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What are the most important prediction of computer science students' online help-seeking behaviors?

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ABSTRACT

This study investigates the most important predictors of computer science students' online help-seeking behaviors. 203 computer science students from a large university in southeastern United States participated in the study. Online help-seeking behaviors explored in this study include online searching, asking teachers online for help, and asking peers online for help. Ten-fold cross validation was used to select the most significant predictors from eight potential factors, including prior knowledge of the learning subject, learning proficiency level, academic performance, epistemological belief, interests, problem difficulty, age and gender. Problem difficulty was selected as the most important predictor for all three types of online help seeking, while learning proficiency level, academic performance, and epistemological belief were selected as the most important predictors for both online searching and asking teachers online for help. Based on the selected factors and their relationships with online help seeking, the study provides guidance on targeted training for online help seeking in an era of mass higher education.

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1. Introduction

Since the late 20th century there has been a mass expansion of higher education on a global scale. In the United States, 41.0% of 18–24 years old were enrolled in degree granting institutions in 2012, compared to 35.5% in 2000, 32.0% in 1990, and 25.7% in 1980 (National Center for Education Statistics, 2015). A further expansion in higher education is crucial to ensure that youth are equipped with skills to find gainful employment and to support the long-term economic competitiveness of the country (Brynjolfsson & McAfee, 2014; Goldin & Katz, 2009; Kearney, Hershbein, & Boddy, 2015). Nevertheless, this expansion has inevitably accompanied a range of stressors to the infrastructure of higher education, especially in terms of the resources and support per-student that institutions can provide. Such pressures have hastened a transition to new forms of teaching and learning, which rely heavily on the Internet and other forms of technologies (Allen & Seaman, 2013;

Bernard et al., 2009; Yang & Cao, 2013).

In this environment, pro-active online help seeking is likely to become increasingly important to the academic success of college students (McInerney & Roberts, 2004; Newman, 2008; Rakes & Dunn, 2010). Help seeking has been identified as an effective learning strategy and is associated with a capacity for self-regulated learning (Lee, 2007; Roll, Alevan, McLaren, & Koedinger, 2011). Online help seeking, more specifically, refers to help seeking facilitated by online tools, including search engines and communication platforms. Online help seeking offers a range of potential advantages compared with help seeking in traditional classroom contexts. For instance, students often hesitate to approach potential helpers due to lack of self-confidence in classroom contexts, while these problems are less prevalent in either searching or asking questions anonymously online (Karabenick, 2003; Kozanitis, Desbiens, & Chouinard, 2007; Ryan & Shin, 2011). However, online help seeking also poses new challenges to students. As an example, search engines remain rather limited in their capacity to respond to students' problems if students fail to input accurate keywords or phrases.

It is crucial, therefore, to have guidelines that can inform

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educators about teaching students to seek help online effectively, given its potentials and challenges. To ensure the effectiveness of such guidelines, there is a need for a better understanding of what factors influence the online help-seeking behavior of students. In response, this study investigated the most significant predictors for computer science students' online help seeking. There are two major reasons why we started with computer science students: a) There are relatively more online learning resources, such as tutorials, digital books, or help forums, for computer science than other majors due to its field nature (Dichev & Dicheva, 2012). b) Undergraduate computer science education is relatively well standardized in comparison to other fields, which makes the generalization of its research less difficult (Kadijevich, Angeli, & Schulte, 2013).

This paper starts with reviewing the existing literature on online help seeking and potential factors associated with online help seeking, then follows with the methodology and results, and finally discusses the main findings with references to the existing literature. The results of this study will contribute to the development of guidelines informing educators about how to best guide students to seek help online.

2. Literature review

2.1. Online help seeking

Help seeking is a cognitive skill involving a set of actions including realizing the need of help, identifying problems, and forming questions to solicit help (Aleven, McLaren, Roll, & Koedinger, 2006; Newman, 2008). Online help seeking specifically refers to help seeking supported by online tools, such as search engine, emails or question & answer forums.

Two classification standards were proposed for online help seeking, including the nature of helpers, such as human beings or machines, and the relationship between helpers and help seekers, such as peers or teachers (Cheng & Tsai, 2011; Le Bigot, Jamet, & Rouet, 2004; Puustinen & Rouet, 2009). Three types of online help seeking emerged based on the above two classifications (Cheng & Tsai, 2011):

1. Online searching
2. Asking teachers for help online
3. Asking peers online for help

Online help seeking has different characteristics compared with help seeking in other contexts. Firstly, online help seeking is more open and "messy" than help seeking in tutor-system environments (Karabenick, 2011). Increasingly ubiquitous, regardless of locations and devices, online environments offer abundant access to information and help from experts around the world. In contrast, tutor systems typically provide limited on-demand hints and glossaries in a closed environment. Secondly, many factors important to face-to-face help seeking are much less important for online help seeking. Both searching and asking questions anonymously online are much less threatening the self-esteem of students than face-to-face help seeking in classroom contexts (Kumrow, 2007). Thirdly, online help seeking poses new and significant challenges to learners. Search engines are limited in adapting to students' questions if students fail to provide accurate queries. In addition, asynchronous communication on question & answer forums with other users can be prone to misunderstandings and thus may not yield the desired information.

2.2. Potential factors influencing online help seeking

This section of the paper reviews the literature on the

potentially influential factors on online help-seeking behavior, including prior knowledge of the learning subject, learning proficiency level, academic performance, epistemological belief, interests, problem difficulty, age and gender. Research on online help seeking is still lacking, although help seeking has been studied extensively in classroom environments (Cheng, Liang, & Tsai, 2013). Given the potential advantages and challenges of online help seeking, the gap in the literature on this topic is significant.

Prior knowledge of the learning subject refers to learners' prior knowledge of the current learning content. Aleven, Stahl, Schworm, Fischer, and Wallace (2003) and Li and Belkin (2010) found that students with less prior knowledge are less likely to know when to seek help, how to organize information and how to form questions. Therefore, they are expected to seek help online less frequently. Different from prior knowledge of the learning subject, learning proficiency level refers to the general learning aptitude and experience of a student, which can be used to differentiate novice and expert learners. Novice learners are often more dependent on authorities and less able to find answers themselves (Kitsantas & Zimmerman, 2002; Yang & Taylor, 2013). Conversely, expert learners are associated with better self-regulation and help-seeking strategies. Notably, Karlsson et al. (2012) found that expert learners have superior skills at online searching. Cheng and Tsai (2011) claimed that student with more experience of online help-seeking activities are likely to have greater confidence and preferences for online help-seeking.

Academic performance has been found an important factor related to face-to-face help seeking in classroom contexts. Studies conducted by Karabenick and Knapp (1991), Karabenick (1998), and Kitsantas and Chow (2007) indicated that students with superior academic achievements generally had higher levels of confidence. As a result, students tended to seek help more frequently, and help seeking in turn consolidated strong academic performance. Nevertheless, in contrast to face-to-face help seeking, it is possible to remain anonymous when seeking help online. Therefore, confidence may be a less important factor for online help seeking.

Epistemological beliefs refer to the personal beliefs of knowledge and knowing. Belief about the source of knowledge, as a component of epistemological belief, is the focus of this study. As an example, Cheng and Tsai (2011), Muis and Franco (2009), and Strømsø and Bråten (2010) noted that students with a perception that knowledge is transmitted from expert external authorities tended to ask teachers online for help rather than search or ask peers for help online. Moreover, Aleven et al. (2003) argued that students with simpler epistemological beliefs might over-estimate their understanding of an issue and be less aware of the need for help.

Relationships between interests in the learning topic and help seeking have been mainly studied in classroom contexts. Though most studies to date indicated that students with higher levels of interests engaged in more face-to-face help-seeking activities (e.g., Beal, Qu, & Lee, 2008; Boscolo & Mason, 2003), Bartholomè, Stahl, Pieschl, and Bromme (2006) found that interests had little effect of help seeking in tutor-system contexts. Aleven et al. (2003) also note that a focus on academic performance over interest can lead to avoiding help seeking to limit embarrassment of needing help from others, which is more likely to happen in face-to-face classroom environments rather than in anonymous online environments. Given the difference between online help seeking and other forms of help seeking, different results may emerge on the relationship between interests and online help seeking.

Difficulty of problems being tackled may also influence the extent to which students engage in online help seeking activities (Jonassen & Hung, 2008; Li & Belkin, 2010). A study by Li and Belkin (2010) found that students facing problems perceived as difficult

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