Users’ Help-Seeking Behaviors in Computer-Based Tasks: An Exploratory Study Using Structural Equation Modeling

For ASIST & Thomson Reuters Doctoral Dissertation Proposal Scholarship

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Rapid development in information technology (IT) has affected people’s lives and changed their work environments, which demands IT competency. The majority of computer users who use IT systems and application programs will frequently encounter interaction or conceptual problems that hinder their completion of the task at hand. These real-time problems occur when the user lacks awareness of, or fails to find, the available function needed to support the task. There are situations when the user has found the function but cannot interpret a message from the system to take correct action. These are some of the problem-solving situations encountered in real-time computer-based tasks. Users need strategies to quickly pinpoint the underlying problem independently, or need to seek external help to move on with interactions. When users lack successful strategies to solve the problem themselves, they are likely to seek help from external sources. Successful help can improve task performance and reduce stress. A better understanding of help-seeking behaviors of users in real-time task-based situations is critical to designing useful sources of help and improving user-system interaction.

There is a substantial body of literature on help-seeking in various learning contexts observed in traditional classroom settings or in interactive computer-assisted learning settings. The majority of the help-seeking studies focused on learners of disciplines, such as chemistry, mathematics, botany, etc.; the purpose of these studies was either to understand if help could
improve learners’ understanding of the subjects and produce better learning outcomes (Aleven, Stahl, Schworm, Fischer, & Wallace, 2003; Aleven, McLaren, Roll, & Koedinger, 2004; Nelson-Le Gall, 1985) or to identify learner-related or system-related factors influencing help-seeking behaviors (Dutke & Reimer, 2000; Ryan, Gheen, & Midgley, 1998; Ryan, Patrick, & Shim, 2005; Ryan, Pintrich & Midgley, 2001). Studies of help seeking in information retrieval (IR) systems (Xie, 2007; Xie & Browser, 2009; Xie & Cool, 2006, 2007, 2009) focused on types of help-seeking situations and related factors, problems of IR help features, and perceived usefulness of IR help features by users. These studies either tested hypotheses to examine how help-seeking behaviors related to personal/system factors and learning outcomes, or qualitatively analyzed help mechanisms in an IR context.

Few studies, however, have investigated the interplay of help seeking, personal factors, and task performance in simulated computer task-based situations. This study proposes a help-seeking behavior model, which posits help seeking in a simulated task setting as the central focus in observing how help-seeking behaviors are affected by personal factors, and also how help-seeking behaviors influence task performance. In addition, because of the availability of various sources of help, this study aims to examine users’ opinions of help sources to enhance our understanding of the help-seeking phenomenon from users’ perspectives. Thus, the purpose of this study is twofold: (1) to identify personal factors influencing help-seeking effectiveness and task performance, and (2) to investigate perceived usefulness of different help types. The findings of the study will provide insight into help-seeking behaviors in a simulated task setting. The results will have theoretical value in helping to establish help-seeking research in the broad context of computer problem-solving situations. Furthermore, the help-seeking behavior model can serve as a foundation for future research into developing a more sophisticated model. As a practical benefit, findings from this study can provide suggestions on improving information
systems design by incorporating users’ characteristics into help-seeking needs in order to
introduce adaptive mechanisms into help features.

**Brief Literature Review**

Help-seeking behavior research has been carried out extensively in traditional classroom
learning settings and in computer-assisted learning environments. The problem-solving process
in learning contexts bears similarities to computer-based task contexts. The prolific results from
research in learning contexts can help identify possible personal factors influencing help seeking
in a non-learning context. Also, help-seeking research in information retrieval systems
investigated problems with, and perceived usefulness of, help features in IR systems when users
performed search tasks. Findings from IR search-task settings could benefit research in a general
computer-based task setting. Therefore, personal factors examined in relation to help-seeking are
discussed in these three contexts.

**Gender**

Gender has an effect on help seeking in both the traditional and the computer-assisted
learning contexts. Male students tended to avoid asking for help more than females did (Ryan et
al., 1998; Butler, 1998); elementary school boys performed better with less help information and
spent less time processing hints in computer-assisted learning systems than did elementary
school girls (Arroyo, 2000, 2001). In addition, earlier studies have also shown gender disparities
in a variety of personal factors such as goal orientation, self-efficacy, attitude, etc.

**Prior Experience**

Prior experience, either prior subject knowledge or experience with computer systems,
has been reported to have a significant effect on people’s help-seeking behaviors in both IR
systems and learning environments (Bartholome et al., 2006; Newman and Schwager, 1995;
Puustinen, 1998; Xie & Cool, 2009). Prior experience was related to the type of help sought, the way to elicit a help request, as well as the situation to seek help in IR system.

**Self Efficacy**

Bandura (1977) defined the efficacy expectation as “the conviction that one can successfully execute the behavior required to produce the outcomes” (p. 193). Self-efficacy affects not only the choice of a certain activity, but also how much effort is put forth and how long individuals sustain it in dealing with a stressful situation. Efficacy in computing environments is redefined to reflect individuals’ assessment of their computing abilities – computer self-efficacy (CSE). Literature results showed that individuals’ CSE affected their help-seeking behaviors, task-accomplishment behaviors, and learning behaviors, which in turn resulted in different learning outcomes or task performance (Brosnan, 1998; Butler & Neuman, 1995; Johnson, Hornik, & Salas, 2008; Newman, 1990; Ryan et al., 1998, 2005).

**Anxiety**

With the introduction of computers into daily life, the demands of learning how to operate and utilize computer technologies have produced computer anxiety (CA). There is scant literature studying associations between help-seeking behaviors and anxiety in learning and IR environments. Studies in a general computing context, however, examined the correlates between CA and computer users’ behaviors in performing tasks. Individuals with high CA had more off-task thoughts during task accomplishment, such as worries about task success or their self-image (Glass & Knight, 1988; Mcelroy & Morrow, 1990).
Table 1. Summary of literature of help seeking studies

<table>
<thead>
<tr>
<th>Personal Factors</th>
<th>Information Retrieval Systems</th>
<th>Traditional Classroom Settings</th>
<th>Computer-Assisted Learning Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>×</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>Prior Experience (Computer) Self-Efficacy</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>Anxiety</td>
<td>×</td>
<td>×</td>
<td>×</td>
</tr>
</tbody>
</table>

Table 1 summarizes help-seeking studies in three contexts, with the personal factors examined as well as the main research methods employed. The aim of the proposed study is to discover the roles of individual differences in help seeking and performance outcomes in the context of one study.

Development of Theoretical Model

*Gender, Prior Experience, Computer Self-Efficacy (CSE), and Computer Anxiety (CA)*

Findings from previous studies suggested that gender relates to a variety of personal factors such as attitude, self-efficacy, and so on. Therefore, the gender effect will be examined concerning its effect on individuals’ cognitive and affective states (computer self-efficacy and computer anxiety). Results from earlier research leads to the following hypotheses regarding gender.

\[ H_1: \text{Males will have higher CSE levels than females.} \]
\[ H_2: \text{Males will have lower CA levels than females.} \]

In this study, prior experience refers to computer users’ expertise level and familiarity with a particular software program that users will use as a basis for accomplishing a novel task. Instead of replicating earlier studies to prove the positive effect of prior experience on task
performance, this study will investigate prior experience in regard to how it influences two psychological personal factors: users’ personal assessment of their abilities (CSE), and their affective responses toward the software and the computing environment (CA).

\[ H_3: \text{Individuals with a higher level of prior experience will show a higher level of CSE.} \]
\[ H_4: \text{Individuals’ prior experience will be negatively associated with their CA level.} \]

**Help Seeking**

The result of making a help request can be successful or not successful in terms of assisting people in making progress. Therefore, help seeking success can be represented as the success rate of help requests, that is, requests that assist computer users in moving on toward accomplishing their task. Gender differences in help-seeking related studies have shown that males had better and more systematic help-seeking strategies than did females. But gender effect on help seeking has seldom been examined in computer-based task environments. This study proposes the following hypothesis.

\[ H_5: \text{Males will have a higher success rate of help requests than females.} \]

Related studies in traditional classroom learning contexts reported the positive effect of academic efficacy on effective help seeking. The finding suggests a possible positive relationship between computer self-efficacy and success rate of help requests. In addition, a negative effect of computer anxiety on computer task performance indicated that high anxiety will hinder computer users’ effective help seeking because of their worries about their performance and thus devoting more time to off-task thoughts.

\[ H_6: \text{Individuals with higher CSE levels will have a higher success rate of help requests.} \]
\[ H_7: \text{Individuals with higher CA levels will have a lower success rate of help requests.} \]
**Task Performance**

The completion of the assigned computer task and time spent on the task will be the criteria to assess individuals’ performances. The literature on help seeking in learning contexts found that there is a positive influence of effective help-seeking strategies on task performance, which indicates a possible positive effect of success rate of help requests on task performance in a computer-based task environment.

**H8**: Individuals having a higher success rate of help requests will have better task performance.

**Theoretical Help-Seeking Model**

The theoretical model (Figure 1) summarizes the variables and their presumed relationships for this study. The straight lines with a single arrowhead connecting two variables represent a hypothesized influence of one variable on the other, whereas the curved line with two arrowheads represents a hypothesized correlation between two variables.

![Figure 1. Theoretical Help Seeking Model](image.png)
Research Methods

The proposed study aims to observe how individuals interact with software and how they move forward to complete a novel task in a problem-solving situation. For this purpose, the researcher will create a task-accomplishment environment in a lab setting to simulate a problem-solving situation. Participants will perform a computer task in a usability lab that has a one-way window separating the participants and the observer to minimize the observer’s effect. The task will be performed using an application software program that participants are familiar with (Microsoft Word). All participants will perform the same task, which uses an advanced Word function, “Table of Contents.” This challenging task will be presented so participants will have access to five types of help: a) Microsoft Word’s built-in system help; (b) a Microsoft Word reference book; (c) the Web; (d) Video help - a video clip about how to create a “Table of Contents”, and (e) human help. To capture participants’ interactions with the computer systems, a usability software package, MORAE, will be used to record interactions.

Participants

Participants will be recruited from undergraduate students enrolled in Public Speaking classes at the University of Tennessee, Knoxville in the Summer and Fall 2010 semesters. This study aims to recruit approximately 200 participants with an approximately equal number of males and females. The sample size meets the requirement of the statistical method, structural equation modeling, which will be used to analyze the data.

Measurements & Instruments

The personal data questionnaire will consist of questions pertaining to the participant’s age, gender, major, and year in school. In addition, participants’ prior experience using Microsoft Word will be collected prior to the task introduction. The prior experience variable measurement will consist of two components: (1) their self-reported level of expertise in using Word (based on
the Dreyfus model of skill acquisition, 1980), and (2) the total number of self-reported familiar Word functions that participants choose from a list.

The Microsoft Word self-efficacy assessment will use a scale adapted from Marakas, Johnson and Clay (2007), which has 11 items. Each item measures personal assessment of ability in using one function of the Word processing package. Participants are first required to respond “yes” or “no” as to whether they can perform the function. With a “yes” answer, participants then report their confidence in using the function on a 10-point scale from “not at all confident (1)” to “totally confident (10).” A “no” answer will be coded as 0 on the scale later.

The computer anxiety scale will be adopted from Thatcher & Perrewé’s study (2002), which was based on the Computer Anxiety Rating scale (CARS-H) developed by Heinssen, Glass and Knight (1987). The scale requires the subject to respond on a 5-point scale from “strongly disagree” to “strongly agree” for four items.

The help seeking variable is measured by the success rate of help-seeking requests, which is calculated as ratio of the number of effective help requests divided by the total number of help requests. An effective help request is defined as a help request that enables the participant to accomplish one or more sub-tasks. Perceived usefulness of help will be measured by participants ranking the help type they have used in the lab from “least helpful” (1) to “most helpful” (5).

The task “Table of Contents” will be decomposed into five sub-tasks, which are milestones of the complete process. A score will be assigned to each sub-task based on whether it is attempted and accomplished (2=success; 1=failure; 0=no attempt). The time spent for the task completion will be recorded. The task performance will be calculated as the task efficiency:

$$\text{Task Efficiency} = \frac{\sum \text{(score on each subtask)}}{\text{(total time spent on the task)}}$$

The researcher will also select participants for conducting exit interviews. The selection process will utilize a systematic sampling method - choose the fifth participant in every group of
ten participants. Questions will focus on the reasons for choosing a particular type of help and the participants’ evaluation of the usefulness of the help. Each interview will last approximately 10 to 20 minutes.

**Procedure**

The observer will lead the participant to the participant’s room and play a video to introduce the purpose and procedures of the study. The participant will then read and sign a consent form. Then, participants will fill out a computerized questionnaire containing personal data, CSE, and CA questions. The observer will then provide a task sheet and show the participant the Word file they will be working on, as well as a Word file with “Table of Contents” created. After confirming with the observer that s/he understands the procedures, the participant will begin the lab session by starting the MORAE recording. The observer will go to the observer room for synchronous observation and will take notes. The participant will be required to finish the task in 30 minutes. If a participant has not used any type of help during the lab session, the case will be dropped. Accordingly, more participants will be recruited to meet the sample size. Upon completion of the task or after 30 minutes, the observer will stop the recording and go to the participant’s room to conduct the exit interview for selected participants. The interview will be audio-recorded with a digital recorder. The total time for one lab session will be approximately 30 minutes to 1 hour.

**Data Analysis**

Structural equation modeling (SEM), a quantitative method, is selected for this study because of its capability of simultaneously testing multiple hypotheses and evaluating the entire model with the consideration of complete information. SEM will be conducted using SPSS Amos. In addition, data about participants’ self-ranked usefulness of help types will be used to examine the most useful help type across all participants, and relationships between personal
factors and perceived usefulness of a particular help type. Inductive analysis will be performed to analyze interview data.
# Timetable of Dissertation Plan

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<tr>
<th>Activities</th>
<th>2010</th>
<th>2011</th>
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<tr>
<td><strong>Proposal Phase</strong></td>
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<td>Obtain approval for proposal</td>
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<td>Fill out Doctoral Committee Appointment form</td>
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<td>Fill out Dissertation Adviser Agreement form</td>
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<td><strong>Data Collection</strong></td>
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<td>Data Collection begins (IRB approved)</td>
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<td>Dissertation writing</td>
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<td><strong>Data Analysis</strong></td>
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<td>Data clean; transcribe interviews</td>
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<td>Quantitative &amp; qualitative analysis</td>
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<td><strong>Dissertation Defense</strong></td>
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<td>Dissertation writing</td>
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<td>Fill out Graduation Application</td>
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<tr>
<td>Meet with Thesis/Dissertation Consultant</td>
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<td>Fill out Scheduling of Defense of Dissertation form</td>
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<td>Defend dissertation</td>
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<td>Submit final copy of dissertation</td>
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<tr>
<td>Submit Report of Final Examination</td>
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Budget Justification

1. Fees to subjects
   Sample size: 200
   Participants’ benefits: 75 students receive course credits; 130 students receive a gift of $10/person

   Estimated subtotal: $1000 - $1300

2. Printing documents, including consent forms, task sheets, post-session surveys
   $0.02/page in library

   Estimated subtotal: $20

3. Statistical consulting: University of Tennessee statistical consulting center provides free charge for 10 hours/semester, beyond that, $20/hour.

   Estimated subtotal: $200

Estimated total: $1220 - $1520
Curriculum Vitae

Lei Wu

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Updated 06/30/2010

Education:
Ph.D. candidate in Information Science, University of Tennessee Knoxville
GPA: 3.97, expected graduation May, 2011
Dissertation Title:
Users’ Help-Seeking Behaviors in Computer-Based Tasks: An Exploratory Study Using Structural Equation Modeling

M.S. in Computer Science, Texas Tech University
GPA: 4.0. December 2004

B.S. in Computer Science, University of Electronic Science and Technology of China, GPA: 3.5 June 2000

Experience:
University of Tennessee, School of Information Sciences
- Graduate Research Assistant, 2005 – now
  Duties: statistical data analysis, report writing
- Graduate Teaching Associate, 2007 – 2009
  Course taught: Technologies for Information Retrieval

Texas Tech University, Computer Science Department
- Graduate Teaching Assistant, 2003 - 2004
  Courses assisted: System programming (C, Shell, Perl)
  Data Structure with C++
  Computer Architecture

Texas Tech University, Texas Cooperative Geospatial Research Laboratory (GAP lab)
- Graduate Research Assistant, 2002 – 2003
  Duties: system administrator in GAP Lab

Chinese Academy of Science, Chengdu branch, P.R.China
- Programmer, 2000 – 2001
  Duties: database application programming, website design

Publications

Journal Articles

2. Carol Tenopir, Donald W. King, Jesse Spencer, and Lei Wu. (2009). Variations in Article


Conference Proceedings

Full Paper


Poster Paper


Practices: Analysis of a Subset of the Preliminary Results from the DataONE Baseline Assessment of Scientists,” College of Communication and Information Research Symposium 2010, poster.


**Book Review in Refereed Journals**


**Magazine**


**Presentations**

**Presentations in Conference**


**Poster Presentations**


Honors & Awards:

Award

1. Outstanding Paper Award for Excellence 2010, “Electronic journals and changes in scholarly article seeking and reading patterns,” Aslib Proceedings, 61(1), 5-32


4. Honorable Mention, 2007, “Information-seeking and communication behaviors of academic researchers in the Internet age: a cross-cultural study”, SIG USE, the 70th Annual Meeting of the American Society for Information Science & Technology

Scholarship

1. Reeder-Siler Scholarship, 2010 – 2011, University of Tennessee

2. Karl A. and Madira Bickel Scholarship, 2009 – 2010, University of Tennessee


5. Karl A. and Madira Bickel Scholarship, 2006 – 2007, University of Tennessee

6. Computer Science Department Scholarship, 2004 Summer, Texas Tech University

7. Computer Science Department Scholarship, 2002-2003, Texas Tech University

8. Computer Science Department Scholarship, 2002 Spring, Texas Tech University

9. Computer Science Department Scholarship, 1997-2000, UESTC

Skills:

Language: C, C++, Java, Perl, VB

Database: Microsoft SQL Server, Oracle 9i, Sybase, Microsoft Access, MySQL

Software: Power Builder, Power Designer, Delphi, Photoshop, Dream weaver, FrontPage