perceived freedom of physical effort (H3c) for using electronic resources. However, the study only found the significant impact of ER on perceived ease of use (H3b, β = .519, t = 5.687), but no significant causal paths from ER to perceived usefulness and perceived freedom of physical effort (see Figure 4.4).

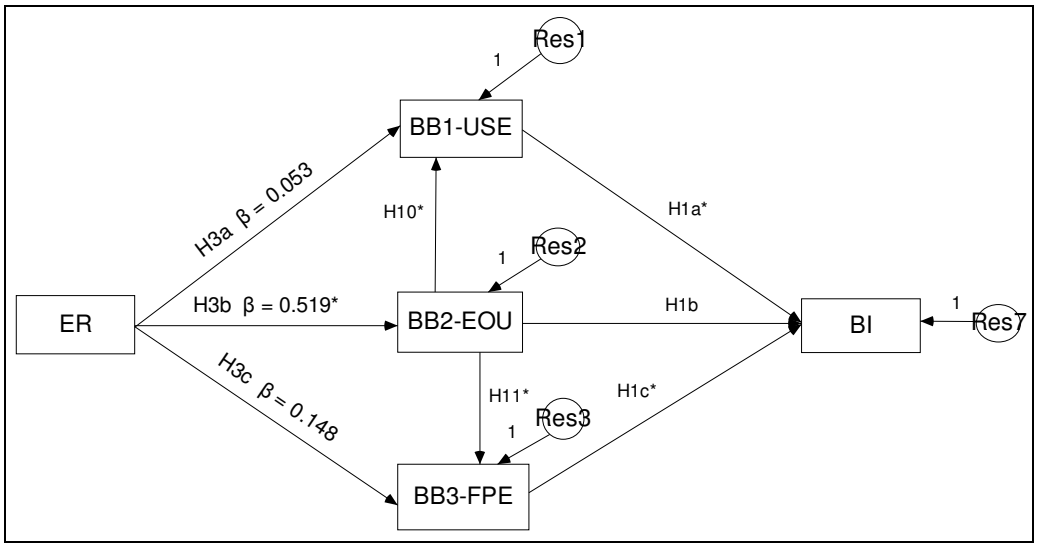

Figure 4.4. Causal paths from electronic resource characteristics to behavior intention.

Print resources, in the present study, included print books/textbooks, journals, course materials, and any other type of publications in print. Not as postulated, perceived print resource characteristics (PR) had not been found significantly influencing three behavior beliefs (H4a, H4b, and H4c) (see Figure 4.5). Interestingly, it was found that PR has negative effects on perceived usefulness and perceived freedom of physical effort.

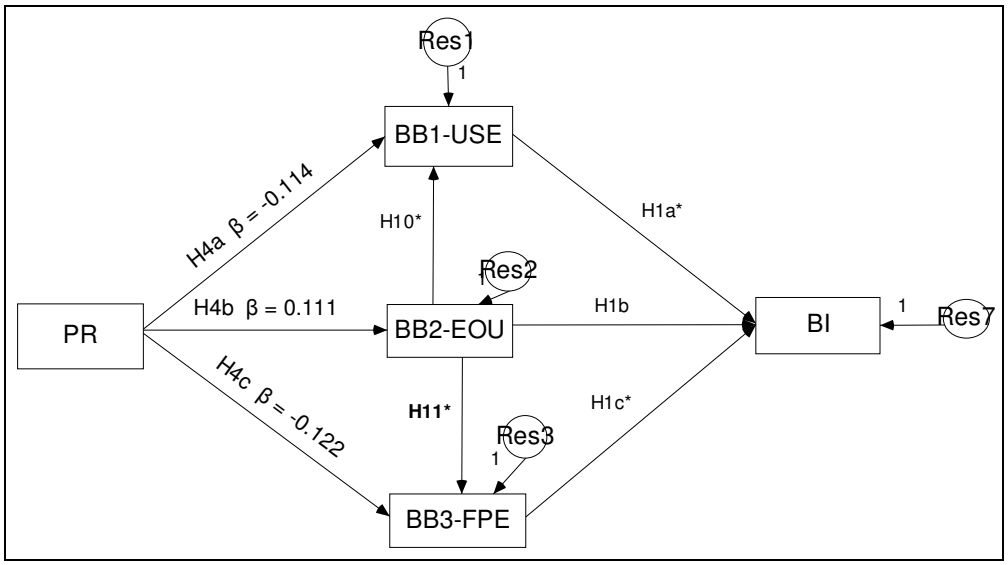

Figure 4.5. Causal paths from print resource characteristics to behavior intention.

Reference services, in the present study, is one type of human information resource. As posited in the proposed model, reference services characteristics (REF) significantly determined perceived usefulness (H5a) (β = .162, t = 2.047) and reference librarian's influence (H5d) (β = .296, t = 3.577). In addition, the direct causal path from REF to behavior intention was also found to be significant (H5e, suggested causal path) (β = .271, t = 2.756) (see Figure 4.6). However, impacts REF had on perceived ease of use (H5b) and to perceived freedom of physical effort (H5c) were not statistically significant.

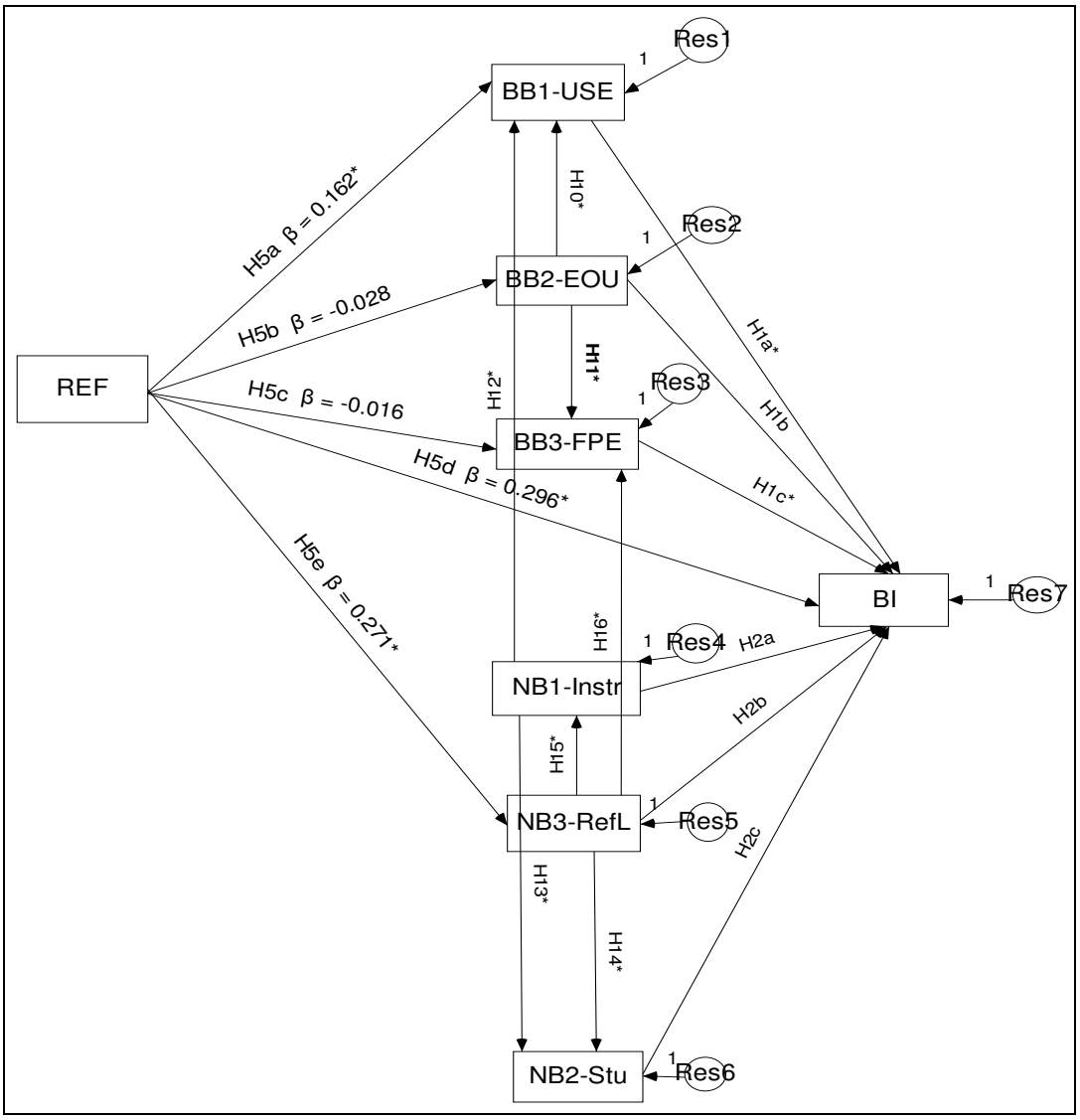

Figure 4.6. Causal paths from reference services characteristics to behavior intention.

Individual Differences' Impact

Domain knowledge, information literacy skills, and previous experience of using the selected primary resource were three individual difference variables included in the proposed model. Due to the unreliability of items measuring the domain knowledge construct, it was removed from the final measurement model and the structure model. The effects of the other two individual difference variables on belief variables and the behavior intention variable were examined.

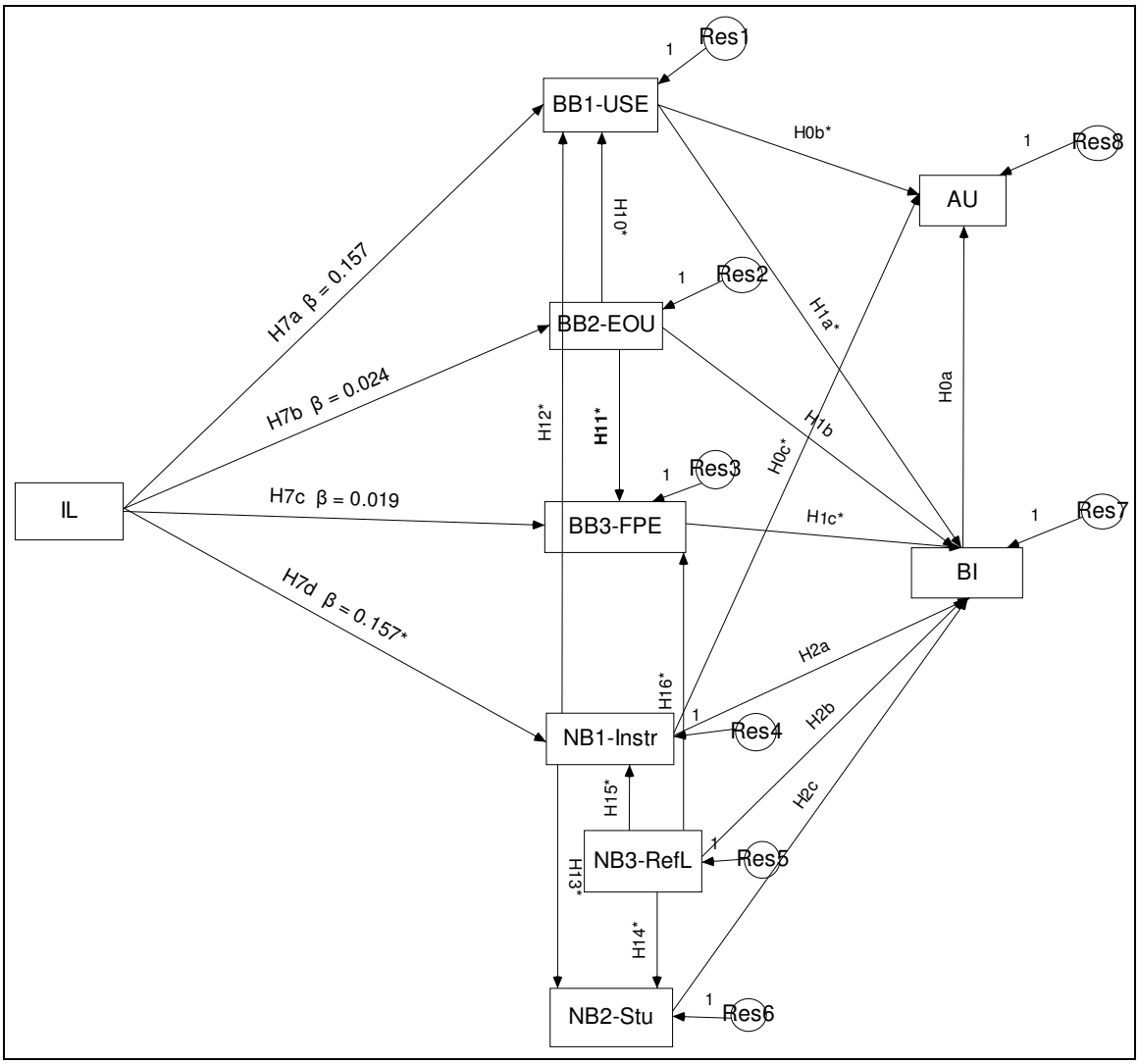

Figure 4.7. Causal paths from information literacy skills to behavior intention.

As shown in Figure 4.7, information literacy skills (IL) were not found to significantly affect perceived usefulness, perceived ease of use, and perceived freedom of physical effort (H7a, H7b, and H7c). However, a suggested causal path from IL to instructor's influence was found significant, which produced the indirect effect that IL had on actual use (H7d, suggested causal path).

As hypothesized, previous experience of using the intend-to-use primary resource had significant direct effects on perceived ease of use (H8b) (β = .286, t = 3.394) and

perceived freedom of physical effort (H8c) (β = .282, t = 3.408) (see Figure 4.8). However, the direct significant effect of previous experience on perceived usefulness (H8a) was not found in this study. Neither did it have an effect on behavior intention (H8d) and actual use (H8e).

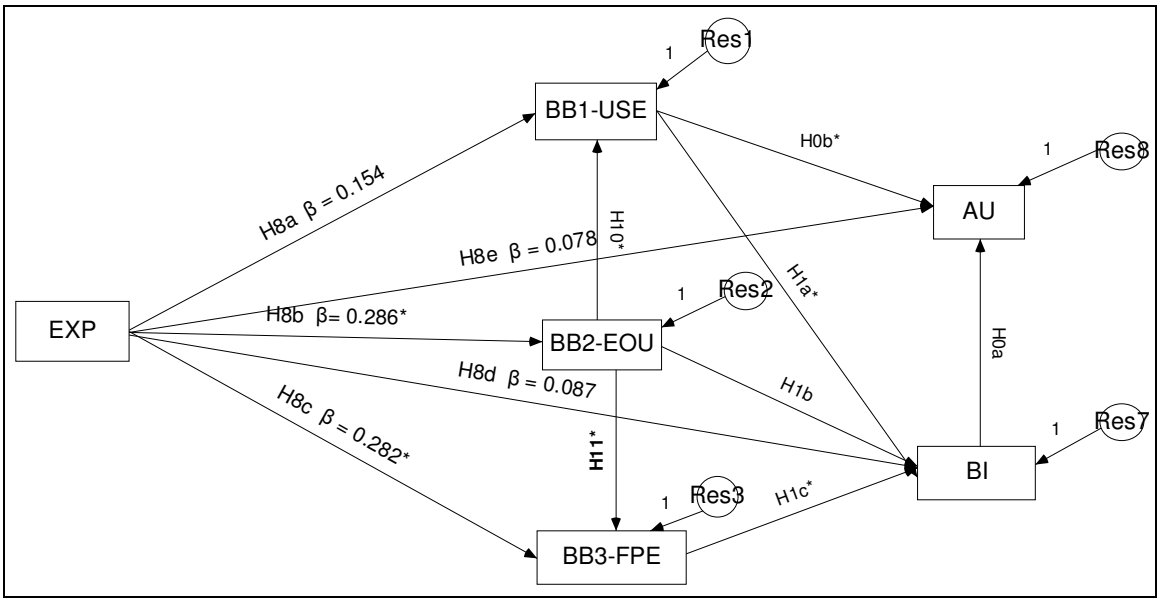

Figure 4.8. Causal paths from previous experience to behavior intention.

Library Environment's Impact

In the present study, the library environment construct was measured through 14 items with three aspects: physical access, resources/facilities and technology support, and library collections and physical arrangement. Contrary to what was postulated, the study did not find the significant effect of library environment (LE) on perceived freedom of physical effort (H9a). However, two significant causal paths were suggested from LE to behavior intention (H9b) (β = -.237, t = -2.612) and from LE to Instructor's Influence (H9c) (β = .158, t = 2.130) (see Figure 4.9).

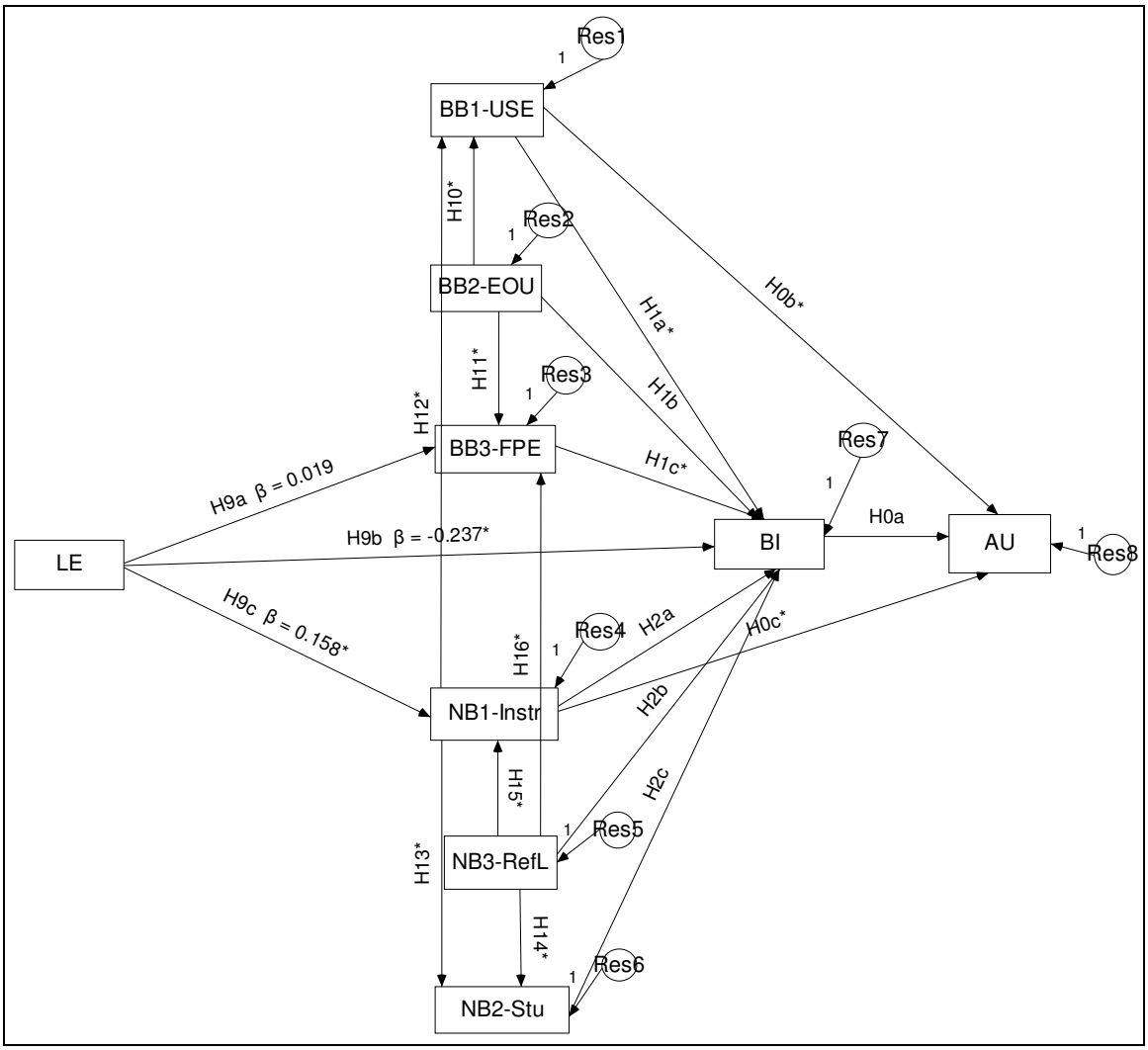

Figure 4.9. Causal Paths from library environment to behavior intention.

Comparison of Factors that Impact Intention to Use and Actual Use

This section answers RQ7.

RQ7: Can the factors that determine the public health students' selection of using a primary information resource also explain and predict the actual use of that primary information resource to finish their assignment?

In order to answer this question, it is necessary to report the direct causal paths to actual use, and take an overall comparison between the factors that impact behavior

intention and the ones affecting actual use as well as their direct effects, indirect effects, and total effects to these two important behavior constructs.

Direct Causal Paths to Actual Use

The proposed model hypothesized that perceived usefulness, instructor's influence, and behavior intention directly determined the students' actual use of primary resources. The study findings supported the postulated direct effects of perceived usefulness (H0b) (β = .265, t = 2.374) and instructor's influences (H0c) (β = .223, t = 2.655) on actual use. However, the study did not find the significant effect of behavior intention on actual use (H0a) (β = .171, t = 1.548) (See Figure 4.10). Combined with other variables that had indirect effects to actual use, the total impact of the significant paths accounted for 13.1% of variance in actual use of the primary resources.

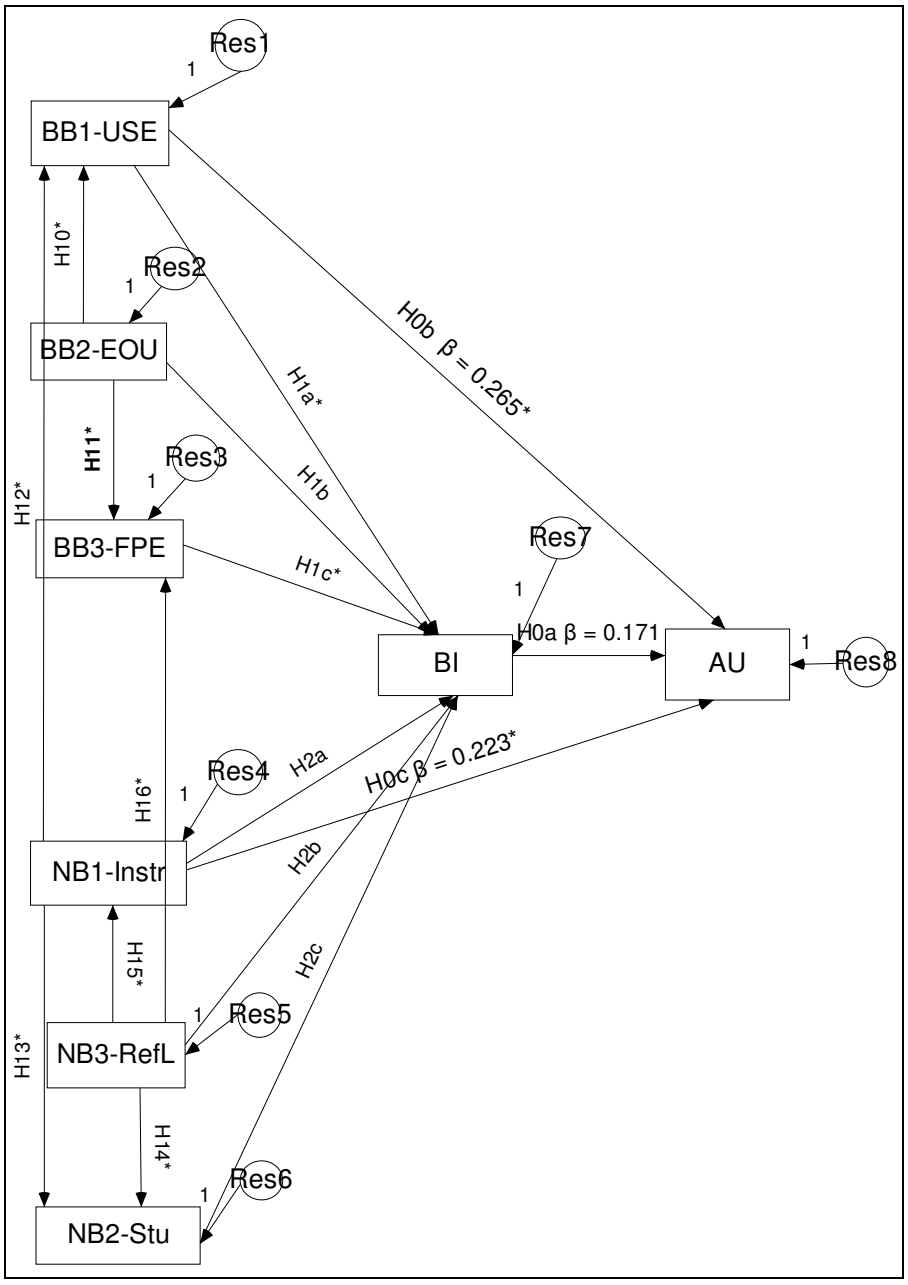

Figure 4.10. Direct causal paths to actual use.

Comparison of Factors that Impact Intention to Use and Actual Use

Figure 4.11 and Figure 4.12 presented the significant causal paths to Behavior Intention and Actual Use. Table 4.9 and Table 4.10 provided a list of direct effects, indirect effects, and total effects that belief variables and external variables had on behavior intention and actual use variables. From these figures and tables, the common

factors that directly and/or indirectly affect intention to use and actual use included two behavior belief constructs (perceived usefulness and perceived ease of use), two normative belief constructs (instructor's influence and reference librarian's influence), and five external variables (electronic resources characteristics, reference services characteristics, information literacy skills, previous experience, and library environment). In other words, although the present study did not confirm the predicted power of behavior intention to actual use as previous studies did, nine of twelve factors that determine behavior intention can also determine actual use. Among these factors, perceived usefulness and perceived ease of use had strong impacts on both behavior intention and actual use while electronic resource characteristics (ER), reference services characteristics (REF) and previous experience (EXP) exerted the heaviest impact to behavior intention and actual use among five external variables.

Table 4.9

Direct effects, Indirect effects, and Total effects to Behavior Intention

To Behavior Intention (BI)	Direct Effect	Indirect Effect	Total Effect
Perceived Usefulness (USE)	.515*	-	.515*
Perceived Ease of Use (EOU)	.432	.660	1.092*
Perceived Freedom of Physical Effort (FPE)	.542*	-	.542*
Instructor's Influence (INSTR)	.027	.095	.122
Student's Influence (STU)	.033	-	.033
Reference Librarian's Influence (REFL)	.006	.165	.171*
Electronic Resources Characteristics (ER)	-	.675	.675*
Reference Services Characteristics (REF)	.271*	.086	.357*
Information Literacy Skills (IL)	-	.267	.267
Previous Experience (EXP)	.087	.545	.632
Library Environment (LE)	-.237*	.030	-.207

Note: * P< 0.05

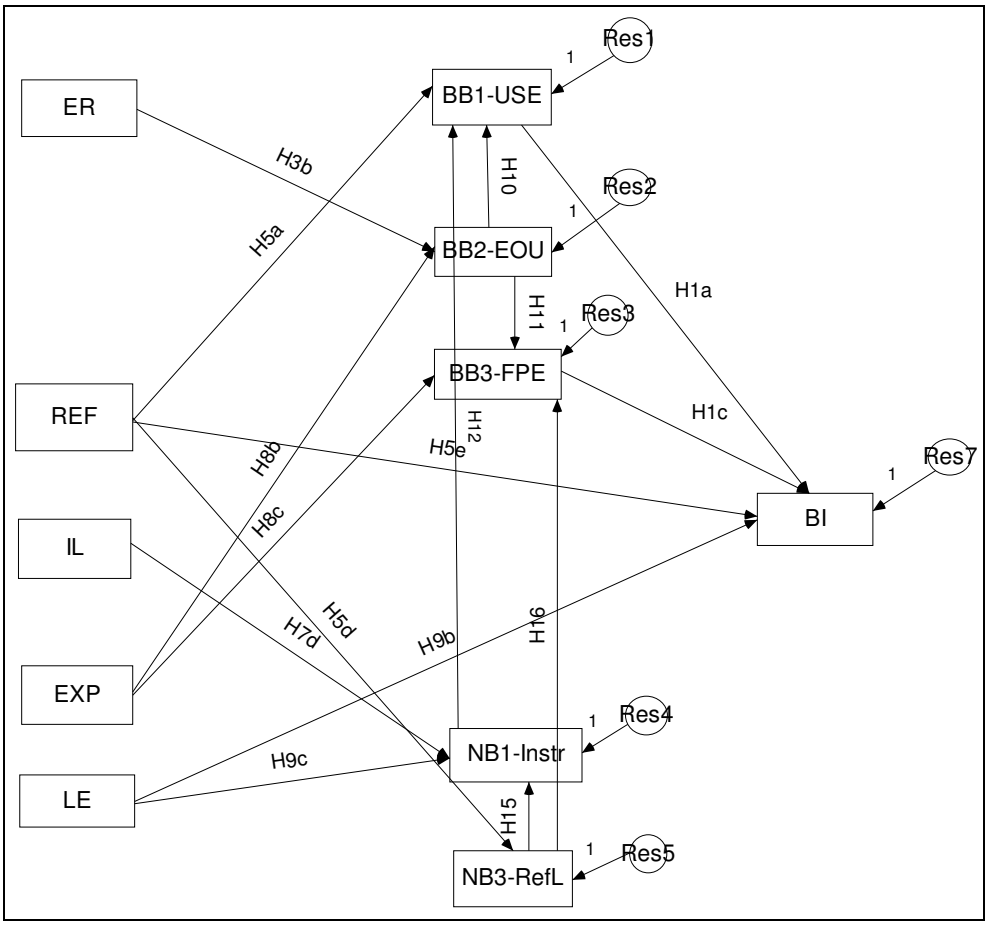

Figure 4.11. Significant causal paths to behavior intention.

Table 4.10

Direct Effects, Indirect Effects, and Total Effects to Actual Use

To Actual Use (AU)	Direct Effect	Indirect Effect	Total Effect
Perceived Usefulness (USE)	.265*	.089	.353*
Perceived Ease of Use (EOU)	-	.318	.318
Instructor's Influence (INSTR)	.223*	.062	.285*
Reference Librarian's Influence (REFL)	-	.114	.114
Electronic Resources Characteristics (ER)	-	.231	.231
Reference Services Characteristics (REF)	-	.130	.130*
Information Literacy Skills (IL)	-	.053	.053*
Previous Experience (EXP)	.078	.205	.283
Library Environment (LE)	-	.007	.007

Note: * P< 0.05

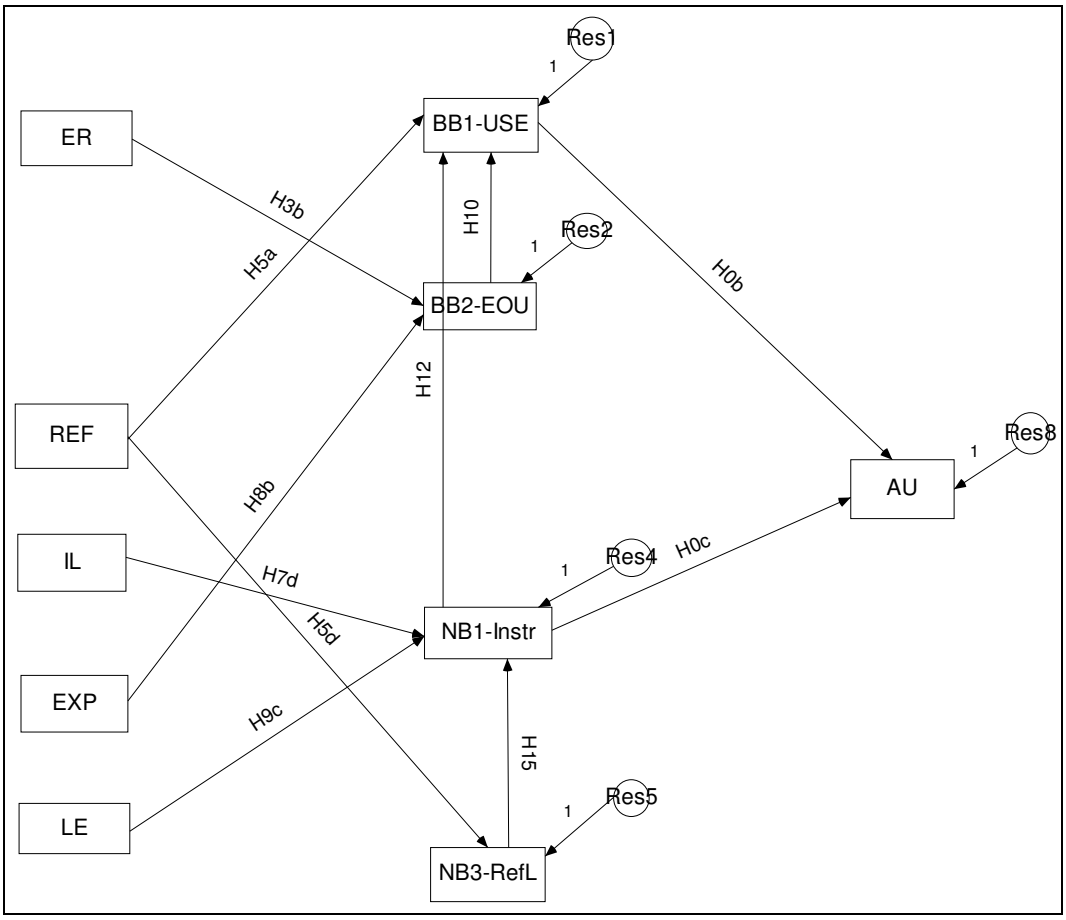

Figure 4.12. Significant causal paths to actual use.

Summary of Study Findings

The answers for seven research questions were summarized as follows:

RQ1: What information resource is the public health students' primary information resource for completing their research papers or projects?

Public health students selected and used all three types of information resources as their primary resources for completing their assignments. Among electronic resources, online databases, the Internet, and electronic journals were the most popular resources. In print resources, the print journals, print course materials, and print textbooks or books

were mostly used. Regarding human information resources, faculty in and outside of classes were the only primary resources selected and used by public health students.

RQ2: Among three types of information resources, which are print, electronic, and human, which type of information resource is primarily used by public health students for completing their research paper or project?

Electronic resources were primarily used by public health students for completing their research paper or project.

RQ3: Do public health students actually use the resource they initially selected to use for completing their research paper or project assignments?

The majority of students (121 of 134) actually used the same types of primary resources that they intended to use.

RQ4: How do public health students' beliefs (behavior beliefs) about the advantages and disadvantages of using a primary information resource (i.e., perceived usefulness, perceived ease of use, and perceived freedom of physical effort of using a primary information resource) influence their selection of using that primary information resource?

Perceived usefulness and perceived freedom of physical effort directly affected students' selection of using the primary resources (behavior intention) while perceived ease of use had the indirect effect on behavior intention through affecting both perceived usefulness and perceived freedom of physical effort. Perceived usefulness had the direct effect on actual use while perceived ease of use had impact on the actual use through the mediating of perceived usefulness.

RQ5: How do public health students' beliefs (normative beliefs) on specific referent's (e.g., instructors, classmates, and reference librarians) recommendations on using a primary information resource influence their selection of using that primary information resource?

None of the three normative beliefs had significant effects on behavior intention. However, both instructor's influence and reference librarian's influence indirectly affected the primary resources selection through affecting perceived usefulness and perceived freedom of physical effort, respectively. Instructor's influence had the direct effect on the actual use of the primary resources while reference librarian's influence indirectly affected the actual use by affecting the instructor's influence.

RQ6: How do primary information resource characteristics, library environment, and individual differences influence public health students' selection of using a primary information resource through affecting their behavior beliefs and normative beliefs?

Electronic resource characteristics' effect on the primary resource selection and actual use was mediated through affecting perceived ease of use. Reference services characteristics had direct and indirect effects on the primary resource selection and the actual use by affecting perceived usefulness and reference librarians' influence. Information literacy skills had indirect effect on the actual use of the primary resources through the mediating of instructor's influence. Previous experience with the primary resource had the indirect effects on the primary resources selection and the actual use through affecting perceived ease of use and perceived freedom of physical effort. The library environment factor had a direct effect on the primary resource selection but indirect effect on the actual use by affecting the instructor's influence.

RQ7: Can the factors that determine public health students' selection of using a primary information resource also explain and predict the actual use of that primary information resource to finish their assignment?

Except perceived freedom of physical effort, classmate's influence, print resource characteristics, and domain knowledge constructs, the other nine variables (perceived usefulness, perceived ease of use, instructor's influence, reference librarian's influence, electronic resources characteristics, reference services characteristics, information literacy skills, previous experience, and library environment) that either directly or indirectly affected the primary resource selection also determined the actual use of that primary information resource.

The following chapter discusses and interprets the study findings.

Chapter V
Discussion

Overview

This chapter discusses the study findings, analyzes possible reasons for the unsupported hypotheses and inconsistent findings from the previous studies, and points out the theoretical and practical implications, as well as study limitations and future studies, which are elaborated in the last chapter. This chapter is arranged by the order of research questions with discussions about the corresponding hypothesis results.

Public Health Students' Primary Information Resource

The study found that 85% (114/134) of students selected and used electronic resources as their primary resources, 12% (16/134) used print resources, and only 3% (4/134) used human resources. It is not surprising at all that the majority of students prefer using electronic resources to search information for their paper assignments. Public health students are young and using high technologies has been part of their life. Most of them had more than 10 years computer and Internet use experience and they reported that electronic resources are convenient, easy to access, and easy to use; have large amounts of information; and is reliable, and quick.

Among the electronic resources, online databases, the Internet, and electronic journals were the most popular resources. As for the print resources, print journals, print course materials, and print textbooks or books were mostly used. Regarding human information resources, faculty in and outside of classes were the only primary resources that were selected and used by public health students. Among the selected and used

primary resources, online databases, electronic journals, print journals, and print textbooks/books are in the library's collections while the Internet, print course materials, and faculty in and outside of classes are the resources outside of the library. Thus, public health students still heavily rely on the library's collections for their academic activities, although the Internet is also one of the resources on the top of the list.

Factors that Impact Behavior Intention

Behavior Beliefs' Impacts on Behavior Intention

The study found that both perceived usefulness (H1a) and perceived free of physical effort (H1c) had a significant impact on intention of using the primary resource while perceived ease of use had an indirect effect on behavior intention through its significant direct effects on perceived usefulness (H10) and perceived free of physical effort (H11, suggested causal path). Combined with reference service characteristics and library environment, the proposed model explained 46.1% of the variance in behavior intention. Overall, the predictive power of the proposed research model in this study is consistent with the meta-analysis of the TRA conducted by Sheppard et al. (1998), which reported that 44% of the variance in behavior intention was explained by behavior beliefs and other variables in the research models.

The result of significant effects of perceived usefulness to behavior intention and perceived ease of use to perceived usefulness were supported by previous studies (Adams, et al, 1992; Chau & Hu, 2002; Chang, et al, 2005; Davis, 1989a; Davis, et al, 1989b; Igbaria, 1995; Lederer, et al, 2000; Szajna, 1996; Taylor & Todd, 1995; Thong, et al, 2002; Venkatesh & Davis, 2000; Venkatesh, et al, 2002; Wixom & Todd, 2005).

The perceived free of physical effort is a new construct developed in the present study based on the multidimensional attributes of resource accessibility. It had the strongest direct effect on behavior intention among three behavior belief constructs. This result is not surprising at all as convenient and easy access were listed as first or second reasons for students to consider selecting and using a primary resource without regard to the format of the primary resources.

Perceived usefulness was the second most important determinant of behavior intention in the final model among these three behavior belief constructs. The explanation for such a finding is based on the fact that in work/study-related settings, "intention will be formed based on performance considerations rather than simply on personal likes or dislikes with respect to performing a behavior." (Davis, et al, 1989b, as cited in Taylor & Todd, 1995a, p. 166). The present study was conducted in a context of completing an assignment. In this study-related setting, students are motivated in large part by considering grades and receiving direct and frequent feedback on their performance. Therefore, a primary resource that can provide useful information will definitely be selected and used as it can improve the student's academic performance.

There were inconsistent findings on the impact of perceived ease of use on behavior intention in the previous studies. Some studies found it had a direct effect on behavior intention but is not stronger than the effect of perceived usefulness, while some studies concluded that the effect of perceived ease of use is too weak to have a significant direct effect on behavior intention (Chau & Hu, 2002; Chang, et al, 2005; Davis, et al, 1989b; Taylor & Todd, 1995a; Szajna, 1996). Venkatesh and Davis (2000) also found that perceived ease of use had lower stable correlation with behavior intention (0.12-0.37)

than perceived usefulness (0.51-0.65) over the system implementation process. These studies explained the inconsistent findings through analyzing the context of using technologies, users' characteristics, and technology's characteristics. In the present study, perceived ease of use did not have a significant direct effect on behavior intention, which can be explained with two reasons. The first reason is that all the students had the experience of using the primary resource they selected and used. No matter how familiar the students are with the primary resource, they know how to use it, but may not know its full range of functionalities as an information professional does. Over time, as students become more and more familiar with the primary resource, the direct effect of perceived ease of use on the resource usage often decreases, being supplanted by an indirect effect via perceived usefulness (Davis, et al, 1989; Chang, et al, 2005; Szajna, 1996) and perceived free of physical effort in the context of the present study. In other words, with students becoming familiar with the resources, perceived ease of use may not be a major concern for them to consider selecting and using the resources. The second reason is that public health students possess a high education level. In general, a higher education level assures more computer and Internet experience, students may have higher confidence to handle the possible difficulties in interacting with the primary resource.

In conclusion, the results suggest that the less physical effort is spent and the more useful the primary resource is perceived to be, the more likely students intend to use the primary resource. In addition, the easier the resource is to use, the more useful the primary resource is perceived to be and the less physical effort is needed, the more students are likely to use the primary resource. When students consider which primary resource to select and use for completing their research papers or projects, free of

physical effort was the first consideration factor, followed by usefulness and ease of use. Although perceived ease of use had not been found to have a significant direct effect on behavior intention, its strong indirect effects on perceived usefulness and perceived free of physical effort increased the predictive power of the model in explaining variance in behavior intention. These findings provide substantial theoretical and practical implications, which are described in detail in the following chapter.

Normative Beliefs' Impact on Behavior Intention

Contrary to the postulated hypotheses, the present study did not find the direct significant effects of three normative beliefs to behavior intention (H2a, H2b, and H2c), which was also the findings of most of the previous studies (Chau, et al, 2002; Davis, 1989; Venkatesh & Davis, 2000). The result can be explained with two reasons.

According to Hartwich and Barki (1994), normative influences only matter in mandated-use situations. Venkatesh and Davis (2000) also found that subjective norm had a positive direct effect on intention to use in mandatory settings, but not in voluntary settings. In general, the context of the present study was a voluntary setting as only 3% of the student participants stated that instructors wanted them to use certain types of resources for completing their assignments and the reason of "required resources" was also listed last among ten main reasons for selecting and using print and electronic resources. Students can freely choose any information resource they want to use to seek information for their assignments. The free resource choice setting in the present study may explain the non-significant effect of three normative beliefs on behavior intention.

In addition, the impact of normative beliefs on behavior intention may also be related to users' previous experience for the primary resources. Hartwick & Barki (1994)

found that subjective norm be more important in early stages of system development when users do not have much experience in the system. Taylor & Todd (1995b) also found that when the relationship between subjective norm and behavioral intention is compared for those with and without prior experience in the Computer Resource Center (CRC), subjective norm was a more important predictor of intention for those without prior experience. In the present study, all the student participants had used the selected primary resources before. Therefore, they all had their independent evaluations on the resources plus voluntary resource use setting. Consequently, students may place less weight on other's opinions.

Although three normative beliefs did not have the direct effects on behavior intention, the study found that the instructor's influence indirectly impacted behavior intention through significantly directly affecting perceived usefulness (H12) while the reference librarian's influence was through perceived free of physical effort (H16). The plausible explanations for these findings could be that students would think that the resources recommended by instructors may more likely provide useful information relevant to their assignments and consequently improve their performance in the assignments. In addition, the resources recommended by reference librarians are the resources that reference librarians teach students how to use so that the students receive more searching tips and learn how to use those resources. Thus, students would think they would spend less physical effort to access and use the resources. Another possible reason is that students expect reference librarians to directly provide the answers to them instead of directing them to a resource, and they still need to search for answers by themselves. Therefore, students would think it is highly possible that they can either

easily find the answers or have reference librarians find the answers from the recommended resources so that less physical effort is even needed for using the recommended resources. These findings indicate the roles of instructors and reference librarians in influencing students selecting and using information resources. The relationships between normative beliefs and behavior beliefs are new findings in the present study and further investigations are needed in the future research.

The present study also found interesting significant relationships among three normative beliefs, which are from instructor's influence to students' influence (H13), from reference librarian's influence to students' influence (H14), and from reference librarian's influence to instructor's influence (H15). Among these three causal effects, the path from reference librarian's influence to instructors' influence provides very practical implications for marketing library resources and services through the instructor's influences in addition to the librarians' direct effort on students. The results also confirmed that the course instructor's recommendation as well as the librarian's instruction and interactions with librarians were two most frequently used channels for students being aware of information resources. It is not possible for students to select and use an information resource if they have never heard of the resource and never knew it was available. More practical implications are elaborated on in the following chapter.

External Variables' Impacts on Behavior Intention

Resource Characteristics

Electronic resources. The study only found the significant impact of ER on perceived ease of use (H3b), but not on perceived usefulness (H3a) and perceived free of physical effort (H3c). The possible reasons are explained below.

The electronic resources can be seen as web-based information retrieval (IR) systems. Any IR system is a two dimensional entity, which includes information contained in the system and system functionalities that store, process, and display the information contained in the system. Therefore, system's characteristics should include measures for both dimensions of systems. In the present study, 12 items were used to measure ER characteristics, which included six items measuring system utility and usability (resource accessibility) and six items measuring information quality. However, the six items measuring information quality failed to meet the criteria of item reliability and construct validity. They were removed from the final measurement model accordingly. As a result, only system utility and usability measures were used for structural equation modeling and were found to significantly influence perceived ease of use, and through which, impact behavior intention. This finding was supported by the previous studies, in which, system characteristics, system quality, and system interface characteristics were found to significantly impact perceived ease of use (Chang, et al, 2005; Dishaw & Strong, 1999; Igbaraia, et al, 1995; Lederer, et al, 2005; Thong, et al, 2002). However, many studies also found that high information quality (reliability, relevance, adequacy, and currency) had a significantly direct positive effect on perceived usefulness (Chang, et al, 2005; Davis, et al, 1992; Lederer, et al, 2000; Shih, 2003; Venkatesh & Davis, 2000; Wixon & Todd, 2005), which was missing in the current study. Further study is needed to improve the psychometric soundness of measures of ER characteristics and to investigate the impacts of system quality and information quality separately on behavior beliefs.

The non-significant impact that ER had on perceived free of physical effort can be explained below. The retained items that measured ER mainly measured system functionalities, navigation, layout and information representation, and response time. These are some of the attributes the user will not experience until they physically access the system. Users need to figure out how the system functions, how to jump the pages back and forth, and how the system represents the retrieved information, and other intellectual activities along with using the system. Although poor system functions and navigation may cause more physical effort (i.e., more clicks), it takes much intellectual effort for users to interact with the system. Therefore, it was found that ER has a significantly direct impact on perceived ease of use, but not to perceived free of physical effort. However, ER has an indirect impact on perceived free of physical effort and perceived usefulness through impacting perceived ease of use, which further affects behavior intention. Therefore, the effect of electronic resource characteristics on behavior intention was mediated through three behavior beliefs, which supports the hypothesis that perceived electronic resource characteristics shape the behavior beliefs of using the electronic resources, which, in turn, affects the behavior intention.

Print resources. In the present study, print resources include print books and textbooks, journals, course materials, and any other type of publications in print. Not as postulated, perceived print resource characteristics (PR) were not found to significantly influence three behavior beliefs (H4a, H4b, and H4c). Interestingly, it was found that PR has negative effects on perceived usefulness and perceived free of physical effort. The findings may be because most of the students (117 vs. 17) selected electronic resources as their primary resources, they have more positive perceptions on electronic resources but

negative perceptions on print resources, which are inconvenient, time-consuming, out-dated, and too specific compared to electronic resources. Therefore, using print resources will take more physical effort (taking the bulky print copy with them, needing to find another copy as the only one has been checked out by someone else, and have to wait until the library is open to access it, etc.) and are not useful.

Reference services. As posited in the proposed model, reference service characteristics (REF) significantly determined perceived usefulness (H5a) and reference librarian's influence (H5d). In addition, the direct causal path from REF to behavior intention was found be significant (H5e, suggested causal path). The results were supported from the Minchow's study (1996), which found that uses of the library catalogs, MEDLINE, books and journals, library staff and Interlibrary Loan increased after reference librarians provided a literature search lecture to medical students.

However, two hypothesized causal paths from REF to perceived ease of use (H5b) and to perceived free of physical effort (H5c) were not found to be statistically significant, but were even negative. The plausible explanations are the students form their beliefs about using a resource through library instructions and interactions with reference librarians when they asked for a literature search help. Due to a short time introduction librarians provide and various information literacy skills that students possess, they may think librarians threw them too much information about the system features and made them feel the resource is not easy to use. They will need to make more physical effort while using it. However, useful information can be retrieved from the resource with librarians' help so that students still think the resource is useful. In addition, students think they can always ask for help from librarians and do not have to use the resource

themselves. Students are satisfied with librarian's services in that librarians can provide useful information and they trust the librarians' recommendations. With all these reasons, REF had direct significant effects on perceived usefulness, reference librarians' influence, and behavior intention.

The negative effect of REF to perceived free of physical effort (H4c) seems to be in conflict with the positive effect of the reference librarian's influence on this behavior belief (H2c), which was reported in the previous section. The possible explanation is that the negative effect that REF had on perceived free of physical effort was because students physically experience the system features demonstrated by librarians and have first-hand information to form their belief about using the system. After learning the features the system provides, students still need to experience those features themselves, which makes them feel they need to use physical effort to explore the system and eventually retrieve relevant information. However, when students received recommendations directly from librarians as second-hand information, they trust that librarians have recommended a resource with useful information. They also expect librarians to show them how to get useful information so that there is no need to physically use the resource themselves.

In conclusion, the effects of perceived resource characteristics on behavior beliefs are different depending on the different types of the resources. For electronic resources, the better the index and thesaurus, the better navigation and display, and the more considerate online assistance the resources provides, the easier the resource is perceived to use, thus, the more likely students are to select and use the resource. Regarding reference services, the better reference services are provided, the more students value the librarian's opinion on using a resource and the more they will learn about the resource,

thus, they may find the resource useful and want to select and use that resource. Therefore, reference librarians play an important role in affecting students' decision on selection of primary resources through answering reference questions and providing literature instructions.

Individual Differences

Information literacy skills (IL.) It was not found that IL had significant effects on perceived usefulness, perceived ease of use, and perceived free of physical effort, which were not consistent with the results found by Igbaria et al (1995) and Thong et al (2002). After carefully comparing the results, the possible reason for the inconsistency is the different connotation of construct of IL in the present study from the previous studies. In the present study, IL means self-reported and self-evaluated computer experience and skills, database searching experience and skills, and the Internet experience and skills. In addition, because six items measuring computer experience, database searching experience, and the Internet experience failed to meet the criteria of item reliability and construct validity, they were removed from the measurement model. Therefore, the three retained items were used to measure the level of computer skills, database searching skills, and the Internet skills with 1-5 Likert Scales. However, in the previous study, Igbaria et al (1995) used the extent of experience to measure computer experience and found its significant effects on perceived ease of use and perceived usefulness. Furthermore, Thong et al (2002) used computer self-efficacy as one of the individual differences variables, which indicated "an individual judgment of one's capability to use a computer" (Compeau & Higgines, 1995, p. 192) and found it had a significantly positive effect on perceived ease of use. As defined by Bandura (1986, p. 391), self-

efficacy is “people’s judgment of their capabilities to organize and execute courses of action required to attain designated type of performances. It is concern not with the skills one has but with the judgments of what one can do with whatever skills one possesses.” Therefore, self-efficacy is a belief construct in relation to people’s capability of performance in a specific context (Driscoll, 2000). It is the perception about capabilities of doing things by using skills, whereas IL in the present study is the perception about skill levels. For example, students possess information literacy skills, but they doubt their capabilities of finding useful information from a resource by using those skills. It is the perceived self-efficacy that is strongly correlated to decision making (Wood & Bandura, 1989), but not the perceived skill levels. Ren’s (1999) findings also confirmed that the higher self-efficacy users have in using an information resource, the more likely they are to use it. Another reason is that IL used a 1-5 Likert scale while three behavior belief constructs used a 1-7 Likert scale. The different connotations of the constructs and inconsistent measures between IL and behavior belief variables may explain the insignificant causal effect from IL to three behavior belief constructs.

The indirect effect that IL has on actual use through directly impacting the instructor’s influence (H7d, suggested causal path) suggested that students with information literacy skills are not sure if they are capable of finding information from the selected resources until the instructors suggested that they use them. This explanation also echoes the above statement that perceived self-efficacy is correlated to decision making, not perceived skill levels. If students think they are capable of finding information from the selected resource with their information literacy skills, they may decide to use that resource and not be easily influenced by the instructors’ opinions.

Previous experience. Previous experience of using the intend-to-use primary resource had significant direct effects on perceived ease of use (H8b) and perceived free of physical effort (H8c). The results were supported by the findings in previous studies (Gerstberger & Allen, 1968; Allen, 1977; Culnan, 1983b, 1985; Hiltz & Turoff, 1981; Agarwal & Prasad, 1999). However, the direct significant effect of previous experience on perceived usefulness (H8a) was not found in this study, which was in conflict with the previous studies (Muha, 1998; Shershneva, 2005). As students used the primary resources before, they had impressions about the resource's ease-of-use and usefulness. These impressions formed perceptions about the resources themselves and the outcomes of using the resources. If the resources are easy to use and useful, students may prefer to use them again. If they experienced unsuccessful search outcomes, they may not use the resources again even though the resource may be easy to use. However, usefulness of a resource is a context-sensitive behavior belief. In other words, depending on the purpose of information seeking and the search topics, a resource that provided useful information for one topic may not do the same thing for other topics. Therefore, the impact of pervious experience on perceived usefulness may not be as stable as its effect on the other two behavior beliefs, which may explain why a significant effect of previous experience on perceived usefulness was not found in the present study.

Contrary to the hypotheses, the study did not find the significant direct effects of previous experience on behavior intention (H8d) and actual use (H8e). These findings confirmed the conclusions made in the previous studies that previous experience of using an information resource may not directly affect the selection of this resource again, but impact an information seeker's perception on using the resource, which then affects their

resource selection and use behavior (Gerstberger & Allen, 1968; Allen, 1977; De Groote et al, 2003).

Library Environment

The study did not find the significant effect of library environment (LE) on perceived free of physical effort (H9a). However, two significant causal paths were suggested from LE to behavior intention (H9b) and from LE to instructor's influence (H9c).

The insignificant causal path from LE to perceived free of physical effort can be attributed to the students favoring electronic resources. Because the majority of public health students select electronic resources as their primary resources, they can access them anywhere and anytime. No geographical limit to access electronic resources was also confirmed by the students' responses to the questionnaires. Only 11 (11/134=8%) students physically come to the library to use primary resources while others access electronic resources either at home, at the computer lab, or at the office. Therefore, distance of the library, library hours and ease of parking are not main concerns when using the resources so that physical effort needed to go to the library is not a major problem, as was found in the previous studies (Buckland, 1988; Heaton, 1997; Boyce, et al, 2004; Kerins, Madden, and Fulton, 2004; Dee & Stanley, 2005).

An interesting finding was that LE had direct significant effects on behavior intention and instructor's influence, which can be explained through the images of the library that are pictured in the students and faculty's minds. Antell and Engel (2006) found that older scholars valued more about the library's physical organization and the library collection's comprehensiveness than younger scholars. Usually, faculty has a

larger scholarly age (number of years from the latest academic degree earned) and most of them experienced print-only while growing up, and needed to physically go to libraries to access library resources and services. Therefore, they had a memorable picture in their mind about the library as a physical place. Although they are also the people who have experienced the transitions from print-only collections, to print and electronic collections, and to electronic-only collections in the library, the physical entity type of picture they had formed about the library still matters. Thus, a good library environment provides a good picture to faculty members so that they recommend students to use library resources and services. By the same token, comprehensive library collections in both print and electronic formats as well as reliable electronic access to the resources provide a positive impression to students, which directly influence students' decision of selecting and using the primary resources.

Comparison of Factors that Impact Intention to Use and Actual Use

Direct Causal Paths to Actual Use

The study findings supported the postulated direct effects of perceived usefulness (H0b) and instructor's influences (H0c) on actual use, which were supported by the previous studies (Davis, et al, 1989a; Adams, et al, 1992; Igbaria, et al, 1995; Szajna, 1996; Lin, 2005). Because students pay more attention to the grades and academic performance, the more useful the primary resources are perceived to be, the more relevant information can be retrieved, the more possibly students perceive the resources to be helpful at increasing their performance, and the more likely students actually use the resources for their assignments. The non-significant effects of three normative beliefs

on behavior intention in the free resource choice setting of the present study were already explained in the aforementioned section. It is interesting to note that the instructor's influence directly impacts student's actual use of the primary resources. It can be easily understood that students care about the direct and frequent feedback on their performance from the instructors. Using the resources recommended by the instructors may add more points to their grade, and usually students trust instructors and think it is highly possible that they can find the useful information from the resources recommended by their instructors, which explains the instructor's influence's direct effect and indirect effect on actual use, which was mediated through perceived usefulness (H12).

However, the study did not find the significant effect of behavior intention on actual use (H0a), which was inconsistent with the previous findings (Davis, et al, 1989b, 1992; Bagozzi, et al, 1992; Taylor & Todd, 1995; Szajna, 1996; Venkatesh & Davis, 2000; Moon & Kim, 2001; Venkatesh, et al, 2002). The correlation between behavior intention and actual use in the present study was 0.02, which was much lower than the findings from most of the previous studies ranging 0.34-0.50 (Sheppard, et al, 1988; Davis, et al, 1989b, 1992; Bagozzi, et al, 1992; Taylor & Todd, 1995; Szajna, 1996; Venkatesh & Davis, 2000; Moon & Kim, 2001; Venlatesh, et al, 2002). The possible explanations are discussed next.

Most of the previous studies measured the actual use construct by examining both frequency (how often) and extent of behaviors (how much) (Davis, et al, 1989b, 1992; Bagozzi, et al, 1992; Taylor & Todd, 1995; Szajna, 1996; Venkatesh & Davis, 2000; Moon & Kim, 2001; Venkatesh, et al, 2002) while some studies only used frequency to measure the resources usage (Davis, 1986 & 1989b; Lederer, et al., 2000). Lederer, et al

(2000) found that with usage measured by the frequency scale, the effect of usefulness and ease of use was significant while the weaker coefficient was found when usage was measured by the number of times used in the past 30 days. Although the present study used both "how often" and "how much" indicators to measure actual use, the correlation between the two items measures is 0.086, which led to a low reliability scale of the actual use construct. It may be because it is more difficult for users to accurately report the number of times they use the primary resource than to rank the frequency of uses.

Another reason is also related to the construct measurement. Many of the studies used subjective self-reported usage (Davis 1986 & 1989b) while some of them used objective measures (Taylor & Todd, 1995a), such as computer logs or actual counts, to measure actual use of a technology. Some research suggests that self-reported usage measures are biased (Straub et al., 1995). In the case of the present study, students perceived that they are heavy users of the primary resources, but they actually may not be. Their perceptions may be a relative concept rather than an absolute concept. For example, students may conceive of themselves as heavy users of the Internet, and consequently record high estimates of the Internet use behavior. However, the high Internet usage may be true as a percentage of their use of all different kinds of resources, but may not be the case when compared to other users. Therefore, due to the limitations of human judgment, critical elements of system usage should be considered when measuring this construct, such as duration, frequency, and number of sessions, and the like (Straub, et al, 1995). In addition, refining the measures would increase the reliability and validity of the measurement model and allow more rigorous testing of the structural equation model.

Causal Paths to Intention to Use and Actual Use

Both the TRA and the TAM used behavior intention to predict actual performance of the behavior. But there is a lack of studies on whether the determinants of behavior intention can also be used to predict actual use. This study found that two behavior belief constructs (perceived usefulness and perceived ease of use), two normative belief constructs (instructor's influence and reference librarian's influence), and five external variables (electronic resource characteristics, reference service characteristics, information literacy skills, previous experience, and library environment) directly and/or indirectly affected both intention to use and actual use. Therefore, most of the variables that had an impact on behavior intention also affected actual use. This finding provides practical implications for reference librarians and system designers and developers to conduct interventions so that the actual usage of the resources can be increased.

However, the causal paths through these common variables to behavior intention and actual use are different. Perceived usefulness, perceived free of physical effort, reference service characteristics, and library environment had the direct affects on behavior intention while perceived usefulness and instructor's influence had direct effects on actual use. Other variables' impact on behavior intention and actual use was exerted indirectly through behavior belief variables. Among the three behavior belief variables, perceived usefulness and perceived ease of use are the two most important belief variables that affect both behavior intention and actual use while electronic resource characteristics (ER), reference service characteristics (REF) and previous experience (EXP) are the three most important external variables that have the heaviest impact on behavior intention and actual use. Any possible changes of three external variables may

produce significant impact on perceived usefulness and perceived ease of use beliefs, which affect the behavior intention and actual use, accordingly. Therefore, any managerial interventions on improving an electronic resource's design and information quality, enhancing reference services and information instructions, exposing students to library resources and services may change students' perceived usefulness and ease of use of using resources, which may promote their intention and actual use of resources.

Principle of Least Effort and Intention and Actual Use of Primary Resources

In this study, effort was defined as public health students' behavior beliefs on the disadvantages of using an information resource, which included physical, intellectual and psychological efforts. As psychological effort is usually made along with the other two efforts, it was not included in the proposed model. Therefore, physical effort corresponded to the perceived free of physical effort construct while intellectual effort corresponded to perceived ease of use in the proposed model.

As analyzed in the previous sections, both perceived ease of use and perceived free of physical effort had direct and/or indirect effect on behavior intention while perceived free of physical effort had a significant effect on behavior intention but not on actual use. This difference implies that public health students consider physical effort along with the other efforts when they decide which resource to select for use. However, as more and more information resources can be accessed online, geographical distance and library hours are not usually barriers for students to use resources. Thus, the physical effort factor may not be considered when students actually use the primary information resources.

Therefore, public health students applied the Principle of Least Effort (PLE) to select their primary resources while they only considered intellectual effort needed when they actually use their primary resources.

Chapter Summary

The summary of the discussions about the study findings is stated below:

1. The majority of public health students (114/134 = 85%) selected and used electronic resources as their primary resources and online databases, the Internet, and electronic journals were the most popular electronic resources. Print journals, print course materials, and print textbooks or books were also used. Thus, public health students still heavily rely on the library's collections for their academic activities, although the Internet is also one of the resources at top of the list.

2. Regarding the impact of behavior beliefs on behavior intention, the results suggested that the less physical effort is spent, the more useful the primary resource is perceived to be, but the more likely students intend to use the primary resource. In addition, the easier the resource is to use, the more useful the primary resource is perceived to be and the less physical effort is needed, the more likely students intend to use the primary resource. When students consider which primary resource to select for use in completing their research papers or projects, free of physical effort was the first consideration factor, followed by usefulness and ease of use.

3. Due to the voluntary settings of the present study and public health students experience with the primary information resources, the study did not find three normative beliefs significantly affecting behavior intention. However, the inter-relationship among

behavior beliefs and normative beliefs suggested the important roles of instructors and reference librarians in students' selection of the primary resources.

4. The effects of perceived resource characteristics on behavior beliefs are different depending on the types of resources. For electronic resources, the more efficient index the resource contains, the better navigation and screen display the resource provides, and the more considerate online assistance is provided, the easier the resource is perceived to use, thus, the more likely students select and use the resource. Regarding reference services, the better reference services are provided, the more likely students would value the librarian's opinion on using a resource, thus, they may find the resource useful and be more likely students select that resource, accordingly. Therefore, reference librarians play an important role in affecting students' decision on the selection of primary resources through answering reference questions and providing literature search instructions.

5. Due to the different connotation of the information literacy skills (IL) construct in the present study from the previous studies and inconsistent scales between IL and behavior belief variables, the study did not find the direct significant effects that IL had on any of the three behavior belief variables. Due to the context-sensitive nature of usefulness, pervious experience did not have a significant impact on perceived usefulness of using a resource, which explained why a significant direct effect was not found that previous experience had on perceived usefulness. In addition, an insignificant causal path from previous experience to behavior intention and actual use also confirmed the conclusions made in the previous studies that previous experience of using an information resource may not directly affect the selection of this resource again, but may

impact users' perception on using the resource, which then affects their resource selection and use behavior.

6. The insignificant effect of library environment (LE) to perceived free of physical effort (LPE) suggested that as students favor electronic resources and can access them anywhere and anytime, the distance of the library, library hours and ease of parking are not main concerns for the students when they use the electronic resources so that physical effort spent on going to the library did not have a significant impact. In addition, because faculty still keep a physical entity type of picture about the library even though now they have also experienced the transitions from print-only collections, to print and electronic collections, even to electronic-only collections in the library, a good library environment provides a good picture to faculty members so that they recommend students to use library resources and services. By the same token, comprehensive library collections in both print and electronic formats as well as reliable electronic access to the resources provide a positive impression to students, which directly influence students' decision on select and use the primary resources.

7. Due to the measurement problem of actual use in this study, behavior intention was not found to be a predictor of actual use. However, nine variables that affect behavior intention also affect actual use. Therefore, any changes on resource characteristics, information literacy skills, previous experience, and library environment would reshape the students' beliefs, which, subsequently, affect their selection and actual use of information resources.

8. Public health students consider physical effort along with the other types of effort when they decide which resource to select for use. However, when they actually use the primary information resources, physical effort may not be considered.

These conclusions bring important implications in both theory and practice in the library and information science, which will be elaborated on in the following chapter.

Chapter VI
Implications, Limitations, and Future Studies

Overview

The previous chapter mainly explained the study findings and compared them with the previous studies. This chapter elaborates the important implications to information science researchers, system designers, medical librarians and library administrators. In addition, the study limitations and the directions for future studies are also reported.

Implications

Theoretical Implications

This study sought empirical support for a proposed model, the Information Resource Selection and Use Model (IRSUM), which was developed based on the TRA (Theory of Reasoned Action) and the TAM (Technology Acceptance Model). Study findings supported more than half of the hypotheses that belief variables are direct determinants for behavior intention and largely mediate the effect of external variables (resource characteristics, individual differences, and library environment) on behavior intention. The study also found that most of the variables that affect behavior intention also affect the actual use.

A few previous studies using the TRA and the TAM as research framework in the information science field investigated that students took distance education courses (Irani, 2000); information professionals used the Internet (Spacey et al, 2004); employees attended continuing education programs (Thornburg & Pryor, 1998); and men intended to

seek prostate cancer information (Ross et al, 2007). Few studies attempted to deeply examine "why" users select an information resource for use over others and what factors determine their selection and use decisions, excluding the study that was conducted by Klobas (1995) about the faculty's use of electronic resources. The research model proposed in the study is so far the first known model to holistically investigate and explore the information resource selection and use behavior from a social-psychological perspective based on the TRA and the TAM in the information science field. In addition, as a new construct, perceived free of physical effort was developed and tested psychometrically reliable and valid in this study. Adding it to the behavior belief construct group enriches the predictive and explanatory power of behavior beliefs to behavior intention. In addition, due to following the TRA framework, the proposed model differentiated perceived resource characteristics (object-based beliefs) from perceived outcomes of using resources (behavior-based beliefs), which shed light on the reason for the inconsistent findings of previous studies that hypothesized that perceived resource characteristics had direct effects on using or not using an information resource. Based on the TRA (Ajzen & Fishbein, 1980), for a belief to be directly predictive of behavior, it needs to be consistent in time, target, and context with the behavior. Perceived resource characteristics, such as perceived ease of navigation, may be different in different time and contexts. However, the perception about using a resource is formed during use of the resource so that it is consistent in time, target, and context with the behavior. The present study also confirmed that behavior-based beliefs fully mediate the relationships between object-based beliefs and the behavior intention.

The above-mentioned uniqueness of the present study makes theoretical contributions to advance knowledge and fill the gap in theoretical development in the study area of human information seeking behavior that is becoming more and more popular in the field of information science. The enrichment of theory development in this area would provide more comprehensive knowledge structure and instructional materials to programs in library and information science, information science, and information systems.

Practical Implications

IR System Design for Utility and Usability

Electronic resources, such as online databases, e-journals, e-books, and the others, in this study, are actually information retrieval systems. System functionalities, system usability, and information contained in the system are three necessary components. The proposed research model and the study findings provide important diagnostic information for system designers at any stage of a system's implementation or usage process.

Both usability specialist Jakob Nielsen and computer science professor Ben Shneiderman have written separately about a framework of system acceptability, in which utility and usability are two important attributes for system acceptability (see Figure 6.1). Utility answers the question of if the functionality of the system in principle can do what is needed, while usability answers the question of how well users can use that functionality (Nielsen, 1994). Whether or not users perceive a system to be able to enhance their ability to execute tasks and perform their jobs, as well as ease of use, determine users' acceptance of the system. The concepts of utility and usability

correspond to the behavior beliefs of perceived usefulness and perceived ease of use in the present study.

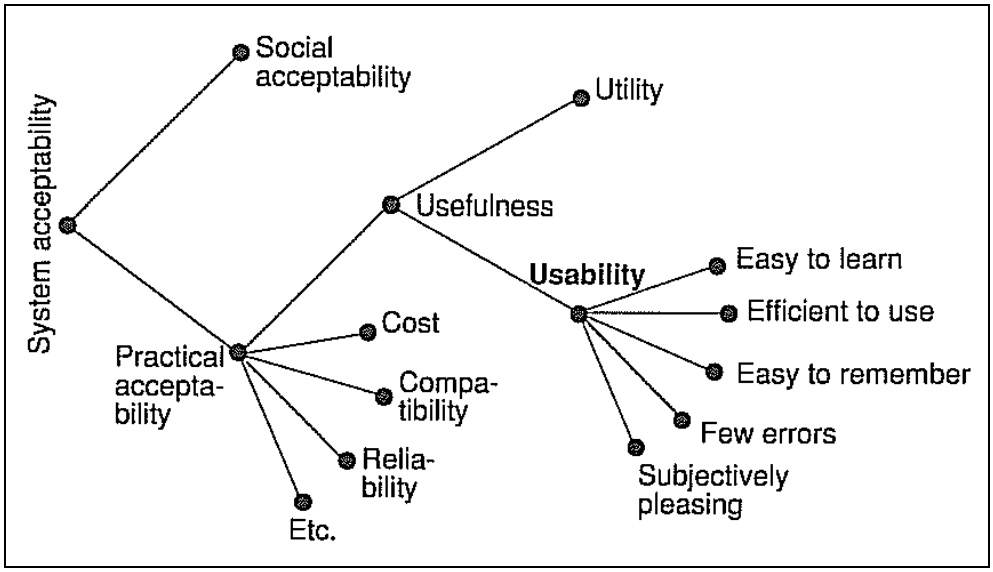

Figure 6.1. A model of the attributes of system acceptability (Nielson, 1994, p. 25)

The present study found that all three behavior beliefs were predictors of behavior intention while perceived usefulness and perceived free of physical effort also mediated the relationship between perceived ease of use and behavior intention, which led perceived ease of use having the strongest total effect on behavior intention. The strong positive effect of electronic resource characteristics to perceived ease of use also helps designers understand what characteristics (navigation, screen layout, information organizations, etc.) users care most about and what kind of changes can have the most meaningful impacts. The more intuitive the system's interface is, the more easily users can access the system, and the less physical and intellectual effort users will spend so that users have more time for other activities and may contribute to improvement of overall job performance (Davis, 1989a), which, subsequently make the system perceived as being more useful, thus, the more likely users will select and use the system.

The present study also found that perceived usefulness had direct positive effects on both behavior intention and actual use of the primary resources while it mediates the relationship between perceived ease of use and the actual use of the primary resources. Therefore, in the long run, the usefulness is even more important and should not be overlooked although ease of use is clearly important. This suggests that the IR systems "at first seem easy to use may in the long run be abandoned if they do not provide critically needed functionality," (Igbaria, et al, 1995, p. 111) and "no amount of ease of use will be able to compensate for a system that doesn't do a useful task." (Davis, et al., 1989b, p. 1000) Therefore, system design can not only consider interface design and ease of use, but should begin at the task level. System designers and developers must acknowledge that a system's ease of use is not independent of any particular task context (Keil, et al, 1995). In order to increase perceived usefulness of an IR system, a system's capabilities must match a person's job content. Schneiderman (2005) emphasizes task analysis for identifying the appropriate functionality of a new information system.

In order to ensure a system's utility and usability, system designers and developers should start with a clear understanding of users' requirements and needs. In addition, getting users involved early in the system design process helps eliminate usability problems. In the early stage of the process, there is greatest flexibility in altering the proposed design since little actual programming has been done. Rapid prototypes, user interface management systems, and videotape mockups are the techniques that can be used to let users learn what a system consists of and assess the system's ease-of-use by usability testing. By the same token, users can assess system utility and usability at any stage of system life cycle in order to improve system acceptance.

Librarian's Role in the Electronic Resources System Design

Due to for-profit considerations, system designers and developers usually do not conduct comprehensive usability testing. Sometimes, it is also because it is hard to find end-users to get involved in the system design process. Librarians subscribe and purchase information resources from publishers and information providers (database companies, aggregators, and vendors, etc.), while end-users usually do not have the opportunity to physically see and try the resources first hand. In addition, librarians are familiar with users' information needs and use behaviors. Librarians, sometimes, can be the proxy of users to evaluate information resources from the users' perspective. Due to this special role, librarians should proactively collaborate with publishers as user representatives to pass the information about the interface defects of electronic resources to the publishers in order to make sure the resources are functional and easy to use.

However, an interface alone, although it provides a more or less supportive search environment, fails to guarantee that users will use the system. It is necessary for end-users to possess basic knowledge about the system structure and the organization of information; become familiar with system features; and acquire a comfortable level with using an IR system. In order to acquire these knowledge and skills, end-user training is necessary and reference librarians play an important role in electronic resources instruction.

In addition, librarians should also initiate the IR system design or actively get involved in managing information at the institutional level. An expert system could be a good example. The expert system can provide a list of results retrieved from library collections with the chosen websites, or even provide with a list of suggested search

terms based on the keywords input by users. Another example is the library's website. The present study found that the library's website was the first access point for students to access electronic resources. Therefore, librarians should actively design a library website and make it a virtual representation of the physical library.

The term "Millennials" was coined in 2001 and they are persons born after 1977 (Sweeney, 2005; New Strategist Editors, 2001). 75.4% of student participants in this study were in the age range of 21-30, which matches the definition of the Millennials generation. Millennials are digital natives because they were born in an age when services were provided digitally everywhere. They like customized or personalized library resources and services; they like instant gratification and think no expected results occurred within a short time is a waste of their time. Millennials favor mobile and wireless technologies that they can use to do their tasks anywhere at anytime. They dream of an ultimate portable device that integrates all of their digital functions such as laptops, telephones, cameras, video games, TVs, and so on (Sweeney, 2005). However, most library catalogs and online databases can not be searchable from a cell phone, PDA, or any other typical portable pocket devices that Millennials carry. Although wireless connectivity is more and more accessible, laptops still have limited access to a wireless network. Therefore, librarians should be creative in initiating the idea of a seamless connection and work with publishers to enrich the catalog and database's functionalities instead of just passively using the systems.

Reference Librarian's Instructional Role

The study found that reference services had widespread and important effects on public health students' selection and use of information resources by directly impacting

their behavior beliefs (perceived usefulness of using primary resources), normative beliefs (reference librarian's influence), and behavior intention (selection of using primary resource). These influences were made through the library's instruction and the interactions with students. Although 85% of students selected and used the electronic resources as their primary resources, 42% (56/134) of students said that they were aware of and knew how to use the primary resource through the library's instructions and the interactions with reference librarians during literature search help. The library's instructions in Saint Louis University include library orientation, invited literature search instruction sessions by faculty members from the School of Public Health, and literature search workshop at the faculty and student's meetings. Whenever students consult librarians for a literature search, librarians usually walk through the searching process and explain the search strategies to the students. Therefore, student-librarian interaction is actually an individual literature search instruction, in which students learn how to use a specific resource and know other resource options. Thus, library instruction, compared to traditional services that directly provide answers, takes a more and more important part in the professional roles of reference librarian. Through the instruction, students know what resources to use, learn the content and features provided by the resources, and gain the skills in evaluating and using the information they found from the resources. In addition, instruction opens a door for students to use the resources and gain experience with using them. Therefore, reference librarians' instructional activities play an important role in impacting students' information resource selection and use behavior through improving students' information literacy skills and increasing their experience of using the primary resources. From a system development cycle perspective, reference librarians' instruction

is an essential component in the resources implementation process. Library's fundamental goal of acquiring and collecting information resources is to make users use them. Therefore, helping users to get familiar with the resources and to form their perceptions about using the resources are important activities in achieving the goal of library collection development.

In order to provide effective instruction, the time at which the instructions are given, the content of the instruction, the target groups of the instruction, and other strategies need to be considered:

1) Early training is very important. Venkatesh, Speier, & Morris' (2002) research found that subsequent user perceptions and motivation had no significant effect on early acceptance, which suggested that once users "turned off" to a system after a short interaction, it is hard to get users to adopt the system over time by fixing and redesigning the system or to use the system from other people's encouragement. Therefore, the perceptions formed about using a system immediately after training are critical. Usually, library users and librarians do not get involved in the IR system design and development process. Users' perceptions about using a new IR system come from librarians' instruction. So, how to make users form a positive perception about using a system after early training is a main task for any reference librarian. Once users form positive perceptions and make acceptance decisions about an IR system, it is high likely that they will continue to use it so that the expenditures of librarys' resources (money, time, personnel) for acquisition and processing of electronic resources are worthwhile.

2) Emphasizing resources' ease-of-use should be the focus in the early training. Davis, et al (1989a), Chang, et al (2005), and Szajna (1996) found that users usually pay

more attention to a system's ease of use than a system's usefulness when they have no or little previous experience of using the system. After they become familiar with the system, a system's usefulness is the major consideration in deciding to continue to use the system or not. The present study also found the negative effects that reference services had on perceived ease of use and perceived free of physical effort. Based on these findings, librarians should customize the instruction according to the specific information seeking context and different levels of information literacy skills students possess. In addition, multi-step training can be planned. Begin with an instruction designed to form perceptions that resources are easy to use, and follow up with workshops providing more advanced search techniques or subject specialization. In this way, students become familiar with resources in general and can use basic search features to retrieve information, and then become experienced in finding more relevant information by using advanced search techniques.

3) Flexible training schedules and various formats of course materials are needed. Schedule library instruction at or close to the time needed or provide a refresher class later in the semester when students start preparing their term papers (Dimartino & Zoe, 1996; Kipnis & Frisby, 2006). Based on the different levels of information literacy skills, paper-based class handouts with screen shots and short explanations, online tutorials, and/or Frequently Asked Questions (FAQs), and other types of course materials should be prepared.

The present study found a strong impact of reference librarians' recommendations on instructor's opinions (β = .452). This finding implies that teaching faculty members about the contents and features of information resources is another approach to affect

students' uses of information resources. Faculty members have the direct impact to students on their actual use of information resources. Therefore, it would be an effective approach to let faculty members learn more about the resources and receive their favor for the resources, so that they would recommend resources to their students.

Although the importance of library's instruction is evident, there is still debate and dilemma over the extent, content, and legitimacy of the academic librarian's teaching role (Owusu-Ansah, 2004). According to the levels of curricular involvement, librarian roles include assistance at the reference desk, instruction at the reference desk, course-related instruction, resource management and utilization, consultation with faculty and students, and group facilitation (Miller, 2001). These instruction involvements focus on the roles of supporting learning and teaching through collecting and providing access to information resources, as well as one-shot bibliographic instruction sessions invited by faculty in a credited course, rather than course-integration instruction, or independent library credit courses about information literacy. However, as more information in different formats becomes accessible, many higher education institutions and accrediting organizations view information literacy as a vital component of critical thinking and analytical skills (Saunders, 2007). Information literacy emphasizes the location, application and evaluation of information, as well as addresses broader concepts with social, ethical, economic, and legal considerations that are related to information and knowledge transfer, acquisition, and use (Dimartino & Zoe, 1996). Therefore, only teaching specific retrieval techniques (e.g., which buttons to hit) can not meet the requirements of information literacy. The expanded content needs to be offered, which can not be done at the reference desk or through the current framework of bibliographic

instruction (Gilson, 1997). Therefore, an expanded format of a library credit course may be needed to complete the mission. However, because academe may still view the library as "a static depository of information" (Dimartino & Zoe, 1996, p. 147) "with occasionally and sporadically teaching faculty and students with the retrieval of information" (Owusu-Ansah, 2004, p. 7), "but not an interactive agent in the acquisition and dissemination of knowledge and information worldwide." (Dimartino & Zoe, 1996, p. 147), it is difficult for librarians to initiate a collaborative partnership with subject faculty to integrate information literacy into the curriculum (Dimartino & Zoe, 1996; Kipnis & Frisby, 2006).

Library Collection Development

Collection is "an accumulation of information resources developed by information professionals intended for a user community or a set of communities" and has been viewed as an aggregation of physical packages of information in an information seeking context (Lee, 2000, p. 1106). In this context, users can retrieve useful and high-quality information readily and conveniently. In other words, library collection should meet the users' information needs as well as provide easy access to users. In order to develop such a functional library collection, three things must be kept in mind.

First, it is always most important that librarians have a solid understanding of the library user's information needs. A group of high-quality and easy-access information resources that do not meet users' needs is not a useful collection. In order to better understand users' information needs, librarians should have rich knowledge of the subject areas that are the users' focus. In addition, librarians should also proactively reach users. At present, more and more reference librarians' positions require a second B.S. or M.S.

degree in a subject area and more and more libraries have developed liaison librarian programs. These changes or trends provide effective practical guidance for better understanding users' information needs.

Second, both content quality and resource accessibility should be considered when librarians develop collections. The current library collection takes a variety of formats, including those in print, electronic, library-owned, or accessed through the library, and the like. Librarians need to learn all aspects of resources, not only the quality of information. Most of the time, librarians pay more attention to the content of the resources when the resources are still in the print version as users have already been familiar with the information organization of the print resources and there were no problems with usability issues. However, as more and more information resources are available electronically and perceived usefulness, perceived ease of use, and perceived free of physical effort have strong impacts on users' resources selection and usage, librarians now should evaluate resources by considering both resource usability and information content.

Third, a well-designed and integrated online library catalog system is needed. At present, most of the libraries purchase commercial online catalog systems, which have limitations to customizing the interface based on library users' preference although they provide some degree of flexibility. How librarians work with system producers to improve system functionalities and interfaces echoes back to the previous section about the librarian's role in system design. In addition, the coverage of the library catalog system should also be carefully considered. Should the Internet resources be included? How about vertical files?

Traditionally, librarians made the collection decision for users. In order to provide users with the first-hand opportunity of using a new resource and provide their feedback, many libraries set up resource trials before the resources are formally purchased or subscribed. Setting up resource trials can get an early reading on users' assessments of the resource and the possible acceptability, which would benefit the library's resource purchase decisions. The proposed research model in the present study is a good predictive model with valid measures of perceived usefulness, perceived ease of use, and perceived free of physical effort linked to user behavior intention.

Library Resources and Services Marketing

As stated before, the goal of library acquisition is to let users use the resources collected by the library. Resources trials and trainings are two effective ways to let users accept and use the resources. However, not everybody tried the resource trials and/or attended the training. It is not unusual that users are surprised to know that the library has the resources that they need by accident. Every year libraries spend thousands of dollars to increase collections, both print and electronic, but users do not know they are available. The lack of communication between librarians and users counteracts the library dollars' value.

The present study found that the course instructor's recommendation is the first channel via which students hear about electronic, print and human resources while library's instruction and interaction with librarians is the second channel. The study also found the positive effects of instructor's influence and reference librarian's influence on students' resource selection and use. Normative beliefs speak to the importance of and avenues for communication and user participation. In addition, they provide an important

rationale for the impact of top management support (Taylor & Todd, 1995a). Library directors and librarians should work closely with faculty members of the liaison departments to promote the resources targeted to their specific fields. In addition, any library instruction opportunity should be viewed as an information resource marketing presentation. For example, library orientation can bring students to the library and introduce library resources and services, which is usually the first awareness of library resources and services for students. In addition, multiple communication means should be used. Public health students are millenials. They are technology followers and prefer to use a variety of electronic communication methods, such as email, chat, virtual reference, Podcasts, Blogs, and instant messenger, to name a few. Therefore, librarians should make creative use of these Web 2.0 technologies to publicize the library's resources and services. Besides trying multiple communication means, promoting library resources and services at the right moment is also very helpful. Attending faculty meetings or student meetings, or initiating training classes/workshops, or serving on the department's committees, and other approaches can be considered.

Taking this from another angle, marketing library resources and services is actually marketing the library itself. The library will get unexpected benefits if libraries build up a positive image in the users' minds by marketing the resources and services they provide. Then, more and more people will use the library's resources and services, which further strengthens the positive image of the library. The positive feedback loop will also help library resources and services' marketing.

Library as a Place

The findings of the impact of library environment to instructor's influence and behavior intention provide thought-provoking practical implications. Although there is an argument that the proliferation of remote access of electronic resources and services eliminate the need for physical library buildings, library environment still influences users' information resource selection and use in its way. Although students prefer using electronic resources rather than coming to the library in person, it absolutely does not mean that libraries serve fewer students. Students still come to the library to check out books, read journals, browse new books, use course reserve materials, consult library staff, use computers and checkout laptops in the library, and other activities (Lapidus, 2003; Chrzastowski & Joseph, 2006; Antell & Engel, 2006). Therefore, the library still needs to be ready at any time to make electronic and print resources, as well as library staff, convenient and easy to access and use. When students come for print collections, ease of navigation of library shelves, library furniture arrangement, and clear signage can provide convenience for students; when they happen to use computers in the library to access electronic resources, the library needs to make sure there are enough computers for student to use, printers and photocopiers are all usable, the network is connected, and the ready-to-serve on-site technical assistance is available; when students come to ask for library staff's help, library staff should be easily approachable. Ease of access of the library's print and electronic resources as well as library staff builds up an effective and efficient service environment, which significantly affects users' selection and use of library resources and services as well as affects users' perceptions about the library.

However, with more and more resources and services accessible online, the library as a physical entity has been endued with more social roles apart from established long-time service roles. The concept of the "library as a space" has been widely accepted. There are still many reasons people love to visit libraries in spite of having so many alternative sources to acquire information today. Students visit the library for reasons other than using library materials or technologies, often for intangible reasons, such as individual study, group discussion, contemplation, concentration, etc. (Antell & Engel, 2006; Chrzastowski, 2006). They greatly value the physical library's conduciveness to scholarship (Antell & Engel, 2006). They want spaces for noisy interaction, group work, study, socializing, etc. and they also want separate rooms or space for quiet activities. Therefore, it is important for library directors and librarians to create an appealing physical appearance of the library to bring users to the facilities (Hernon & Nitecki, 1999). A comfortable and quiet atmosphere with excellent lighting, various types of study spaces, and easy-to-access computers, printers, scanners, and copiers, etc. are all needed. In addition, library hours in an academic institution need to be rethought. It is not just about scheduling. It represents the level of availability of the library as a research facility and the readiness of library staff to help library users with their needs (Lapidus, 2003). Library directors and librarians should convince academic administrators to find ways to support libraries either by financial means or by providing additional facilities and technologies.

While users like to access information electronically, they actually still use library resources and services, but may not realize that. Meanwhile, students also value the library as a place for their social needs. The physical and virtual libraries must not just be

intertwined, they must be inseparable (Sweeney, 2005). While more and more print materials in the library were transformed to their electronic counterparts and may be gradually removed from the library's physical building, how to make great use of the library space to create a comfortable and multi-functional place is an upcoming or on-going task to more and more libraries.

Study Limitations and Future Studies

Notwithstanding the contributions of the present study to the existing literature, there are a number of limitations that need to be considered. The key limitations are the sample size, the generalizability of the findings, the usage measurements, and the independence-of-observations assumption.

Study Limitations and the Recommended Improvement

Sample Size

Although there is no absolute standard about the required sample size for the Structural Equation Modeling method, some guidelines were offered: small, N<100; medium, N between 100 and 200; large, N>200 (Kline, 2005). Model complexity should also be considered to identify reasonable sample size. More complex models require larger samples in order for the estimates to be comparably stable. "A sample size of 200 or even much larger may be necessary for a very complex path model." (Kline, 2005, p.110) In addition, power analysis can be used to more precisely estimate minimum sample sizes. A table provided by MacCallum et al (1996) presented the minimum sample size with the power of 0.80 for selected levels of degrees of freedom (df), which is 178 sample size as df equals to 100. With df increasing, the sample size slightly

decreases. As df of the final structure model of the present study is 126, the estimated minimum sample size needs to be about 150. The sample size used for the hypothesis testing in the present study was 121, which is smaller than the recommended minimum sample size. Considering the complexity of the research model (98 measured items) and the basic guidelines mentioned above, a 200 sample size or more would be safe to reduce the error of estimation and draw more generalized conclusions. Surveying more public health students in a similar study context is recommended to improve the study.

Generalization of the Study Findings

The present study only sampled public health students from one academic institution rather than all 38 accredited schools of public health all over the U.S. Due to the different academic environments, the findings may not apply to public health students in other academic institutions. Surveying more students in other universities with the same instruments may obtain more generalized data. In addition, students in other majors may have different information resource selection and use behavior because they put different weights on behavior beliefs, they view resources differently, and their individual differences have large disparity from the public health students. Therefore, the research model should be tested with different user groups in different settings for reliability and validity.

In addition, the research model and the study findings were derived in an information seeking context of public health students completing research paper or project assignments that requires them to seek information from a variety of information resources. Therefore, study findings may not be generalized in different information seeking contexts. Investigating information resource selection and use behavior with the

same model in various information seeking contexts should be conducted in the future studies to determine the model's predictive robustness.

Subjective and Objective Usage Measures

The present study did not find a significant predictive relationship from behavior intention to actual use. The poor measurement of actual use and the weaknesses of self-reported usage may be explanations. Many researchers have been aware of the different results obtained by using subjective and objective usage measures in technology acceptance research. Some researchers suggested that self-reported usage measures correlate well with actual usage measures (Blair & Burton, 1987; Taylor & Todd, 1995a) so that self-reported usage can be a surrogate for usage, while some suggested that self-reported usage measures are biased so that it can not accurately represent actual usage (Straub et al., 1995). Moreover, in his study of validating measurement scales of perceived usefulness and perceived ease of use, Davis (1989a) suggested that:

> "Not enough is currently known about how accurately self-reports reflect actual behavior. Also, since usage was reported on the same questionnaire used to measure usefulness and ease of use, the possibility of a halo effect should not be overlooked. Future research addressing the relationship between these concepts and objectively measured use if needed before claims about the behavioral predictiveness can be made conclusively." (p. 334)

Some researchers attempted to investigate the relationship between belief and intention variables with self-reported usage and objective usage measures. Straub et al (1995) found that self-reported usage was more related to behavior beliefs than computer-recorded system usage and Szajan (1996) found that behavior intention only predicted self-reported usage rather than computer-recorded usage. However, Venkatesh et al (2002) did find the high correlation of belief and intention variables with objective computer-

recorded usage. The inconsistent findings impede the accumulation of knowledge and theory in the technology acceptance study area.

Although the present study avoids halo effect (the same student participants reporting both independent and dependent variables at the same time) by measuring usage determinants at one point of time (in the pre-questionnaire) and self-reported usage at the subsequent time period (in the post-questionnaire), future research should examine resource usage through both subjective and objective measurements to find the patterns and determine the generalization of the findings across persons, settings, and time periods (Straub, et al, 1995).

Independence-of-observation Assumption

The present study surveyed all the public health students who enrolled in the academic year 2006-2007. The questionnaires were distributed to students who took 21 different courses in the spring semester in 2007. Given that students within the same class might score more similar to one another than individuals in different classes, the statistical assumption of independence might be violated. Intraclass correlations (ICC) can be used to examine the possible group-level effects. The formula of ICC is ICC = $(MS_B - MS_W)/(MS_B + (C-1)MS_W)$, where C refers to the average group size and MS_B and MS_W are the mean square between and within groups, respectively. As the independence of observation has small difference between groups, the smaller ICC is the better. The rule of thumb is that maximum value of ICC is around 0.25 (Hox & Maas, 2001). However, because some of the sessions of in-class questionnaire distribution in the present study were done through the instructors by email, the number of students in those courses was not known. Therefore, limited data is available to calculate C (average group

size), which led to the failure of getting the ICC value to test the independence-of-observation assumption. The researcher is aware that more careful research design should be done to ensure that the study is more scientific.

Future Studies

Compare the Research Model with other Social-psychological Models

Although the research model-IRSUM was based on the Theory of Reasoned Action (TRA) and the Technology Acceptance Model (TAM) and was found to have good predictive power (accounting for 46.1% of variance in behavior intention), different models' contribution to the understanding of students' selection and use of information resources remain unknown. Therefore, model comparison is needed. Among social psychological theoretical models, the TRA is the root. Adapted from the TRA, the TAM was developed by identifying two concrete behavior beliefs. Because the TRA shows good prediction when applied to behaviors that are under an individual's volitional control, in order to account for non-volitional conditions, Ajzen (1985) modified the TRA by adding a third behavior belief construct, perceived behavior control, as a determinant of behavioral intention. Thus, the TRA was extended and termed as the Theory of Planned Behavior (TPB) (see Figure 6.2). Because of the TPB's unidimensional view toward belief structures and the determinants of intention, Taylor & Todd (1995a) used a decomposed TPB (DTPB) to examine the specific antecedents to attitude, subjective norm, and perceived behavioral control (see Figure 6.3). These series of models are related. Therefore, the model comparison should be conducted among the research model-IRSUM, TRA, TAM, TPB, and DTPB to examine the different goodness-of-fit, predictive power, and significance of paths.

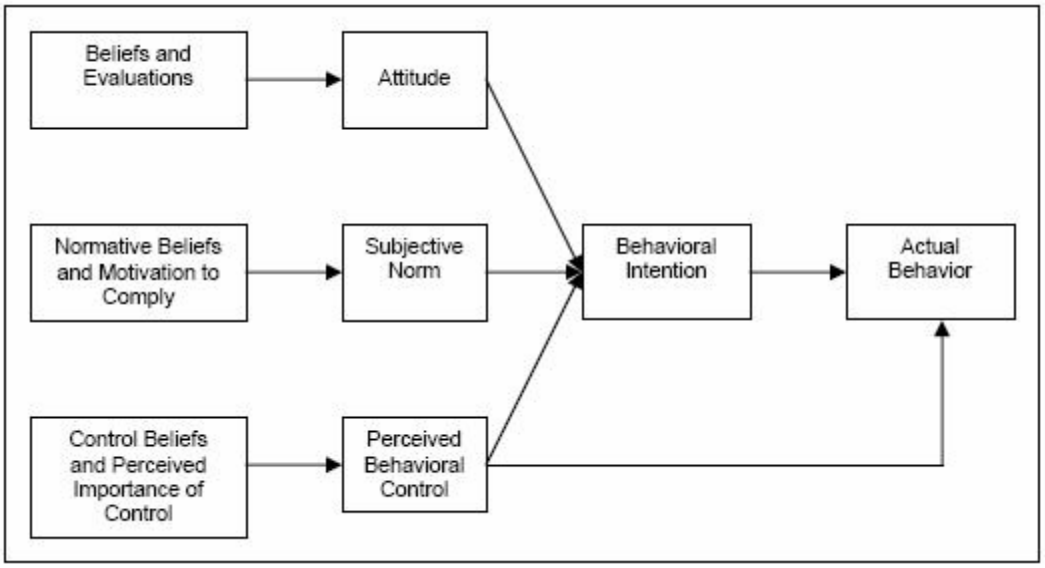

Figure 6.2. Theory of Planned Behavior (TPB) (Ajzen, 1985)

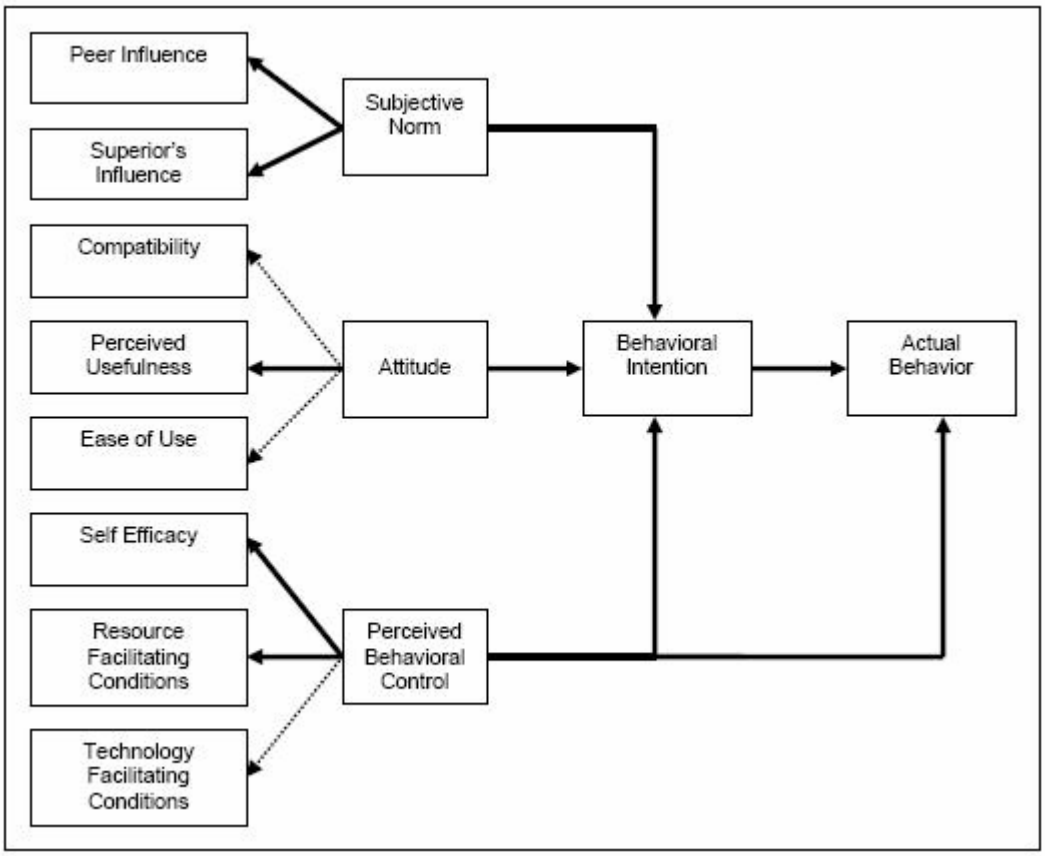

Figure 6.3. The Decomposed TPB (Taylor & Todd, 1995a)

Theory Refinement and Model Decomposition

The present study used multi-items to measure each external variable with the purpose of examining the effects of different aspects of each external variable to behavior beliefs and normative beliefs. For example, 6 measured items were used to measure the resource quality and resource accessibility constructs for each type of information resource. The same design was used for information literacy skills (see Table 3.10, p. 131 and library environment variables (see Table 3.12, p. 133). However, because some of the measured items did not meet the requirement for item reliability, they were removed from the measurement model. In order to refine the model and investigate the impacts of specific aspects of external variables, the possible solutions might be: 1) Decompose each external variable into two or three antecedent variables and run the model with one external variable with its antecedents at one time; 2) Collect more data to increase sample size and examine the impact of external variables by modifying the model to a second-order model with external variables as second-order variables.

Another theory refinement solution is to fully examine the relationship among external variables. Due to the functionality limitations of AMOS statistic software, the relationships among external variables were set up as none. In reality, these variables are not independent of one another. For example, reference service characteristics may affect student's level of information literacy skills due to the reference librarian's instructions. Therefore, discovering more relationships among external variables may also be helpful to increase the overall model fit and the explanation power.

Theory Expansion and Model Integration

The model accounts for 46.1% of the variance in behavior intention and 13.1 % in actual use, which suggested that some important predictors may be missing. Further exploration of alternative factors that might influence resource selection and usage is needed. Candidate variables include individual factors such as perceived expressiveness, self-efficacy, personalities, intrinsic and extrinsic motivations (Lee, et al, 2007; Venkatesh, et al, 2002), perceived enjoyment or perceived playfulness (Moon & Kim, 2001; Sun & Zhang, 2006), participation and involvement in the design process (Hartwick & Barki, 1994), task-technology fit (Dishaw & Strong, 1999; Keil, et al, 1995), and organizational factors (Taylor & Todd, 1995a). The researcher expects that adding external variables in the research model would increase the model's ability to explain and predict behavior intention and behavior itself.

One important construct that should be added is perceived behavioral control (PBC) and its corresponding decomposed antecedents based on DTPB (Taylor & Todd. 1995a). PBC refers to an individual's perceptions and assessment of one's own capabilities and resources required to perform a behavior (Ajzen, 1991). In other words, PBC beliefs are "the individual perceptions of the extent to which s/he possesses internal and external factors that may increase or decrease the perceived difficulty of performing the behavior" (Park, 2003, p. 40). According to Ajzen (1985), internal factors may include self-efficacy, power of will, emotions, etc. while external factors may include time, opportunity, and dependence on others, etc. Based on Ajzen's proposition, Taylor & Todd (1995a) decomposed PBC to self-efficacy, resource facilitating conditions, and technology facilitating conditions. If these specific beliefs are added to the proposed

model, the significant causal paths from information literacy skills to instructors' influence (H7d) to actual use (H0c) may be changed as from information literacy skills to self-efficacy to actual use. Similarly, the impacts of three different dimensions of library environment to behavior intention may also be mediated through resource facilitating conditions and technology facilitating conditions. Thus, the research model will introduce a larger number of factors and provide a full understanding of information resources election and use behaviors. In addition, by focusing on specific beliefs and external variable dimensions, the model will be more managerially relevant, pointing to specific factors that may influence resource selection and usage.

Longitudinal Study Needed

Some studies found that the effects of behavior beliefs to behavior intention, behavior intention to actual use, and behavior beliefs and behavior intention to actual use are changing over the time of user's using technologies (Davis, et al, 1989b; Taylor & Todd, 1995a; Venkatesh, et al, 2002). Given that the beliefs and intentions are subject to change over the time, collecting data about intention, self-reported usage, and objective computer-recorded usage at different points of time in the process of information resource uses and examining the changes of the effects of belief variables have on resource uses could provide a more comprehensive picture to researchers and librarians to understand when intentions disappear, when intention and actual use have the strongest relationship, when the best time is to make managerial interventions, such as librarians' instructions, library resource promoting events, and others, in order to improve library resources and services usage.

Conclusion

The present study proposed a research model to investigate resource characteristics, individual differences, and library environment factors that affect public health student selection and use of information resources for completing a research paper or project through affecting behavior beliefs and normative beliefs. The study found out that electronic resources were the primary resources used by public health students and online databases, e-journals, and the Internet were the resources most frequently selected and used. Three behavior beliefs (perceived usefulness, perceived ease of use, and perceived free of physical effort) and two normative beliefs (instructor and reference librarian's influence) largely mediated the relationship between external variables and primary resource selection while they fully mediated the relationship between external variables and actual use. Among the statistically significant paths found in the proposed model, perceived ease of use had the strongest impact on students' primary resource selection while perceived usefulness had the strongest impact on students' actual use of primary resources.

These findings confirmed the trends of the change of health sciences libraries "from as repositories of a printed-based knowledge base to a new focus on their role as the center or 'nexus' for the organization, in access, and use of an increasingly digital-based knowledge base." (Kronenfeld, 2005, p. 32). The librarian's role has also changed from information "housekeepers" to information filers, information disseminators, and information literacy educators (Kronenfeld, 2005; Lee, 2000; Perry, et al, 2005) in the information age when users prefer to use electronic resources to search information themselves. Although the librarian's mediation functions have been questioned with

various new technologies developed, as early adaptors of information technologies, librarians should take them as opportunities and use these ever-emerging new information technologies to add value to information resources and services rather than viewing them as competitors. Actively getting involved in the system design and evaluation, conducting user-centered collection development, initiating information literacy education, marketing library resources and services through multiple communication approaches, and providing a comfortable and multi-functional library environment are all important and on-going tasks for librarians to optimize the library's functions in order to keep up with the ever-changing information age and meet users' information needs.

APPENDIX A

Focus Group Recruitment Letter

February 28, 2007

Dear Public Health Student:

Donghua Tao, health sciences reference librarian at the Medical Center Library of Saint Louis University and Sanda Erdelez, associate professor at the School of Information Science & Learning Technologies of University of Missouri Columbia are inviting you to participate in a focus group interview, which is a part of a dissertation study on "Using Theory of Reasoned Action (TRA) in Understanding Selection and Use of Information Resources: An Information Resource Selection and Use Model". The purpose of the study is to investigate the information resources that students intend to use and actually used as well as to examine the effect of information resource characteristics, library environment and information literacy skills on students' selection and use of information resources for an ongoing or to-be-finished term paper or project in the spring semester.

During the focus group discussion, you will be asked:

- To brainstorm information resources you have used, information sources and the geographical location where you accessed information resources, and the channels through which you know or heard about the information resources.
- To identify the people whose opinions will affect your selection and use of information resources.
- To sort the index cards with the measured items labeled into the appropriate construct categories in order to assess the content validity of the questionnaire question items for each construct.
- To answer drafted questionnaires and provide your feedback.

Based on your input, the questionnaires will be revised and ready to distribute to all the Public Health students in the near future. The average time commitment for completing the interview will be approximately 45 minutes to 1 hour.

All records and information collected in the focus group interview will be confidential. In any reporting of the data all individuals will be anonymous and no identity information will be requested during the focus group. The records of the focus group interviews will be kept three years after the study completely finishes just for the possible auditing purpose and will not be released to any other people except the principal investigator and the co-investigator. The results of this study may be published in scientific research journals or presented at professional conferences. However, your name and identity will not be revealed and your record will remain confidential.

Participation in the focus group interview is completely voluntary, and you may withdraw from the interview at any time. Your participation will NOT affect your grade in the classes you are taking.

If you would like to participate in the focus group interview, please send a brief reply to this email to indicate your interest. In the meantime, should you have any questions about the focus group interview process, please contact Donghua Tao at taod@slu.edu or 977-8812. If you have any questions about the study validity and ethical concerns, please contact MU IRB office at 483 McReynolds, University of Missouri Columbia, MO 65211 or call at (573) 882-9585.

Thank you for your consideration.

Sincerely,

Donghua Tao, M.L.I.S., Assistant Professor, Principal investigator
Sanda Erdelez, Ph.D., Associate Professor, Co-investigator

APPENDIX B

Focus Group Answer Sheet

Focus Group Answer Sheet

1. Please check the resources listed below you have used with "√" and cross out the resources that you never used for your coursework and academic activities.

Print Resources	**Electronic Resources**	**Human Resources**
1. Textbooks or books	15. Library online catalog	26. Faculty in class
2. Journals	16. Books on line	27. Faculty out of the class
3. Index/Abstract	17. E-journals	28. Peers (Classmates or fellow students
4. Reference works	18. Online databases (e.g. MEDLINE, PubMed, PsychInfo, etc.)	29. Colleagues or others at your place of study/work
5. Course reserve	19. E-Reserve articles and book chapters	30. Colleagues at outside of your place of study/work
6. Materials received through Interlibrary Loan	20. Materials received through Interlibrary Loan	31. Information service staff (e.g. Reference librarians)
7. Curriculum materials (e.g. Course handouts, etc.)	21. The Internet (Search engines, Websites other than the library websites, Blogs, email lists, etc.)	
8. Conference proceedings	22. Electronic curricular materials (WebCT)	
9. Archives (e.g. Documents and records)	23. Online tutorials	
10. Annual report/Technical report	24. Computer Aided Learning (CAL) materials (e.g. education software, etc.)	
11. Thesis/Dissertation	25. TV, radio, and other media	
12. Library orientation handout		
13. Library instruction handout		
14. Newsletter		

2. Do you have any added items for the following list that provides the channels from which you heard about the information resources that you have used for your coursework and academic activities?

___From course instructor's recommendation
___From classmates and/or fellow students
___From the experts in the field
___From professional conference
___From the Internet (Search engines, Websites, blogs, email list, forum, etc.)
___From the library's instructions
___From the interaction with reference librarians when I ask for literature search help

3. The following lists the sources you might approach to access information resources that you have used for the coursework and academic activities. Please cross out the ones you have never used before and add what you have used but not listed below.

a. Libraries
___Physically go to the Medical Center Library
___Medical Center Library's Website
___Physically go to Pius library or law library
___Pius or law library's Website
___Personal library or collections
___Other academic libraries or public libraries
Please specify: _____

b. Courses-related activities
___Course lectures
___Course-related small group study
___Exams and tests
___Training sessions/CE courses
___Practicing activities (e.g., internship, fellowship, volunteer, etc.)
___Others, Please specify:_____

c. The Internet
___The department's Website
___ Publisher's Website
___Author's Website
___Search Engines (Google, Yahoo, AskJeeves, etc.)
___Any other Websites and resources on the Internet (e.g., Websites, email lists, forum, blogs, RSS feed, etc.)
___Any audio and/or video media (radio, TV, etc.)

d. People
___Course instructor(s)
___Classmates and/or fellow students
___Reference Librarians
___Co-workers within SLU
___Co-workers outside the SLU
___Others, Please specify:_____

e. Personal experience
___Previous domain knowledge
___Life experience
___Observation

4. The following list provides you with the geographical locations where you might be to access/use the information resources for your coursework and academic activities. Do you have any added options or is there any item that you think is not necessary?

___In the Medical Center Library
___In the Pius or Law Library
___At home
___In class
___In the computer lab
___Other places on campus, please specify: _____
___Other places off campus, please specify: _____

Card Sorting Results

1. **Sort 70 question items posted on the index cards into the following 11 construct categories. Please write down the number of each question item to the appropriate category and tell me the best item sequence in your mind for each construct.**

   1) Perceived usefulness:

   2) Perceived ease of use:

   3) Perceived free of physical effort:

   4) The quality of information contained in the information resources:

   5) E-resource system quality:

   6) Print resource quality:

   7) Reference services quality:

   8) Library environment:

   9) Computer literacy:

   10) Database searching literacy:

   11) The Internet use literacy:

2. **Please write down the number of question items that you think are ambiguous or poorly worded as well as your revision suggestions.**

APPENDIX C

Pre-Questionnaire Recruitment Letter

March 25, 2007

Dear Public Health Student:

Donghua Tao, health sciences reference librarian at the Medical Center Library of Saint Louis University and Sanda Erdelez, associate professor at the School of Information Science & Learning Technologies of University of Missouri Columbia are inviting you to participate in a dissertation study on "Using Theory of Reasoned Action (TRA) in Understanding Selection and Use of Information Resources: An Information Resource Selection and Use Model". The purpose of this study is to investigate the information resources that you intend to use and actually used as well as to examine the effect of information resource characteristics, library environment and information literacy skills on your selection and use of information resources for an ongoing or to-be-finished term paper or project in the spring semester.

Two self-administered questionnaires will be used as instruments for this study. They are a pre-questionnaire and a post-questionnaire. The pre-questionnaire will ask about the information resource you intend to use to finish your paper assignment, from which source and geographical location you will access the information resource, your previous experience of using your primary resource, and behavior beliefs and your perceptions on the information resource characteristics and library environment. The post- questionnaire will be distributed at the end of April, when you have nearly finished your assignment and will ask you what resource you actually used to finish your paper assignment, the sources and geographical locations where you actually accessed the resource, your information literacy skills, and some basic demographic information. The average time commitment for completing the pre-questionnaire will be approximately 15-20 minutes and the post-questionnaire 10 minutes.

Your answers for the both questionnaires will be confidential and no direct identifying information will be requested on the questionnaires. Your answers for the questionnaire will be kept three years after the study completely finishes just for the possible auditing purpose and will not be released to any other people except the principal investigator and the co-investigator. The results of this study may be published in scientific research journals or presented at professional conferences. However, your name and identity will not be revealed and your record will remain confidential.

Your participation is completely voluntary, and you may withdraw at any time. Your participation will NOT affect your grade in the classes you are taking. You may choose not to participate. If you decide not to participate, there will be no penalty to you and your grade will NOT be affected. In appreciation of your participation, we will provide you with **an $8 Barnes & Noble bookstore gift card or an $8 Billiken Bucks on-campus printing gift certificate** after you finish both pre- and post- questionnaires.

If you would like to answer the pre-questionnaire, please click on (the URL of the pre-questionnaire) and start presenting your opinions and expectations. Should you have any questions about this study and comments about the questionnaires, please contact Donghua Tao at taod@slu.edu or 977-8812. If you have any questions about the study validity and ethical concerns, please contact MU IRB office at 483 McReynolds, University of Missouri Columbia, MO 65211 or call at (573) 882-9585.

Thank you very much for your support!

Sincerely,

Donghua Tao, M.L.I.S., Assistant Professor, Principal investigator
Sanda Erdelez, Ph.D., Associate Professor, Co-investigator

APPENDIX D

Pre-Questionnaire

Information Resource Selection and Use Survey I

INTRODUCTION

Welcome to Information Resource Selection and Use Survey website!

Information Resource Selection and Use Survey includes two surveys, which is called Information Resource Selection and Use Survey I (Survey I) and Information Resource Selection and Use Survey II (Survey II). What you have currently accessed is Survey I. Survey II will be distributed at the end of April.

This survey I will ask you questions about the information resources that you **intend to use** for a new or an ongoing research paper or project assignment in this semester. In addition, your perceptions on print, electronic, and human information resources as well as library environment will also be asked. There are no right or wrong answers, please simply answer as accurately as possible.

There will be three parts for Survey I. The average time commitment for completing this survey is approximately 15-20 minutes.

Your participation is completely voluntary, and you may withdraw at any time. Your participation will NOT affect your grade in the classes you are taking. You may choose not to participate. If you decide not to participate, there will be no penalty to you and your grade will NOT be affected. However, your participation is greatly appreciated and will benefit all the Public Health students by helping us provide more user-centered information services.

Your answers for the post-questionnaire will be confidential. The questionnaire will be kept confidential and no direct identifying information will be requested on the questionnaires. The results of this study may be published in scientific research journals or presented at professional conferences. However, your name and identity will not be revealed and your record will remain confidential.

In appreciation of your participation, either **an $8 Barnes & Noble bookstore gift card** or **an $8 Billiken Bucks on-campus printing gift certificate** after you finish both Survey I and Survey II will be provided. At the end of Survey II, you will be asked to choose the incentive type. In order to track the incentive you have chosen, the last four digits of your Banner ID number will be asked to fill out at the end of both Survey I and Survey II.

Thank you for your time and have fun!

Part I: Intend-to-use Information Resources

The following six questions will ask you about the information resources that you **intend to use** to finish your research paper or project assignment.

1. What are the PRINT resources that you will possibly use to finish your paper or project assignment? Please check all that apply.

___Textbooks or books
___Journals
___Index/Abstract
___Reference works
___Course reserve
___Materials received through Interlibrary Loan
___Curriculum materials (e.g. Course handouts, etc.)
___Conference proceedings
___Archives (e.g. Documents and records)
___Annual report/Technical report
___Thesis/Dissertation
___Library orientation handout
___Library instruction handout
___Newsletter
___Others (Please specify)_____

2. What are the ELECTRONIC resources that you will possibly use to finish your paper or project assignment? Please check all that apply.

___Library online catalog
___Books on line
___E-journals
___Online databases (e.g. MEDLINE, PubMed, PsychInfo, etc.)
___E-Reserve articles and book chapters
___Materials received through Interlibrary Loan
___The Internet (Search engines, Websites other than the library websites, Blogs, email lists, etc.)
___Electronic curricular materials (WebCT)
___Online tutorials
___Computer Aided Learning (CAL) materials (e.g. education software, etc.)
___TV, radio, and other mass media
___Others (Please specify) _____

3. What are the HUMAN information resources that you will possibly use or will be using to finish your paper or project assignment? Please check all that apply.

___Faculty in class

___Faculty, scholars, and professionals outside of the class outside of the class
___Peers (Classmates or fellow students
___Colleagues or others at your place of study/work
___Colleagues outside of your place of study/work
___Information service staff (e.g. Reference librarians)
___Others (Please specify) _____

4. Which specific resource will you use FIRST among the resources you picked in Questions 1-3.

5. Which specific resource will you use LAST among the resources you picked in Questions 1-3.

6. What is your PRIMARY RESOURCE that you intend to use among all the resources you answered in Questions 1-3? Please choose only one resource.

Part II: Access, Previous Experience, Perceptions of Using the Intend-to-use Primary Resource

Please keep the primary resource that you just picked in mind. The following questions will ask you about the access, previous experience, and the perceptions on using the primary resource you intend to use to finish your assignment.

1. Which specific source will you primarily approach to access/use the primary resource that you intend to use to finish your assignment? Please pick only one category and only one source within that category.

a. Libraries
___Physically go to the Medical Center Library
___Medical Center Library's Website
___Physically go to Pius library or law library
___Pius or law library's Website
___Personal library or collections
___Other academic libraries or public libraries
Please specify: _____

b. Courses-related activities
___Course lectures
___Course-related small group study
___Exams and tests
___Training sessions/CE courses
___Practicing activities (e.g., internship, fellowship, volunteer, etc.)
___Others (Please specify): _____

c. The Internet
___The School of Public Health's Website
___ Publisher's Website
___Author's Website
___Search Engines (Google, Yahoo, AskJeeves, etc.)

d. People
___Course instructor(s)
___Classmates and/or fellow students
___Reference Librarians
___Co-workers within SLU

___Any other Websites and resources on the Internet (e.g., Websites, email lists, forum, blogs, RSS feed, etc.)
___Any audio and/or video media (radio, TV, etc.)
___Others (Please specify) _____

___Co-workers outside the SLU
___Scholars, experts, and professionals outside the SLU
___Others (Please specify): _____

e. Personal experience

___Previous knowledge in the public health field
___Life experience
___Observation
___Others (Please specify) _____

2. **At which geographical location will you primarily be to access/use the primary resource that you intend to use to finish your assignment? Please <u>pick only one</u>.**
   ___In the Medical Center Library
   ___In the Pius or Law Library
   ___At home
   ___In class
   ___In the computer lab
   ___Others, please specify: _____

3. **How did you know or hear about the primary resource that you intend to use to finish your assignment? Please <u>check all that apply</u>.**
   ___From course instructor's recommendation
   ___From classmates and/or fellow students
   ___From the experts in the field
   ___From professional conference
   ___From the Internet (Search engines, Websites, blogs, email list, forum, etc.)
   ___From the library's instructions
   ___From the interaction with reference librarians when I ask for literature search help
   ___Others, please specify: _____

Intention to use

4. **I intend to use the primary resource to finish my assignment.**

Strongly DISAGREE			Neutral			Strongly AGREE
1	2	3	4	5	6	7

5. **I intend to use the primary resource at every opportunity while completing the assignment.**

Strongly Strongly
DISAGREE Neutral AGREE
1 2 3 4 5 6 7

6. To the extent possible, I would use the primary resource to find information for finishing my assignment.

Strongly Strongly
DISAGREE Neutral AGREE
1 2 3 4 5 6 7

7. I intend to increase my use of the primary resource in the future.

Strongly Strongly
DISAGREE Neutral AGREE
1 2 3 4 5 6 7

Previous experience of using the intent-to-use primary resource

8. Regarding the primary resource you have chosen for finishing your paper/project, have you used it before? ____ Yes ___ No
(*Note: If you choose "No", please jump to question 18. Otherwise, please continue answering the following questions.)

9. How long have you been using the primary resource?
___ Less than 1 year ___ 1-3 years ___4-6 years ___7-10 years ___over 10 years

10. On the average, how often do you use the primary resource?
___ at least once a week ___ at least once a month ___2-3 times within one semester
___ 3-5 times within one year ___ rarely

11. What probability do you think you could find what you were looking for from the primary resource?
__10%-20% __30% __50% __60% __80%
__ More than 80%

12. How much do you think you are aware of the availability of the primary resource that you intend to use?
___Not at all ___a little ___some ___pretty much ___a lot

13. How much do you think you know about the scope and content of the primary resource that you intend to use?
___Not at all ___a little ___some ___pretty much ___a lot

14. How much do you think you know about the functions, features, and tools provided by the primary resource that you intend to use?

___Not at all ___a little ___some ___ pretty much ___a lot

Open-ended questions

15. Please give THREE main reasons why you choose the primary resource to finish your assignment.

16. Please give THREE main reasons why you do not choose the resources in the other two resource categories that do not include your selected primary resource. Please give THREE reasons for each type of information resource. (For example, if you choose print textbooks as your primary resource, please give three main reasons why you do not intend to use resources in the categories of electronic and human resources.)

Normative Beliefs	Strongly DISAGREE			Neutral			Strongly AGREE
1. My Instructors expect me to use the primary resource that I intend to use	1	2	3	4	5	6	7
2. My Instructors want me to frequently use the primary resource that I intend to use	1	2	3	4	5	6	7
3. Generally speaking I try to do what Instructors think I should do	1	2	3	4	5	6	7
4. My Classmates expect me to use the primary resource that I intend to use	1	2	3	4	5	6	7
5. My Classmates want me to frequently use the primary resource that I intend to use	1	2	3	4	5	6	7

6. Generally speaking I try to do what Classmates think I should do	1	2	3	4	5	6	7
7. The health sciences Reference Librarians expect me to use the primary resource that I intend to use	1	2	3	4	5	6	7
8. The health sciences Reference Librarians want me to frequently use the primary resource that I intend to use	1	2	3	4	5	6	7
9. Generally speaking I try to do what health sciences Reference Librarians think I should do	1	2	3	4	5	6	7

Behavior Beliefs	Strongly DISAGREE			Neutral			Strongly AGREE
1. Using the Primary Resource helps me to be a productive student	1	2	3	4	5	6	7
2. Using the Primary Resource enhances my effectiveness on the coursework	1	2	3	4	5	6	7
3. Using the Primary Resource improves my academic performance	1	2	3	4	5	6	7
4. I find the Primary Resource a useful tool for me to finish the assignment	1	2	3	4	5	6	7
5. Learning to use the Primary Resource is easy for me	1	2	3	4	5	6	7
6. I find it is easy to get the Primary Resource to do what I want to do	1	2	3	4	5	6	7
7. It is easy for me to become skillful at using the Primary Resource	1	2	3	4	5	6	7
8. The Primary Resource is easy to use	1	2	3	4	5	6	7

9. I find I don't need to take too much physical effort to find or approach the Primary Resource	1	2	3	4	5	6	7
10. I find the Primary Resource is always available whenever I need to use it	1	2	3	4	5	6	7
11. Accessing the Primary Resource is convenient	1	2	3	4	5	6	7
12. Overall, using the Primary Resource will save me a lot of physical effort	1	2	3	4	5	6	7

Part III: Perceptions on the Difference Types of Information Resources and Library Environment

The following questions will ask you about your perceptions on Print, Electronic, and Human information resources as well as library environment. The resources listed in the question 1-3 provide you with some sample resources of each type. Please rate the following statements.

* Tips: For example, if you choose print textbook as your intend-to-use primary resource, please provide your perception on the Print resource quality by using print textbook as an example. For the other two types of information resources (E-resource and Reference services), please try your best to provide your general perceptions. The same strategy can be applied when your intend-to-use primary resource is one of the E-resources or Reference librarians.

Perceptions on Electronic Resources	Strongly DISAGREE			Neutral			Strongly AGREE
1. E-resource(s) contains relevant information to the topic of the assignment	1	2	3	4	5	6	7
2. E-resource(s) contains current, latest, and up-to-date information	1	2	3	4	5	6	7
3. E-resource(s) contains reliable information	1	2	3	4	5	6	7
4. E-resource(s) contains accurate and valid information	1	2	3	4	5	6	7
5. E-resource(s) contains information in a wide scope and depth	1	2	3	4	5	6	7
6. E-resource(s) contains enough information for me to finish the assignment	1	2	3	4	5	6	7
7. E-resource(s) provides searching functions that I can use to finish my assignment	1	2	3	4	5	6	7
8. E-resource(s) provides assistance to help me identify the search terms	1	2	3	4	5	6	7
9. The information on the web pages of E-resources is presented in a clear and well-organized manner	1	2	3	4	5	6	7
10. The E-resource(s) is easy to navigate	1	2	3	4	5	6	7
11. The E-resource(s) responds quickly when I am doing a search on it	1	2	3	4	5	6	7
12. The E-resource(s) allows me to manage the search results in different ways (display, export, print, save, email, etc.) based on my personal preference	1	2	3	4	5	6	7

Perceptions on Print Resources	Strongly DISAGREE			Neutral			Strongly AGREE
1. Print-resource(s) contains relevant information to the topic of the assignment	1	2	3	4	5	6	7
2. Print-resource(s) contains current, latest, and up-to-date information	1	2	3	4	5	6	7
3. Print-resource(s) contains reliable information	1	2	3	4	5	6	7
4. Print-resource(s) contains accurate and valid information	1	2	3	4	5	6	7
5. Print-resource(s) contains information in a wide scope and depth	1	2	3	4	5	6	7
6. Print-resource(s) contains enough information for me to finish the assignment	1	2	3	4	5	6	7
7. Print-resource(s) provides clear index systems	1	2	3	4	5	6	7
8. Print-resource(s) provides an easy to understand reference system (such as “see”, “see also”, etc.)	1	2	3	4	5	6	7
9. Print-resource(s) provides clear user instructions	1	2	3	4	5	6	7
10. The information on each page of the Print-resource(s) is presented in a clear and well-organized manner	1	2	3	4	5	6	7
11. Print-resource(s) is organized well to make it easy to go to other pages to find the information and return to the previous page	1	2	3	4	5	6	7
12. Print-resource(s) uses consistent terms	1	2	3	4	5	6	7

Perceptions on Reference services	Strongly DISAGREE			Neutral			Strongly AGREE
1. Reference librarians provide the information that is related to the topic of the assignment.	1	2	3	4	5	6	7
2. Reference librarians give the current, latest, and up-to-date information	1	2	3	4	5	6	7
3. Reference librarians provide reliable information	1	2	3	4	5	6	7
4. Reference librarians provide accurate and valid information	1	2	3	4	5	6	7
5. Reference librarians provide information in a wide scope and depth	1	2	3	4	5	6	7
6. Reference librarians provide enough information for me to finish the assignment	1	2	3	4	5	6	7
7. Reference librarians are ready to help me whenever I approach them	1	2	3	4	5	6	7
8. Reference librarians acknowledge me waiting for services when he/she is serving other users	1	2	3	4	5	6	7
9. Reference librarians show interest in my question	1	2	3	4	5	6	7
10. Reference librarians understand my question	1	2	3	4	5	6	7
11. Reference librarians help me to articulate ambiguous question	1	2	3	4	5	6	7
12. Reference librarians make sure I find what I want	1	2	3	4	5	6	7

13. Reference librarians' literature search instruction and/or library orientation gives me awareness of information resources and services provided by the library	1	2	3	4	5	6	7
14. Reference librarians' literature search instruction and/or library orientation gets me to use information resources and services provided by the library	1	2	3	4	5	6	7
15. Reference librarians' literature search instruction and/or library orientation makes me skillful at searching online databases	1	2	3	4	5	6	7
16. Overall, I am satisfied with the reference services I received	1	2	3	4	5	6	7
Perceptions on Library Environment	Strongly DISAGREE			Neutral			Strongly AGREE
1. The library is close to my home or work	1	2	3	4	5	6	7
2. It is easy to find a parking space when I drive to the library	1	2	3	4	5	6	7
3. The library's hours are convenient to me	1	2	3	4	5	6	7
4. I can get on-site assistance from the staff of the circulation, Interlibrary Loan, and reference departments in the library	1	2	3	4	5	6	7
5. I can get on-site technical assistance in the library	1	2	3	4	5	6	7
6. The library has a rich collection of books, journals, reference works, and other hard copy materials	1	2	3	4	5	6	7
7. The library has a rich collection of e-journals, e-books, online databases, and other electronic materials	1	2	3	4	5	6	7

8. The library provides easy off-campus access to the library's electronic resources and services	1	2	3	4	5	6	7
9. Most of the time, I can find or have a computer/laptop to use in the library	1	2	3	4	5	6	7
10. Photocopying is convenient in the library	1	2	3	4	5	6	7
11. Printing is convenient in the library	1	2	3	4	5	6	7
12. It is easy to figure out the arrangement of the materials in the library	1	2	3	4	5	6	7
13. The book shelves in the library are easy to navigate	1	2	3	4	5	6	7
14. Overall, the library's environment provides me with easy access of information resources and services	1	2	3	4	5	6	7

Thank you very much! ☺

Thank you very much for your participation. We cordially look forward to your participation in Survey II in April.
You will be asked to pick either **an $8 Barnes & Noble bookstore gift card** or **an $8 Billiken Bucks on-campus printing gift certificate** at the end of the Survey II. In order for us to track the incentive that you will choose at the end of Survey II, please write down the last four digits of your Banner ID number (e.g., the full number of your Banner ID is 000456789. Please write down "6789" into the answer box.)

_____

APPENDIX E

Post-Questionnaire Recruitment Letter

April 20, 2007

Dear Public Health Student:

Thank you for filling out the pre-questionnaire for the dissertation study on "Using Theory of Reasoned Action (TRA) in Understanding Selection and Use of Information Resources: An Information Resource Selection and Use Model". We greatly appreciate your participation and we hope you had a smooth process of writing your paper and/or completing your projects.

As stated in the previous letter, a post-questionnaire will be distributed at the end of April. This post-questionnaire will ask you what resource you actually used to finish your paper assignment, the sources and geographical locations where you actually accessed the resource, your information literacy skills, and some basic demographic information. The average time commitment for completing the post-questionnaire will be approximately 10 minutes.

Your answers for the post-questionnaire will be confidential. The questionnaire will be kept confidential and no direct identifying information will be requested on the questionnaires. Your answers for the questionnaire will be kept three years after the study completely finishes just for the possible auditing purpose and will not be released to any other people except the principal investigator and the co-investigator. The results of this study may be published in scientific research journals or presented at professional conferences. However, your name and identity will not be revealed and your record will remain confidential.

Your participation is completely voluntary, and you may withdraw at any time. Your participation will NOT affect your grade in the classes you are taking. You may choose not to participate. If you decide not to participate, there will be no penalty to you and your grade will NOT be affected. In appreciation your participation, you will receive **an $8 Barnes & Noble bookstore gift card or an $8 Billiken Bucks on-campus printing gift certificate** after you finish both pre- and post-questionnaires.

If you would like to answer the post-questionnaire, please click on (the URL of the post-questionnaire) and start answer questions. Should you have any questions about this study and comments about the questionnaires, please contact Donghua Tao at taod@slu.edu or 977-8812. If you have any questions about the study validity and ethical concerns, please contact MU IRB office at 483 McReynolds, University of Missouri Columbia, MO 65211 or call at (573) 882-9585.

Thank you very much for your support!

Sincerely,

Donghua Tao, M.L.I.S., Assistant Professor, Principal investigator
Health Sciences Reference Librarian
The Liaison to the School of Public Health
The Medical Center Library
Saint Louis University
(314) 977-8812 (O)
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University of Missouri-Columbia
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APPENDIX F

Post-Questionnaire

Information Resources Selection and Use Survey II

INTRODUCTION

Thank you for filling out the Survey I for our study. We greatly appreciate your participation and we hope you had a smooth process of writing your paper and/or completing your projects. Now, here comes the Survey II.

The Survey II asks questions about the information resources that you **have actually used** for your assignment and the basic demographic information. Your information technologies experience and skills will also be asked. Please be aware that those questions aim to get general information about those areas and your answers will help us to find the information service gap. They do not mean you should possess those skills. In addition, there are no right or wrong answers. Please simply answer as accurately as possible.

There will be four parts for the Survey II. The average time commitment for completing the post-questionnaire will be approximately 10 minutes.

Your participation is completely voluntary, and you may withdraw at any time. Your participation will NOT affect your grade in the classes you are taking. You may choose not to participate. If you decide not to participate, there will be no penalty to you and your grade will NOT be affected. However, your participation is greatly appreciated and will benefit all the Public Health students by helping us provide more user-centered information services.

Your answers for the post-questionnaire will be confidential. The questionnaire will be kept confidential and no direct identifying information will be requested on the questionnaires. The results of this study may be published in scientific research journals or presented at professional conferences. However, your name and identity will not be revealed and your record will remain confidential.

In appreciation of your participation, either **an $8 Barnes & Noble bookstore gift card** or **an $8 Billiken Bucks on-campus printing gift certificate** will be provided after you finish both Survey I and Survey II. At the end of this survey, you will be asked to choose the incentive. In order for us to track the incentive that you have chosen, the last four digits of your Banner ID number will also be asked to fill out.

Thank you for your time again!

Part I: Actual Use of Information Resources

The following six questions will ask you about the information resources that you **have actually used** to finish your research paper or project assignment.

1. What are the <u>PRINT</u> resources that you have actually used to finish your paper or project assignment? Please check all that apply

___Textbooks or books
___Journals
___Index/Abstract
___Reference works
___Course reserve
___Materials received through Interlibrary Loan
___Curriculum materials (e.g. Course handouts, etc.)
___Conference proceedings
___Archives (e.g. Documents and records)
___Annual report/Technical report
___Thesis/Dissertation
___Library orientation handout
___Library instruction handout
___Newsletter
___Others (Please specify)_____

2. What are the <u>ELECTRONIC</u> resources that you have actually used to finish your paper or project assignment? Please check all that apply.

___Library online catalog
___Books on line
___E-journals
___Online databases (e.g. MEDLINE, PubMed, PsychInfo, etc.)
___E-Reserve articles and book chapters
___Materials received through Interlibrary Loan
___The Internet (Search engines, Websites other than the library websites, Blogs, email lists, etc.)
___Electronic curricular materials (WebCT)
___Online tutorials
___Computer Aided Learning (CAL) materials (e.g. education software, etc.)
___TV, radio, and other mass media
___Others (Please specify) _____

3. What are the <u>HUMAN</u> information resources that you have actually used to finish your paper or project assignment? Please check all that apply.

___Faculty in class
___Faculty, scholars, and professionals outside of the class outside of the class
___Peers (Classmates or fellow students
___Colleagues or others at your place of study/work
___Colleagues outside of your place of study/work
___Information service staff (e.g. Reference librarians)
___Others (Please specify) _____

4. Which specific resource have you actually used FIRST among the resources you picked in Questions 1-3.

5. Which specific resource have you actually used LAST among the resources you picked in Questions 1-3.

6. What is your PRIMARY RESOURCE that you have used to finish your assignment? Please choose only one resource from what you've picked in questions 1-3.

Part II

Please keep the primary resource that you just picked in mind. The following questions will ask you about the access and the actual use of the primary resource to finish your assignment.

1. Which specific source have you primarily approached to access/use the primary resource that you have actually used to finish your assignment? Please pick only one category and only one source within that category.

a. Libraries

___Physically went to the Medical Center Library
___Medical Center Library's Website
___Physically went to Pius library or Law library
___Pius or Law library's Website
___Personal library or collections
___Other academic libraries or public libraries
Please specify: _____

b. Courses-related activities

___Course lectures
___Course-related small group study
___Exams and tests
___Training sessions/CE courses
___Practicing activities (e.g., internship, fellowship, volunteer, etc.)
___Others (Please specify): _____

c. The Internet

___The School of Public Health's Website
___ Publisher's Website
___Author's Website
___Search Engines (Google, Yahoo, AskJeeves, etc.)
___Any other Websites and resources on the Internet (e.g., Websites, email lists, forum, blogs, RSS feed, etc.)
___Any audio and/or video media (radio, TV, etc.)
___Others (Please specify) _____

d. People

___ Course instructor(s)
___Classmates and/or fellow students
___Reference Librarians
___Co-workers within SLU
___Co-workers outside the SLU
___Scholars, experts, and professionals outside the SLU
___Others (Please specify) _____

e. Personal experience

___Previous knowledge in the public health field
___Life experience
___Observation
___Others (Please specify) _____

2. **Where did you primarily access/use the primary resource to finish your assignment? Please <u>pick only one</u>.**
   ___In the Medical Center Library
   ___In the Pius or Law Library
   ___At home
   ___In class
   ___In the computer lab
   ___Others, please specify: _____

3. **How do you know or hear about the primary resource that you used to finish your assignment? Please <u>check all that apply</u>.**
   ___From course instructor's recommendation
   ___From classmates and/or fellow students
   ___From the experts in the field
   ___From professional conference
   ___From the Internet (Search engines, Websites, blogs, email list, forum, etc.)
   ___From the library's instructions
   ___From the interaction with reference librarians when I ask for literature search help
   ___Others, please specify: _____

Actual Use of the Primary Resource

4. Can you estimate how many total hours you have used the primary resource for completing the assignment?
   ____Less than 1 hour ____1-5 hours ____6-10 hours ____11-15 hours
   ____16-20 hours ____21-25 hours ____More than 26 hours

5. How often have you accessed the primary resource that you used for completing your assignment?
   ____More than 5 times a day ____2-5 times a day ____Once a day
   ____2-3 times a week ____Once a week ____2-3 times a month
   ____Once a month

Open-ended questions

6. If the primary resource you have actually used is different from the primary resource you planned to use before you started the paper, could you give **<u>THREE</u>** main reasons to explain why?

7. Is the primary resource you have actually used the one that you happened to find when you searched the information by using other resources? If yes, were there any other resources you also encountered that were useful for your assignment?

8. Are there any other resources you happened to find when you searched for information to finish your paper that could actually be useful to other assignments or projects? If so, could you list as many of them as possible?

PART III: Demographic Information

1. What is your gender?
Male_____ Female_____

2. Which age range do you fall in?
____ under 20 ____ 21-25 ____ 26-30 ____ 31-35
____ 36-40 ____ 41-45 ____ 46-50 ____ over 51

3. What is the highest level of education or degree you have completed before you started your current program?
____Undergraduate course work ____Specialist ____Certificate
____B.S./B.A. ____M.S./M.A. ____Ph.D.
____Others, please specify:_____

4. What is the major of your highest degree completed? _____

5. Please indicate whether you are also currently enrolled in any of the below programs beside programs in the School of Public Health (Dual Degrees)?
____No, I am not ____Specialist ____Certificate ____B.S/B.A. ____M.S./M.A.
____Ph.D. ____Others, please specify:_____

6. Please specify the major, if any, of your second degree program you are currently enrolled:
_____

7. How many total years of previous and/or current work experience do you have that is relevant to the public health field?
___None ___ 1-3 years ___4-6 years ___7-10 years ___over 10 years

8. Before you started the graduate program in public health, how much do you think you knew about public health?
___Not at all ___a little ___some ___much ___pretty much

Part IV: Information Literacy Skills

Computer use

1. How long have you been using a personal computer?

___ Less than 6 months ___ 6 months – 2 years ___ 2 - 5 years
___ 5-10 years ___ More than 10 years

2. On average, how many hours a week do you use a computer for the purposes of studying and working?

___Less than 10 hours ___10-20 hours ___20-30 hours
___30-40 hours ___More than 40 hours

3. How would you rate your proficiency in using the following software/computer program? Please write down the number (1-5) for each program.

1. Have not used it 2. Fair 3. Good 4. Very Good 5. Excellent

___ MicroSoft Office applications, such as Word, Excel, and PowerPoint
___ Microsoft Access
___ Microsoft Publisher
___ EndNote or Reference Manager
___ SPSS or SAS
___ Dreamweaver or Frontpage
___ MicroSoft Viso
___ Adobe PhotoShop or Paint
___ Adobe Acrobat Reader
___ Real player, Windows Media Player, or QuickTime Player
___ WinZip or WinRar
___ Anti-virus, such as Norton

4. How would you rate your proficiency in the following general computer skills? Please write down the number (1-5) for each skill.

1. Don't know how to do it 2. Fair 3. Good 4. Very Good 5. Excellent

___ Copy and paste among Word documents
___ Select, copy, and paste among image files
___ File management in the operation system, such as create a folder, delete a file, save a file to another folder, etc.
___ Compress a folder
___ Open a compressed file
___ Import and export data between different software systems
___ Search files by using "Search" function in Windows XP Operating System
___ Install and/or uninstall a software program
___ Use a scanner
___ Print the documents or image files from software programs

Online database use

5. How long have you been using online databases available in the libraries or any other places?

___ Less than 1 year ___ 1 - 2 years ___ 2-3 years
___ 3- 5 years ___ More than 5 years

6. How often do you use online databases?

___ at least once a week ___ at least once a month
___2-3 times within one semester ___ 3-5 times within one year
___ Less than 3-5 times within one year

7. How would you rate your proficiency in the following database searching skills? Please write down the number (1-5) for each skill.

1. Don't know how to do it 2. Fair 3. Good 4. Very Good 5. Excellent

___ Use keywords or phrases to search a topic
___ Use a thesaurus in a database to select appropriate subject terms for searching
___ Use Boolean operators (e.g. AND, OR, NOT) to construct a search
___ Use a particular search field (e.g., title, author, journal, etc.) to conduct a search
___ Use limits features provided by the databases to narrow a search
___ Use truncation symbols (e.g., *, $) to find variants of search words (e.g., disease, diseases, diseasing)
___ Find full text articles from the search results
___ Email search results, with abstracts, to myself or to someone else
___ Export search citations to EndNote
___ Save a search so that I can re-run it later

The Internet use

8. How long have you been using the Internet?

___ Less than 6 months ___ 6 months – 2 years ___ 2 - 5 years
___ 5-10 years ___ More than 10 years

9. How many hours per week do you spend on the Internet?

___I don't get on to the Internet ___ 0-5 hours ___ 6-10 hours
___ 11-20 hours ___ More than 20 hours

10. How would you rate your proficiency in the following Internet activities? Please write down the number (1-5) for each activity.

1. Don't know how to do it 2. Fair 3. Good 4. Very Good 5. Excellent

___ Check e-mail
___ Search by using search engines
___ Online chatting
___ Use listserv
___ Browsing—exploring one or more sites
___ Navigate web pages within one website
___ Bookmark the websites
___ Print a web page
___ Download files
___ Create a personal homepage

Thank you very much! ☺

I appreciate your full participation for our study. Your answers will help us to design more customized information service programs to all the students at the School of Public Health.

Thanks again!

1. **Please choose which gift card you prefer to receive**
   ___One $8 Barnes & Noble bookstore gift card, **OR**
   ___One $8 Billiken Bucks on-campus printing gift certificate

2. **In order to help us track the incentive you have chosen, please write down the last four digits of your Banner ID number here (e.g. The full number of your Banner ID is 000456789. Please write down "6789" in the answer box.)**
   _____

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