Contents lists available at ScienceDirect

Computers & Education

journal homepage: www.elsevier.com/locate/compedu

Gender difference in web search perceptions and behavior: Does it vary by task performance?

Mingming Zhou*

Faculty of Education, University of Macau, Av. Padre Tomas Pereira, Taipa, Macau

ABSTRACT

This study investigates Chinese students' gender differences in their actual use of the web for online information seeking. One hundred and seven Chinese university students responded to questionnaires regarding their perceptions about the use of the web for learning purposes. Afterwards, all the participants were asked to search online to answer two questions about bees' decision for hive location. As they searched, the online system logged participants' search activities during the search, including the type of activities during search, the frequency of each activity and the time spent on each activity. Participants were compared by gender in terms of their web search efficacy, web search anxiety, frequency counts of different web search activities, time spent on each search activity and search task performance. Web search efficacy levels varied by gender but not by performance levels. Anxiety did not vary by gender or performance levels. The interaction effect between gender and performance level was found in several search process variables: significant gender differences were only found in medium-performing students wherein males were engaged in more search activities than females, as seen in the larger number of searches, search queries, and times male students updated the search queries. One factor that could explain the significant gender differences in the medium-level group was their web search efficacy. The more confident medium-performing male students were in web search, the less need they perceived to access information to solve the task. This pattern was reversed for medium-performing females. The high- and low-performing males did not differ much from females in their search activities. It appeared that students' perceptions of their web search ability did not contribute much to their search activities in these two groups. Implications of the findings were also discussed.

© 2014 Elsevier Ltd. All rights reserved.

1. Introduction

In the 21st century, the proliferation of digital information technologies for knowledge construction requires individuals to be able to manage the overload of information adequately. This online information search process encompasses a set of cognitive skills including identifying the purpose of search, locating appropriate information sources, selecting and organizing relevant information, and synthesizing information from multiple sources into cogent, productive uses (Moore, 1995). As the Internet has become a popular platform for various purposes, such as online learning, electronic commerce and information search, individuals with different backgrounds use different approaches in their interactions with the web. Recent research finds that age, education, and gender are among the most important predictors of online information search behavior (Maghferat & Stock, 2010; Singer, Norbisrath, & Lewandowski, 2012; Steinerova & Susol, 2007; Weber & Jaimes, 2011). Therefore, these human factors must be taken into account in our explanation of different levels of performance by using the web to solve problems.

A growing body of studies has been conducted to examine gender differences in information seeking on the web. However, previous research has shown that students vary widely in their ability to find and retrieve information in loosely structured information environments (e.g., Brand-Gruwel, Wopereis, & Vermetten, 2005; Tabatabai & Shore, 2005), such as the Internet. A recent review by Chen and Macredie (2010) suggests that major differences between males' and females' online information seeking lie in their navigation patterns,

attitudes and perceptions. In general, literature has suggested that males report lower levels of computer anxiety than females (Karavidas, Lim, & Katsikas, 2004); females lag behind males in the degree to which they are experienced with and motivated by technology (Leong & Hawamdeh, 1999; Light, Littleton, Bale, Joiner, & Messer, 2000; Schumacher & Morahan-Martin, 2001). In addition, it also seems that males were more successful in finding required information (Kim, Lehto, & Morrison, 2007).

However, Agosto (2004) argued that gender as a sole determining factor was too simplistic a way to look at information-seeking behavior. Studies consistently reported that males were more interested and involved with technology than females, yet this is often no longer the case (North & Noyes, 2002). Other factors could also co-influence individuals' search behavior. As several researchers have noted that the effect of gender on learners' self-perceptions and learning processes could vary by different performance levels (e.g., Khalid & Hasan, 2011; Sheu, Wang, & Hsu, 2013), gender differences in web search efficacy and behavior by search task performance was examined in the current study. In the following sections of this paper, a brief review of empirical studies on gender differences in individuals' navigation patterns when searching for information online as well as their perceptions about web search is first presented, followed by the purpose of the current study.

2. Gender difference in perceptions about the use of web

Web efficacy has been the subject of many research studies in seeking online information. It has been defined by Savolainen (2002) as a person's perception of "his or her ability to organize and execute action, such as finding information on the Web" (p. 211). This perception is supposed to be clearly reflected in one's web search behavior. Higher web search efficacy may help individuals try better web search strategies and facilitate higher-order metacognitive skills, such as information selection and evaluation. This, in turn, facilitates individual performance in a web-based environment (Tsai & Tsai, 2003). Research has been done on the influence of gender differences on individuals' attitudes/perceptions toward the use of web to seek information. Results are mixed. On one hand, the majority of literature suggests that females reported more computer anxiety, lower levels of competence and higher levels of discomfort than their male counterparts when using the web to search for information (e.g., Hu, Zhang, Dai, & Zhang, 2012; Jackson, Ervin, Gardner, & Schmitt, 2001; Koohang, 2004; Li & Kirkup, 2007; Liaw, 2002; Peng, Tsai, & Wu, 2006; Schumacher & Morahan-Martin, 2001). On the other hand, some studies indicate that females showed stronger positive attitudes than males towards using the web as major resources to gather information (e.g., Kim et al., 2007). Also, several researchers found no significant gender differences in their perceptions toward using the web for trip planning information search (e.g., Koohang & Durante, 2003). Tsai and Tsai (2010) went one step further by examining high school students' perceptions about different uses of the Internet. They found that boys and girls perceived themselves about the same confident with regards to exploring and navigating the web, but girls held significantly more confidence than boys regarding using the web as an online communication tool.

3. Gender difference in navigation patterns

It has been repeatedly evidenced that problem-solving strategies directly affect problem-solving success (e.g., Tsai, Hou, Lai, Liu, & Yang, 2012; Tu, Shih, & Tsai, 2008). When searching information online for a given search task, search patterns determined search success to a large extent. Tabatabai and Shore (2005) noted that experts' performance was differentiated by the cognitive and metacognitive strategies they employed. By evaluating and monitoring the search process, expert searchers had higher chances of success. In contrast, poor searchers relied more on trial-and-error with less patience. Impatience led them to navigate more, to click more, and to execute before spending sufficient time planning or evaluating. However, there was less evidence available regarding whether males searched for information online in a different way from females, in comparison to the effort to study gender differences in individuals' attitudes and perceptions about the web use. In Tsai and Tsai's (2010) study, boys were found to be more exploration-oriented who navigated or searched information on the web mostly, whereas the girls were more communication-oriented who mainly communicated via the Internet. The authors attributed the observed different patterns of web use to users' different purposes (or goals) of web use. Arcand, Nantel, and Sénécal (2011) found that women spent more time per page but viewed fewer pages, whereas men spent less time per page but accessed more pages throughout the task. This could be explained by the selectivity model (Meyers-Levy, 1989) whereby females are comprehensive processors who tended to assimilate all available information and elaborated more on it, whereas males were selective information processors who did not generally engage in extensive processing of all available information. Instead, they employed various heuristic devices that served as surrogates for more detailed processing.

Large, Beheshti, and Rahman (2002) examined sixth graders' web searching process to complete a class assignment. They found that boys conducted more search activities including formulating more queries, clicking on more links per minute, and following up on more hits. On the other hand, girls spent more time reading documents. The authors speculated this was because girls were generally less skilled or practised in navigating the web who had to spend more time in processing information. Roy and Chi (2003) had similar findings to Large et al. (2002) that middle school boys tended to employ a different search pattern from girls when searching for answers to an academic question and that this difference was related to the search performance. Specifically, boys navigated the Internet in a non-linear way and girls tended to browse entire linked documents and to follow a linear navigation approach. Liu and Huang (2008) also found in university students that male readers preferred non-linear reading than female readers, who tended to spend more time on browsing, scanning and non-linear reading (such as jumps) in their report. The authors again borrowed the selectivity model to explain the findings that men naturally tended to be more selective in web searching. Women, however, tended to make a greater effort and employ a more conscientious approach (Hupfer & Detlor, 2006).

With eye tracking data, Lorigo et al.'s (2006) observed that girls more often returned to previously visited abstracts when they searched information while boy's navigation paths were more likely to be strictly linear. These inconsistent findings about whether males search for information in a linear way as compared to females invite further investigation. Moreover, the aforementioned studies did not relate the different web search behavior to any measure of search success. Hence, it is unknown if such differences are relevant to search performance. This will be examined in the current study.