J. EDUCATIONAL COMPUTING RESEARCH, Vol. 48(4) 469-489, 2013

THE ROLE OF INTERNET-SPECIFIC EPISTEMIC BELIEFS AND SELF-REGULATION IN HIGH SCHOOL STUDENTS' ONLINE ACADEMIC HELP SEEKING: A STRUCTURAL EQUATION MODELING ANALYSIS

KUN-HUNG CHENG
National Chiao Tung University and
National Taiwan University of Science and Technology

JYH-CHONG LIANG
CHIN-CHUNG TSAI
National Taiwan University of Science and Technology

ABSTRACT

Three instruments (i.e., Internet-specific epistemic beliefs, self-regulation, and online academic help seeking questionnaires) were administered to 319 high school students with the aim of understanding the role of Internet-specific epistemic beliefs and self-regulation in their online academic help seeking. Through a structure equation modeling analysis, the results confirm the mediated effects of self-regulation on the relationships between Internet-specific epistemic beliefs and online academic help seeking. Interestingly, naïve beliefs about how Internet-based knowledge is constructed and sophisticated beliefs about how Internet-based knowledge is evaluated are verified to be linked with the students' online academic help seeking. The results imply that, with the focus on the Internet as a context of information, the positive influences of sophisticated epistemic beliefs on learning might be challenged, and the role of personal epistemic beliefs should be reinterpreted.

INTRODUCTION

For contemporary students born into this digital generation, the Internet has become a vital channel for retrieving and exchanging information. In particular,

doi: http://dx.doi.org/10.2190/EC.48.4.d
http://baywood.com

considering the situation that students encounter course-related problems and perceive a need to seek help, searching for information or querying other experts (e.g., instructors, knowledgeable peers, or unknown experts from the Internet) via online channels is a likely solution for them (Cheng & Tsai, 2011). Moreover, when students seek academic help through the Internet, their criteria and strategies for accessing information and their self-regulation have been further suggested as important issues to be discussed (Cheng, Liang, & Tsai, 2013).

The process of searching for and evaluating online information involves learners in cognitive and metacognitive thinking, and this process may be guided by their epistemic beliefs (Hofer, 2004; Tsai, 2004), which refer to what individuals believe knowledge is and how they come to know (Hofer & Pintrich, 1997). Previous studies have emphasized the importance of epistemic beliefs as evaluative standards for processing online information (Bendixen & Hartley, 2003; Bråten & Strømsø, 2006; Tsai, 2001). It has also been reported that students' evaluation and searching strategies of online information may relate to their epistemic beliefs (Bråten, Strømsø, & Samuelstuen, 2005; Tu, Shih, & Tsai, 2008). In general, sophisticated epistemic beliefs (e.g., justifying knowledge claims through the evaluation of evidence) may lead learners to use advanced searching strategies (e.g., searching for online information from multiple sources).

As well as the use of strategies for self-regulated learning, several studies have suggested its correlation with personal epistemic beliefs (Dahl, Bals, & Turi, 2005; Muis, 2007; Muis & Franco, 2010). Specifically focusing on accessing online course-related information, an epistemic belief that the Internet is a sophisticated academic resource may guide students to use self-regulatory skills to search for and justify information (Strømsø & Bråten, 2010). Moreover, when self-regulation is positioned as a mediator, Cheng et al. (2013) found that it may mediate the relationships between students' criteria and strategies for selecting online information, and their behaviors of online academic help seeking. Taking this a step further, the present study supposed that students' self-regulation can play a role in the relationships between their epistemic beliefs and online academic help seeking.

Recently, several studies regarding learners' epistemic beliefs in Internet-based learning were quantitatively conducted with small sample sizes (e.g., Strømsø & Bråten, 2010), or were qualitatively explored by interview or think aloud methods (e.g., Mason, Ariasi, & Boldrin, 2011). This may indicate a need to investigate relevant topics with a large sample size and to further verify what role epistemic beliefs play in Internet-based learning. In consideration of this, the present study therefore conducted an analysis of structural equation modeling (SEM) to examine the previously assumed possible structural relationships among students' epistemic beliefs, self-regulation, and online academic help seeking.

THE VARIABLES EXAMINED IN THE PRESENT STUDY

Based on the aforementioned argumentation, there were three main variables examined in the present study, namely personal epistemic beliefs, self-regulation, and online academic help seeking. All these variables are discussed on the premise of accessing course-related information via online channels. In the following, the relevant research for each variable is reviewed.

Internet-Specific Epistemic Beliefs

In the last decades, personal epistemic beliefs have been documented for their influences on learning processes and outcomes (e.g., Buehl & Alexander, 2001; Hofer & Pintrich, 1997). Theoretically, an individual's epistemic beliefs refer to their personal beliefs about the nature of knowledge and knowing (Hofer & Pintrich, 1997). While beliefs concerning the nature of knowledge could be interpreted as what an individual believes knowledge is, beliefs about the nature of knowing are similar to how an individual comes to know.

According to Hofer and Pintrich (1997), the two areas of epistemic beliefs, including the nature of knowledge and knowing, are comprised of multiple dimensions which can each be represented as a continuum. As generally adopted by several studies (Hofer, 2004; Mason et al., 2011; Strømsø & Bråten, 2010), there are four dimensions of epistemic beliefs. That is, the area of the nature of knowledge includes two dimensions:

1. *simplicity of knowledge*, ranging from knowledge viewed as isolated facts to knowledge considered as interrelated concepts; and
2. *certainty of knowledge*, ranging from individuals believing knowledge to be absolute and unchanging truth to considering knowledge to be tentative and evolving.

The other area of the nature of knowing also comprises two dimensions:

3. *source of knowledge*, that is, the extent to which one conceives knowledge as being transmitted by external authority to knowledge as actively constructed by self; and
4. *justification for knowing*, ranging from one's belief in observation or authority as a way to knowing to beliefs about inquiry, evaluation, and integration of multiple sources for knowing.

In addition to the characteristics of multiple dimensions that epistemic beliefs present, studies have suggested that there should be domain specificity in personal epistemic beliefs (Buehl, Alexander, & Murphy, 2002; Hofer, 2000). Hofer (2000) reported that, for instance, students' beliefs about knowledge in science are more certain and unchanging than they are in psychology. In terms of knowledge retrieved from the Internet, the notion of Internet-specific epistemic beliefs was initially proposed by Bråten et al. (2005), with the focus on the Internet as a context of information. Also, they developed an instrument to measure students'

beliefs about what Internet-based knowledge is (the nature of knowledge on the Internet) and how one comes to know when using Internet-based resources (the nature of knowing on the Internet).

Although the instrument of Internet-specific epistemic beliefs was developed with the four dimensions, Bråten et al. (2005) found that there were only two dimensions generated by the factor analysis. That is, one dimension included a mixed way of thinking about the source, certainty, and simplicity of Internet-based knowledge. The beliefs about justification for knowing were retained as the second dimension. In Strømsø and Bråten's (2010) study, similarly, three dimensions (i.e., certainty and source of knowledge, simplicity of knowledge, and justification for knowing) were reported. Moreover, through the think aloud method, Mason, Boldrin, and Ariasi (2010) found that university students exhibited these four dimensions of epistemic beliefs while searching online for information related to a controversial topic. It should be noted that the two beliefs about the nature of knowing (i.e., sources of knowledge and justification for knowing) were mostly presented by those students. A similar result was found in Mason et al.'s (2011) study with a group of high school students during a task of online information searching.

To summarize, students may express mixed beliefs about Internet-based knowledge and knowing, but exhibit a distinct construct of justification for knowing (Bråten et al., 2005; Strømsø & Bråten, 2010). Moreover, according to Mason et al.'s (2010, 2011) findings, students do not equally reflect the four epistemic beliefs and explicitly show how they come to know (the nature of knowing), especially when involved in the context of accessing online information. In other words, these results may indicate that students' beliefs about the nature of knowing (i.e., sources of knowledge and justification for knowing) are important issues to explore further during the processes of various online activities, such as online academic help seeking. Therefore, the present study considers selecting students' beliefs about the nature of knowing as chief variables to represent their epistemic beliefs when assessing Internet-based information.

Self-Regulation

Self-regulation is an active and constructive process in which students target learning objectives, conduct and monitor learning tasks, and evaluate learning outcomes (Boekaerts, 1999; Zimmerman, 2001). In traditional classroom environments, learners' self-regulation has been suggested to play a role in academic achievement (Pintrich, 2004; Zimmerman, 2001). To adapt and integrate the possibilities of plentiful sources of information, media, and materials offered by the Internet, learners' self-regulatory skills have also been emphasized (Hodges, 2005; Schwartz, Andersen, Hong, Howard, & McGee, 2004) and their positive influences on learning performance have been documented (Azevedo & Cromley, 2004; Azevedo, Moos, Greene, Winters, & Cromley, 2008). Recently, in addition

to considering self-regulation as personal forms of learning strategies, in the social context of online courses, the affordances of self-regulatory learning behaviors (e.g., forethought and planning, monitoring, and strategy use) are highlighted for its mediated role in the interactions with technology, peers, and instructors engaged in learning activities (Shea & Bidjerano, 2010; Shea, Hayes, Smith, Vickers, Bidjerano, Pickett, et al., 2012).

To understand how students self-regulate their learning in online and blended courses, some researchers have investigated this through an instrument, namely online self-regulated learning questionnaire, which includes several dimensions: students' perceived environment structuring (finding a place for efficiently studying online courses), goal setting, time management, help seeking, task strategies, and self-evaluation (Barnard, Lan, To, Paton, & Lai, 2009; Barnard, Paton, & Lan, 2008). Shea and Bidjerano (2012) also used this instrument to examine the role of self-regulation in the community of online and blended learning courses for moderating learners' cognitive, social, and teaching presence. The framework of online self-regulated learning questionnaire (Barnard et al., 2008, 2009) was proposed for investigating the perceived self-regulation of students who have experiences in taking online or blended courses. However, the research context in the present study is laid on the premise of accessing online information for academic purposes. Due to the difference between the two conditions, other categories or dimensions of students' self-regulated learning in online environments should be considered in this study.

As proposed by Pintrich (2000, 2004), a student's self-regulated learning generally involves four phases, namely:

1. planning;
2. monitoring;
3. controlling; and
4. reflecting.

Despite a linear structure presented by the four phases of self-regulation, practically, the boundaries between the phases 2, 3, and 4 are indistinct. Pintrich (2000, 2004) addressed that, when learners change their goals or plans during the learning process, they may simultaneously or dynamically alter their actions for monitoring, controlling, and reflecting on their tasks. In the context of online learning community, Akyol and Garrison (2011) interpreted self-regulatory learning through the lens of metacognition which consists of three dimensions: knowledge of cognition, monitoring of cognition, and regulation of cognition. While knowledge of cognition reflects students' awareness as learners and their motivation to learn, monitoring and regulation of cognition indicate their reflective metacognitive states (e.g., assessment of task or asking for clarification) during the learning process. Based on the above argument, self-regulated students may learn in either traditional or online environments by representing two levels of stage in self-regulation alternatively. Hence, to probe students' perceived

self-regulated learning when accessing online information for academic help, Cheng et al. (2013) have proposed the idea of two levels of self-regulation for the examination. While one is *basic self-regulation,* which refers to self-awareness of planning how to implement learning tasks (i.e., planning), the other is *advanced self-regulation,* which refers to following actions for supervising and regulating learning processes and evaluating learning outcomes (i.e., monitoring, controlling, and reflecting). In line with the research context of online academic help seeking in Cheng et al.'s (2013) study, the present study adopted these two levels (categories) of self-regulation for further investigation.

Online Academic Help Seeking

A phenomenon of perceiving a negative attitude toward help seeking, for example, embarrassment (Ryan & Pintrich, 1997), a threat to self-esteem (Karabenick, 1998), or anxiety (Ryan, Patrick, & Shim, 2005), is common in traditional classroom contexts. With the development of educational technology, online environments provide possibilities for benefiting students' academic help seeking behaviors (Mäkitalo-Siegl, Kohnle, & Fischer, 2011; Puustinen, Bernicot, & Bert-Erboul, 2011). To understand such behaviors when faced with abundant sources of course-related information located on the Internet, Cheng and Tsai (2011) suggested that students may adopt any of three types of help seeking:

1. *information searching* on Google or relevant websites when they encounter academic problems;
2. *formal query* for solving academic problems with teachers' or tutors' help; and
3. *informal query* for seeking course-related help from knowledgeable peers or unknown experts.

In the following study, Cheng et al. (2013) also verified these three behaviors. Therefore, it could be contended that the three types of online academic help seeking are representative. To further testify how well the three factors represent the construct of online academic help seeking behaviors, a confirmatory factor analysis was conducted in this study.

The Relationships among Internet-Specific Epistemic Beliefs, Self-Regulation, and Online Academic Help Seeking

During the last years, it has been documented that sophisticated epistemic beliefs relate to advanced learning strategies and better learning outcomes, in studies on academic performance (Schommer, 1993), conceptual change (Mason & Boscolo, 2004), or self-regulatory skills (Pieschl, Stahl, & Bromme, 2008). As the Internet is characterized as a knowledge source of academic information,

similarly, students' Internet-specific epistemic beliefs have been suggested to relate to their self-regulation. For example, Strømsø and Bråten (2010) found that, when using the Internet for course-related purposes, students with sophisticated beliefs about justification for knowing (e.g., checking Internet-based knowledge against other sources) tended to use self-regulatory skills (e.g., planning, monitoring, and regulating). The self-regulatory skills mentioned here, it should be noted, were similar to both levels of basic and advanced self-regulation identified in Cheng et al.'s (2013) study.

Moreover, help seeking is characterized as a behavioral self-regulated strategy in the literature (e.g., Pintrich, 2004). For academic purposes, it was reported that students who perceived greater self-regulation were inclined to seek help via online channels (Cheng et al., 2013). As far as personal epistemic beliefs are concerned, it has been suggested that students with more advanced beliefs about knowledge show a tendency for help seeking in web-based environments (Aleven, Stahl, Schworm, Fischer, & Wallace, 2003; Bartholomé, Stahl, Pieschl, & Bromme, 2006) or on the Internet (Strømsø & Bråten, 2010). Further regarding Internet-specific epistemic beliefs, the present study therefore contended that they could play a role in behaviors of online academic help seeking.

In particular, an interesting result found in Bråten et al.'s (2005) study should be noticed. That is, students who held naïve epistemic beliefs about Internet-based knowledge were likely to be involved in Internet-based communication activities. For example, students believing the knowledge on the Internet to be an authoritative source of true or simple facts showed a preference for communicating with teachers or peers online rather than discussing with them face-to-face. These results may imply a link between naïve Internet-specific epistemic beliefs with online query behaviors of academic help seeking. However, this assumption needs further verification in this study.

Additionally, the mediated effects of self-regulation in the relationships between students' criteria and strategies for selecting online information and their behaviors of online academic help seeking have been verified (Cheng et al., (2013). That is, the enhancement of perceived self-regulated learning may encourage students to use advanced criteria and strategies when seeking academic help online. Since students' evaluation and searching strategies regarding online information were suggested to relate to their epistemic beliefs (Bråten et al., 2005; Tu et al., 2008), it might be assumed that their self-regulation can play a role in the relationships between their Internet-specific epistemic beliefs and online academic help seeking. In other words, when students seek online help for course-related problems, their epistemic beliefs about Internet knowledge may be relevant to the use of self-regulation strategies to filter the information they retrieve and query via the Internet.

RESEARCH QUESTIONS

The research samples of the studies cited above were mostly at the higher education level. Although university students have adequate experience in various online activities, for example undergraduate students in Taiwan spend a certain amount of time on searching for course-related information via the Internet (Tien & Fu, 2008), a need to probe K-12 school students' online behaviors regarding accessing academic information has been suggested by recent studies (e.g., Cheng et al., 2013). As a result, high school students were chosen as the research participants for the present study.

In sum, the present study intends to explore how high school students know about Internet information and regulate their learning for the purpose of academic help seeking. Through a structural equation modeling analysis, the relationships among their Internet-specific epistemic beliefs, self-regulation, and online academic help seeking behaviors might be better understood. Hence, the research questions of this study are as follows:

1. Are the instruments utilized in this study valid and reliable for the measurement of high school students' Internet-specific epistemic beliefs, self-regulation, and online academic help seeking?
2. What are the relationships among high school students' Internet-specific epistemic beliefs, self-regulation, and online academic help seeking?
3. What roles do Internet-specific epistemic beliefs and self-regulation play in the high school students' online academic help seeking behaviors?
4. Does the high school students' self-regulation mediate the relationships between their Internet-specific epistemic beliefs and online academic help seeking?

METHOD

Sample

The participants of the present study were 319 students from several high schools across various areas in Taiwan, of whom 150 were females and 169 were males. The mean age of these students was about 17 years (SD = 0.87). Almost all of the students reported that they had experience of searching for course-related information via online channels. In other words, the students were assumed to have adequate experience for responding to the questionnaires.

Instruments

Three questionnaires were used to investigate what Internet-specific epistemic beliefs, self-regulation, and online academic help seeking the high school students perceived when accessing online academic information. The items in the three questionnaires were presented on a 7-point anchored scale (from 1, "strongly disagree," to 7, "strongly agree").

Internet-Specific Epistemic Beliefs Questionnaire

The Internet-specific epistemic beliefs questionnaire was originally developed by Bråten et al. (2005). Through factor analysis, they found that two factors labeled general Internet epistemic beliefs (14 items, $\alpha = 0.90$) and justification for knowing (four items, $\alpha = 0.70$) were extracted. The 14 items were designed to assess students' beliefs about certainty of knowledge (five items), simplicity of knowledge (five items), and source of knowledge (four items). To specifically measure students' beliefs about the nature of knowing (i.e., *source of knowledge* and *justification for knowing*) in the context of accessing Internet-based information, this study adopted the relevant items in the Internet-specific epistemic beliefs questionnaire developed by Bråten et al. (2005).

In Bråten et al.'s (2005) study, the items in the dimension of source of knowledge were originally designed as reversed questions. It should be noted that, in this study, the rating scores of these items were reversed after the statistical analysis. To be more specific, higher scores represent more advanced epistemic beliefs about certain course-related knowledge provided by the Internet (e.g., suspecting the authority of Internet-based knowledge). Similarly, high scores on the dimension of justification for knowing reflect sophisticated epistemic beliefs about the evaluation of multiple sources retrieved via the Internet (e.g., assessing Internet-based knowledge with evidence). Following are sample items for the two dimensions of Internet-specific epistemic beliefs about the nature of knowing.

1. *Source of knowledge*: Most of the knowledge provided by the Internet can help me to succeed in my courses (reversed).
2. *Justification for knowing*: I evaluate whether the course-related knowledge I find on the Internet is reliable by comparing it with multiple sources.

Self-Regulation Questionnaire

This study adopted the self-regulation questionnaire generated by Cheng et al. (2013) which includes the two scales of *basic self-regulation* and *advanced self-regulation*. Reporting acceptable internal consistency, the overall α value of the self-regulation questionnaire was 0.89 and the α values for the two scales were 0.80 (*basic self-regulation,* four items) and 0.87 (*advanced self-regulation,* six items). Sample items of the two scales are as follows:

1. *Basic self-regulation* scale: When I access academic information on the Internet, I can set goals for the topics I am interested in.
2. *Advanced self-regulation* scale: I can evaluate the quality of the academic materials which I access on the Internet.

Online Academic Help Seeking Questionnaire

The online academic help seeking questionnaire adopted in this study, including three scales (*information searching*, *formal query,* and *informal query*), was originally developed by Cheng and Tsai (2011). In a following study, Cheng et al. (2013) also verified the reliability of the questionnaire for assessing students' academic help seeking in online environments. For example, the overall α value of the questionnaire was 0.82 and the α values for the three scales were 0.62 (*information searching*, three items), 0.85 (*formal query*, four items), and 0.78 (*Informal query*, four items), respectively. The sample questions for the three scales are demonstrated in the following.

1. *Information searching* scale: When I have a course-related problem, I will seek a solution by searching relevant posts in web forums.
2. *Formal query* scale: When I have a course-related problem, I will ask teachers or class assistants for help by e-mail.
3. *Informal query* scale: When I have a course-related problem, I will ask for unknown experts' help by posting a query on relevant knowledge community websites.

Data Analysis

In the social science field, structural equation modeling (SEM) analysis is increasingly used to confirm the validity and reliability of the factors of an instrument and to testify the causal relationships among the factors in an assumptive structural model. On the whole, SEM analyses are comprised of two parts for testing results, a measurement model and a structural model. The measurement model is estimated through confirmatory factor analysis (CFA) to specify whether the items (observed variables) construct to a certain factor (latent variable). The structural model is then testified by the examination of the causal relationships among the factors (latent variables).

Especially, there is a need to consider several statistical indices for goodness of fit of both models when conducting SEM analyses. For example, a non-significant chi-square (χ^2) value or a chi-square to degree of freedom (χ^2/df) ratio of less than 5 (suggested by Kelloway (1998)) indicates a satisfactory model fit. Other evaluative values commonly accepted, such as goodness of fit index (GFI $\geq$ 0.9), adjusted goodness of fit index (AGFI $\geq$ 0.8), comparative fit index (CFI $\geq$ 0.9), normed fit index (NFI $\geq$ 0.9), non-normed fit index (NNFI $\geq$ 0.9), or root mean square error of approximation (RSMA $\leq$ 0.08), are also important indices for assessing the fitness of the models.

As a result, to further verify the validity and reliability of the instruments used in this study, a series of CFA analyses were firstly conducted. Moreover, the relationships among students' Internet-specific epistemic beliefs, self-regulation, and online academic help seeking were then examined with structural model testing.

RESULTS

CFA for Internet-Specific Epistemic Beliefs, Self-Regulation, and Online Academic Help Seeking Questionnaires

To examine the measurement model of the three instruments, including Internet-specific epistemic beliefs, self-regulation, and online academic help seeking questionnaires, the present study conducted a series of CFA analyses. As the results show in Table 1, all of the factor loadings are greater than 0.05 and the *t*-values reveal significance at the 0.05 level, indicating sufficient convergent validity of the Internet-specific epistemic beliefs questionnaire. That is, the observed variables (items) were specified to relate to their posited latent variables (scales), including source of knowledge and justification for knowing. Moreover, the Cronbach alpha (α) coefficients for each scale were 0.79 and 0.92, respectively, showing acceptable internal consistency of this questionnaire. In addition, the several fitness indices of the measurement model (i.e., $\chi^2 = 7.99$ (n.s.), RMSEA = 0.01, GFI = 0.99, AGFI = 0.98, CFI = 0.99, NFI = 0.99, NNFI = 0.99) indicated a good model fit and also confirmed the structure of the Internet-specific epistemic beliefs questionnaire.

According to Table 2, seven items for which the factor loadings are greater than 0.05 remained on the two scales of the self-regulation questionnaire, including basic and advanced self-regulation. All of the *t*-values of these items show statistical significance at the 0.05 level and then reveal the convergent validity, indicating that these items within each scale were associated with each other. The

Table 1. CFA for Internet-Specific Epistemic Beliefs Questionnaires ($N = 319$)

Scale	Items	Factor loading	*t*-Value	Cronbach alpha	Mean (*SD*)
Source of knowledge (SO)	SO1	0.61	10.90*	0.79	3.69 (1.18)
	SO2	0.88	16.19*		
	SO3	0.77	14.01*		
Justification for knowing (JU)	JU1	0.78	16.07*	0.92	5.40 (1.03)
	JU2	0.90	20.19*		
	JU3	0.88	19.59*		
	JU4	0.88	19.50*		

*$p < 0.05$.

Model fit statistics: Chi-square (χ^2) = 7.99 (n.s.), degree of freedom (df) = 13, RMSEA = 0.01, GFI = 0.99, AGFI = 0.98, CFI = 0.99, NFI = 0.99, NNFI = 0.99.

Table 2. CFA for Self-Regulation Questionnaire (N = 319)

Scale	Items	Factor loading	t-Value	Cronbach alpha	Mean (SD)
Basic self-regulation (BSR)	BSR1	0.63	11.79*	0.80	5.59 (1.02)
	BSR2	0.82	16.60*		
	BSR3	0.84	17.21*		
Advanced self-regulation (ASR)	ASR1	0.77	15.32*	0.84	5.14 (1.01)
	ASR2	0.81	16.48*		
	ASR3	0.75	14.91*		
	ASR4	0.68	13.09*		

*$p < 0.05$.

Model fit statistics: Chi-square (χ^2) = 12.80*, degree of freedom (df) = 13, χ^2/df = 0.98, RMSEA = 0.01, GFI = 0.99, AGFI = 0.98, CFI = 0.99, NFI = 0.99, NNFI = 0.99.

α coefficients for the two scales were 0.80 and 0.84, respectively, presenting the satisfactory reliability of the self-regulation questionnaire. Moreover, the fitness of the items for each scale of the self-regulation questionnaire (i.e., χ^2/df = 0.98, RMSEA = 0.01, GFI = 0.99, AGFI = 0.98, CFI = 0.99, NFI = 0.99, NNFI = 0.99) showed the goodness of the measurement model fit. Also, it could be proved that the structure of the self-regulation questionnaire was acceptable.

In Table 3, the CFA for the measurement model analysis included nine items yielding to three constructs of the online academic help seeking questionnaire (i.e., information searching, formal query, and informal query). It further reveals the convergent validity according to the results that all of the t-values of these items show significance at the 0.05 level. Regarding the reliability of this questionnaire, the α coefficients for the three scales were 0.72, 0.89, and 0.83, respectively, indicating that the instrument was reliable for measuring students' perceived online academic help seeking. Additionally, the statistical indices for assessing the goodness of model fit, such as χ^2/df = 1.53, RMSEA = 0.041, GFI = 0.98, AGFI = 0.95, CFI = 0.99, NFI = 0.98, and NNFI = 0.99, verify the structure of the online academic help seeking questionnaire.

Correlation Analyses for the Students' Responses to the Scales of the Three Questionnaires

To understand the relationships among the high school students' perceived Internet-specific epistemic beliefs, self-regulation, and online academic help seeking, a series of Pearson's correlation analyses was conducted in this study. In Table 4, it is revealed that the students' perceived self-regulation was significantly

Table 3. CFA for Online Academic Help Seeking Questionnaire (N = 319)

Scale	Items	Factor loading	*t*-Value	Cronbach alpha	Mean (*SD*)
Information searching (IS)	IS1	0.77	13.48*	0.72	5.43 (1.21)
	IS2	0.83	14.61*		
	IS3	0.50	8.60*		
Formal query (FQ)	FQ1	0.87	18.64*	0.89	2.79 (1.46)
	FQ2	0.92	20.44*		
	FQ3	0.78	16.09*		
Informal query (IQ)	IQ1	0.87	17.93*	0.83	3.70 (1.65)
	IQ2	0.75	14.64*		
	IQ3	0.75	14.68*		

*$p < 0.05$.

Model fit statistics: Chi-square (χ^2) = 36.75*, degree of freedom (df) = 24, χ^2/df = 1.53, RMSEA = 0.041, GFI = 0.98, AGFI = 0.95, CFI = 0.99, NFI = 0.98, NNFI = 0.99.

related to their perceptions of online academic help seeking. For example, the coefficients of the correlations between advanced self-regulation and information searching, formal query, and informal query for online academic help seeking were 0.40 ($p < 0.01$), 0.15 ($p < 0.01$), and 0.26 ($p < 0.01$), respectively. However, there was no correlation between basic self-regulation and formal query. The results generally indicated that, for these high school students, the ones who held greater self-regulatory perceptions were inclined to seek academic help via the Internet.

Moreover, Table 4 shows that the students' beliefs about source of knowledge have negative relationships with their perceptions of basic self-regulation ($r = –0.11$, $p < 0.05$) and advanced self-regulation ($r = –0.17$, $p < 0.01$), as well as their perceived information searching ($r = –0.16$, $p < 0.01$), formal query ($r = –0.20$, $p < 0.01$), and informal query ($r = –0.25$, $p < 0.01$) when seeking academic help online. These results may indicate that those students believing that the Internet-based knowledge is transmitted by external authority (naïve epistemic beliefs) tended to activate self-regulated learning and further searched for relevant information or asked for help via the Internet when encountering academic problems.

On the contrary, the students' beliefs about justification for knowing were positively related to their self-regulatory perceptions (i.e., basic self-regulation ($r = 0.50$, $p < 0.01$) and advanced self-regulation ($r = 0.44$, $p < 0.01$)) and perceived online academic help seeking (i.e., information searching ($r = 0.41$,

Table 4. Correlations among Scales of the Three Questionnaires (N = 319)

	SO	JU	BSR	ASR	IS	FQ	IQ
SO	1						
JU	–0.17**	1					
BSR	–0.11*	0.50**	1				
ASR	–0.17**	0.44**	0.69**	1			
IS	–0.16**	0.41**	0.36**	0.40**	1		
FQ	–0.20**	0.09	0.03	0.15**	0.20**	1	
IQ	–0.25**	0.19**	0.19**	0.26**	0.41**	0.41**	1

*$p < 0.05$, **$p < 0.01$.

Note: SO: source of knowledge, JU: justification for knowing, BSR: basic self-regulation, ASR: advanced self-regulation, IS: information searching, FQ: formal query, IQ: informal query.

$p < 0.01$) and informal query ($r = 0.19$, $p < 0.01$)) except for formal query behavior. That is, the students with more sophisticated beliefs about justifying information retrieved from the Internet against multiple sources may show the tendency to seek academic help with self-regulatory perceptions by means of searching for information or querying unknown experts. For these high school students, however, their beliefs about justification for knowing may be irrelevant to their behaviors of querying teachers for course-related help (formal query) in online environments.

Path Analysis for the Structural Model

Following the research questions, the present study conducted SEM analyses to examine the structural model of the relationships among the high school students' Internet-specific epistemic beliefs, self-regulation, and online academic help seeking. Also, the mediations of the students' perceived self-regulation between their Internet-specific epistemic beliefs and online academic help seeking were explored through the path analysis.

First of all, the results of the path model testing revealed a good model fit with the acceptable fitting indices, such as $\chi^2/df = 2.00$, RMSEA = 0.056, GFI = 0.98, AGFI = 0.95, CFI = 0.99, NFI = 0.97, and NNFI = 0.97. As shown in Figure 1, the students' perceived information searching for online academic help seeking ($\beta = 0.27$, $p < 0.01$), as well as their basic self-regulation ($\beta = 0.50$, $p < 0.01$) and advanced self-regulation ($\beta = 0.44$, $p < 0.01$) were directly predicted by their beliefs about justification for knowing Internet-based knowledge.

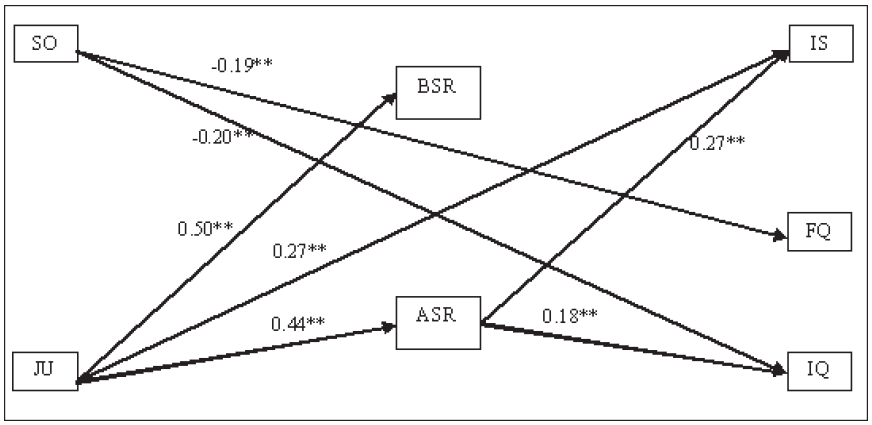

Figure 1. Path analysis for the structural model (n = 319).
*p < 0.05, **p < 0.01.
Model fit statistics: Chi-square (χ^2) = 18.06*, degree of freedom (df) = 9, χ^2/df = 2.00, RMSEA = 0.056, GFI = 0.98, AGFI = 0.95, CFI = 0.99, NFI = 0.97, NNFI = 0.97.
SO: source of knowledge, JU: justification for knowing, BSR: basic self-regulation, ASR: advanced self-regulation, IS: information searching, FQ: formal query, IQ: informal query.

However, when positing self-regulation as the mediated variables between Internet-specific epistemic beliefs and online academic help seeking, it was found that only advanced self-regulatory perceptions positively mediated the relationships between the students' beliefs about justification for knowing ($\beta = 0.44$, $p < 0.01$) and their perceived information searching ($\beta = 0.27$, $p < 0.01$) and informal query ($\beta = 0.18$, $p < 0.01$) for online academic help seeking. In other words, basic self-regulation did not play a role in the relationships between justification for knowing Internet-based knowledge and online academic help seeking behaviors. That is to say, for the purposes of help seeking, the students with advanced self-regulatory perceptions may tend to believe that course-related knowledge is constructed by evaluating information which is searched for or informally queried via the Internet against a variety of evidence.

It is interesting to note that formal query ($\beta = -0.19$, $p < 0.01$) and informal query ($\beta = -0.20$, $p < 0.01$) were negatively predicted by the students' beliefs about source of knowledge. Moreover, neither basic nor advanced self-regulation showed significant mediated effects on the relationships between source of knowledge and online academic help seeking. These results may suggest that the students who conceive Internet-based knowledge as not being constructed by self (naïve Internet-specific epistemic beliefs about source of knowledge) were

inclined to seek help by querying teachers or knowledgeable classmates through online channels. In other words, when the students had doubts about the authority of the course-related information accessed via the Internet (sophisticated Internet-specific epistemic beliefs about source of knowledge), they may not have been willing to formally or informally ask for help via online channels.

DISCUSSION AND IMPLICATIONS

Corresponding to the findings of previous studies (e.g., Dahl et al., 2005; Pieschl et. al., 2008; Strømsø & Bråten, 2010), the present study verified that those students who considered that Internet-based knowledge needs to be evaluated against evidence from multiple sources (sophisticated epistemic beliefs about justification for knowing) were likely to possess self-regulatory perceptions and show a tendency to seek help through online channels. Concerning their epistemic beliefs about source of knowledge, interestingly it was indicated that personal beliefs about Internet-based knowledge being transmitted by authoritative online information (naïve epistemic beliefs) may lead to behaviors of online queries for academic help through formal (e.g., teachers) or informal (e.g., peers) channels. To a certain extent, the results in this study are in line with Bråten et al.'s (2005) findings that learners with naïve epistemic beliefs about Internet-based knowledge would show a tendency to communicate with teachers or peers in online environments.

Traditionally, educators would agree with the viewpoints that possessing sophisticated epistemic beliefs, such as thinking about knowledge as being interrelation, uncertainty, or constructed by self, is beneficial for learning activities. Previous studies have also highlighted the positive links between sophisticated epistemic beliefs and learning (e.g., Dahl et al., 2005; Mason & Boscolo, 2004; Schommer, 1993). However, the epistemic beliefs about general knowledge or specific disciplines rather than the concern of the Internet as a context of information were the main focus in those studies. The present study therefore argues that, when confronting online course-related information, the positive influences of sophisticated epistemic beliefs on learning might be challenged, and the role of personal epistemic beliefs should be reconsidered. According to the results of this study, *naïve beliefs about how Internet-based knowledge is constructed* and *sophisticated beliefs about how Internet-based knowledge is evaluated* may positively influence students' intentions to seek online academic help. In other words, if students do not show initial trust in the course-related knowledge on the Internet, online academic help seeking may not come to mind. It also indicates that, to some extent, epistemic beliefs about suspecting online information as credible knowledge might impede students' learning behaviors in online environments. Therefore, a practical implication for high school curricula regarding Internet literacy is that instructors could guide students to first come to some agreement about the credibility of online information and to carefully check the information against the sources they searched or queried.

Moreover, similar to Cheng et al.'s (2013) findings, the mediated effects of self-regulation on the relationships between Internet-specific epistemic beliefs and online academic help seeking were further confirmed in this study. That is, for high school students, it is suggested that the perceptions of advanced self-regulation (i.e., monitoring, controlling, and reflecting learning processes) may facilitate the behaviors of online academic help seeking, especially information searching and informal query, with the thinking about critical evaluation of Internet-based knowledge. Because the role of self-regulation (especially advanced self-regulatory skills) in processing online course-related information has been highlighted, an opportunity for enhancing high school students' online help seeking behaviors might be implied. It is considered here that, in addition to the ideas of self- and peer-assessment activities for cultivating students' self-regulatory skills suggested by Yang and Tsai (2010), high school educators could foster students' self-regulatory competences by getting them involved in problem-solving activities (Sungur & Tekkaya, 2006). Teachers could set up a problem-based context to assist self-regulated learning in which students are responsible for discovering information, monitoring understanding, and achieving goals (Paris & Paris, 2001; Perry, Vandekamp, Mercer, & Nordby, 2002). Therefore, this study contends that an ill-structured academic problem (e.g., "What are the advantages and disadvantages of nuclear energy?") which students are required to solve via online channels may train them to use self-regulatory skills and further scaffold them to seek help via the Internet.

CONCLUSION

In conclusion, the structures of the three instruments utilized in this study were confirmed to be valid and reliable. The relationships among the high school students' Internet-specific epistemic beliefs, self-regulation, and online academic help seeking were also verified. Further, the findings of the present study contribute to a better understanding of contemporary high school students' online academic help seeking accompanying the roles of Internet-specific epistemic beliefs and self-regulation.

Besides the verification of the mediated effects of self-regulation, this study also raises an interesting issue of noticing that how learners think about Internet-based knowledge when accessing online information could influence their behaviors of seeking academic help. This issue may be elicited by a follow-up study using qualitative methods (e.g., interviews) to thoroughly acquire learners' Internet-specific epistemic beliefs, especially focusing on beliefs about source of knowledge. For example, why and how do naïve epistemic beliefs about source of knowledge affect students' online academic help seeking? Moreover, since previous studies have quantitatively investigated students' perceptions of online academic help seeking (Cheng et al., 2013; Cheng & Tsai, 2011), the actual behaviors of help seeking through the Internet are needed to be qualitatively

probed. Summarizing the abovementioned research suggestions may point out a direction for future work. Through in-depth qualitative data, students' epistemic beliefs about the Internet as a context of information when seeking help online can be thoroughly understood.

ACKNOWLEDGMENT

Funding of this research work is supported by the National Science Council, Taiwan, under grant numbers NSC 99-2511-S-011-008-MY3, 100-2511-S-011-004-MY3, and 101-2628-S-011-001-MY3.

REFERENCES

Akyol, Z., & Garrison, D. R. (2011). Assessing metacognition in an online community of inquiry. *The Internet and Higher Education, 14*(3), 183-190.

Aleven, V., Stahl, E., Schworm, S., Fischer, F., & Wallace, R. (2003). Help seeking and help design in interactive learning environments. *Review of Educational Research, 73*(3), 277-320.

Azevedo, R., & Cromley, J. G. (2004). Does training on self-regulated learning facilitate students' learning with hypermedia? *Journal of Educational Psychology, 96*(3), 523-535.

Azevedo, R., Moos, D. C., Greene, J. A., Winters, F. I., & Cromley, J. G. (2008). Why is externally-facilitated regulated learning more effective than self-regulated learning with hypermedia? *Educational Technology Research and Development, 56*(1), 45-72.

Barnard, L., Lan, W. Y., To, Y. M., Paton, V. O., & Lai, S. L. (2009). Measuring self-regulation in online and blended learning environments. *The Internet and Higher Education, 12*(1), 1-6.

Barnard, L., Paton, V., & Lan, W. Y. (2008). Online self-regulatory learning behaviors as a mediator in the relationship between online course perceptions with achievement. *The International Review of Research in Open and Distance Learning, 9*(2), 1-11.

Bartholomé, T., Stahl, E., Pieschl, S., & Bromme, R. (2006). What matters in help-seeking? A study of help effectiveness and learner-related factors. *Computers in Human Behavior, 22*(1), 113-129.

Bendixen, L. D., & Hartley, K. (2003). Successful learning with hypermedia: The role of epistemological beliefs and metacognitive awareness. *Journal of Educational Computing Research, 28*(1), 15-30.

Boekaerts, M. (1999). Self-regulated learning: Where we are today. *International Journal of Educational Research, 31*(6), 445-457.

Bråten, I., & Strømsø, H. I. (2006). Epistemological beliefs, interest, and gender as predictors of Internet-based learning activities. *Computers in Human Behavior, 22*(6), 1027-1042.

Bråten, I., Strømsø, H. I., & Samuelstuen, M. S. (2005). The relationship between Internet-specific epistemological beliefs and learning within Internet technologies. *Journal of Educational Computing Research, 33*(2), 141-171.

Buehl, M. M., & Alexander, P. A. (2001). Beliefs about academic knowledge. *Educational Psychology Review, 13*(4), 385-418.

Buehl, M. M., Alexander, P. A., & Murphy, P. K. (2002). Beliefs about schooled knowledge: Domain specific or domain general? *Contemporary Educational Psychology, 27*(3),415-449.

Cheng, K. H., Liang, J. C., & Tsai, C. C. (2013). University students' online academic help seeking: The role of self-regulation and information commitments. *Internet and Higher Education, 16,* 70-77.

Cheng, K. H., & Tsai, C. C. (2011). An investigation of Taiwan University students' perceptions of online academic help seeking, and their web-based learning self-efficacy. *Internet and Higher Education, 14*(3), 150-157.

Dahl, T. I., Bals, M., & Turi, A. L. (2005). Are students' beliefs about knowledge and learning associated with their reported use of learning strategies? *British Journal of Educational Psychology, 75*(2), 257-273.

Hodges, C. B. (2005). Self-regulation in web-based courses: A review and the need for research. *The Quarterly Review of Distance Education, 6*(4), 375-383.

Hofer, B. K. (2000). Dimensionality and disciplinary differences in personal epistemology. *Contemporary Educational Psychology, 25*(4), 378-405.

Hofer, B. K. (2004). Epistemological understanding as a metacognitive process: Thinking aloud during online searching. *Educational Psychologist, 39*(1), 43-55.

Hofer, B. K., & Pintrich, P. R. (1997). The development of epistemological theories: Beliefs about knowledge and knowing and their relation to learning. *Review of Educational Research, 67*(1), 88-140.

Karabenick, S. A. (1998). Help seeking as a strategic resource. In S. A. Karabenick (Ed.), *Strategic help seeking: Implications for learning and teaching*. Mahwah, NJ: Lawrence Erlbaum Associates.

Kelloway, E. K. (1998). *Using LISREL for structural equation modeling*. Thousand Oaks, CA: Sage.

Mäkitalo-Siegl, K., Kohnle, C., & Fischer, F. (2011). Computer-supported collaborative inquiry learning and classroom scripts: Effects on help-seeking processes and learning outcomes. *Learning and Instruction, 21*(2), 257-266.

Mason, L., Ariasi, N., & Boldrin, A. (2011). Epistemic beliefs in action: Spontaneous reflections about knowledge and knowing during online information searching and their influence on learning. *Learning and Instruction, 21*(2), 137-151.

Mason, L., Boldrin, A., & Ariasi, N. (2010). Searching the web to learn about a controversial topic: Are students epistemically active? *Instructional Science, 38*(6), 607-633.

Mason, L., & Boscolo, P. (2004). Role of epistemological understanding and interest in interpreting a controversy and in topic-specific belief change. *Contemporary Educational Psychology, 29*(2), 103-128.

Muis, K. R. (2007). The role of epistemic beliefs in self-regulated learning. *Educational Psychologist, 42*(3), 173-190.

Muis, K., & Franco, G. (2010). Epistemic profiles and metacognition: Support for the consistency hypothesis. *Metacognition and Learning, 5*(1), 27-45.

Paris, S. G., & Paris, A. H. (2001). Classroom applications of research on self-regulated learning. *Educational Psychologist, 36*(2), 89-101.

Perry, N. E., VandeKamp, K. O., Mercer, L. K., & Nordby, C. J. (2002). Investigating teacher-student interactions that foster self-regulated learning. *Educational Psychologist, 37*(1), 5-15.

Pieschl, S., Stahl, E., & Bromme, R. (2008). Epistemological beliefs and self-regulated learning with hypertext. *Metacognition and Learning, 3*(1), 17-37.

Pintrich, P. R. (2000). The role of goal orientation in self-regulated learning. In M. Boekaerts, P. R. Pintrich, & M. Zeidner (Eds.), *Handbook of self-regulation* (pp. 451-502). San Diego, CA: Academic Press.

Pintrich, P. R. (2004). A conceptual framework for assessing motivation and self-regulated learning in college students. *Educational Psychology Review, 16*(4), 385-407.

Puustinen, M., Bernicot, J., & Bert-Erboul, A. (2011). Written computer-mediated requests for help by French-speaking students: An analysis of their forms and functions. *Learning and Instruction, 21*(2), 281-289.

Ryan, A. M., & Pintrich, P. R. (1997). "Should I ask for help?" The role of motivation and attitudes in adolescents' help-seeking in math class. *Journal of Educational Psychology, 89*(2), 329-341.

Ryan, A. M., Patrick, H., & Shim, S. O. (2005). Differential profiles of students identified by their teacher as having avoidant, appropriate or dependent help-seeking tendencies in the classroom. *Journal of Educational Psychology, 97*(2), 275-285.

Schommer, M. (1993). Epistemological development and academic performance among secondary students. *Journal of Educational Psychology, 85*(3), 406-411.

Schwartz, N. H., Andersen, C., Hong, N., Howard, B., & McGee, S. (2004). The influence of metacognitive skills on learners' memory of information in a hypermedia environment. *Journal of Educational Computing Research, 31*(1), 77-93.

Shea, P., & Bidjerano, T. (2010). Learning presence: towards a theory of self-efficacy, self-regulation, and the development of communities of inquiry in online and blended learning environments. *Computers & Education, 55*(4), 1721-1731.

Shea, P., & Bidjerano, T. (2012). Learning presence as a moderator in the community of inquiry model. *Computers & Education, 59*(2), 316-326.

Shea, P., Hayes, S., Smith, S. U., Vickers, J., Bidjerano, T., Pickett, A., et al. (2012). Learning presence: Additional research on a new conceptual element within the community of inquiry (CoI) framework. *Internet and Higher Education, 15*(2), 89-95.

Strømsø, H. I., & Bråten, I. (2010). The role of personal epistemology in the self-regulation of internet-based learning. *Metacognition and Learning, 5*(1), 91-111.

Sungur, S., & Tekkaya, C. (2006). Effects of problem-based learning and traditional instruction on self-regulated learning. *Journal of Educational Research, 99*(5), 307-317.

Tien, F. F., & Fu, T. T. (2008). The correlates of the digital divide and their impact on college student learning. *Computers & Education, 50*(1), 421-436.

Tsai, C. C. (2001). A review and discussion of epistemological commitments, metacognition, and critical thinking with suggestions on their enhancement in internet-assisted chemistry classrooms. *Journal of Chemical Education, 78*(7), 970-974.

Tsai, C. C. (2004). Beyond cognitive and metacognitive tools: The use of the Internet as an 'epistemological' tool for instruction. *British Journal of Educational Technology, 35*(5), 525-536.

Tu, Y. W., Shih, M., & Tsai, C. C. (2008). Eighth graders' web searching strategies and outcomes: The role of task types, web experiences and epistemological beliefs. *Computers & Education, 51*(3), 1142-1153.

Yang, Y. F., & Tsai, C. C. (2010). Conceptions of and approaches to learning through online peer assessment. *Learning and Instruction, 20*(1), 72-83.

Zimmerman, B. J. (2001). Theories of self-regulated learning and academic achievement: An overview and analysis. In B. J. Zimmerman & D. E. Schunk (Eds.), *Self-regulated learning and academic achievement: Theoretical perspectives* (pp. 1-37). Mahwah, NJ: Lawrence Erlbaum Associates.

Direct reprint requests to:

Dr. Kun-Hung Cheng
Digital Content Production Center
National Chiao Tung University, Taiwan
Graduate Institute of Applied Science and Technology
National Taiwan University of Science and Technology, Taiwan
#1001, University Rd.
Hsinchu, 300, Taiwan
e-mail: kuhu@mail.nctu.edu.tw