# Help Seeking from Peers in an Online Class: Roles of Students' Help-seeking Profiles and Epistemic Beliefs

## Kun Huang[1*] and Victor Law[2]

[1]University of Kentucky, USA // [2]University of New Mexico, USA // k.huang@uky.edu // vlaw@unm.edu
[*]Corresponding author

**ABSTRACT**: Help seeking is a self-regulated learning strategy, and peer help is an important form of interaction in online education. Yet, students often do not seek help even at the cost of lower performance. To understand the factors behind online students' commitment to peer help, this study implemented a peer-help discussion forum in an online course and investigated the relationship among students' help-seeking profiles, epistemic beliefs (EB), and their actual participation in peer help. The findings revealed a significant relationship between students' EB and the number of response posts in the peer-help forum. Moreover, EB moderated the relationship between students' help-seeking profiles and the number of response posts. Theoretical and practical implications are drawn from the findings.

**Keywords**: Help seeking, Epistemic beliefs, Online education, Self-regulation, Peer help, Online discussion

## 1. Introduction

Learner interaction is a key mechanism to promote online learning (Garrison et al., 2000). Peer help, a particular form of learner interaction, constitutes an important self-regulated learning strategy (Karabenick, 2011; Pintrich & DeGroot, 1990) and allows learners to build a knowledge community (Greer et al., 2000). Peer help is particularly important in online education where an instructor is not physically available in the classroom to offer help. Yet, studies show that online students often do not seek help even at the cost of lower performance (Mahasneh et al., 2012). Given the benefits of help seeking (Richardson et al., 2012) and the prevalence of online education, it is important to understand the mechanism of online learners' help seeking in order to facilitate it. In a previous study that implemented a peer-help discussion forum in an online course, students perceived the forum to be highly helpful and participated far beyond the course requirement (Huang & Law, 2018). As a follow-up, the current study sought to understand the factors behind online learners' commitment to peer help, from the perspective of learners' epistemic beliefs (EB) and their help-seeking profiles such as help-seeking attitudes, tendencies, and goals. The findings would help develop a better understanding of online learners' help seeking and offer implications for encouraging online peer help. We start by reviewing relevant literature which led to the specific research questions we sought to answer.

## 2. Literature review

### 2.1. Help seeking

Help seeking is an effective self-regulated learning strategy to overcome academic difficulties (Karabenick, 2011; Pintrich & DeGroot, 1990). Nelson-Le Gall (1985) delineates five stages of help seeking: awareness of the need for help, deciding to seek help, identifying helpers, employing strategies to elicit help, and evaluating help. Throughout the stages, various learner-related factors play a role in whether, for what reason, and from whom learners seek help (Ryan et al., 2001). For instance, when help seeking threatens their self-esteem, learners may choose not to seek help despite the awareness of such a need (Karabenick & Knapp, 1991; Ryan et al., 2001). In such instances where learners need but do not seek help, they display a help-seeking avoidance (Ryan & Pintrich, 1997). Even when they decide to seek help, learners may opt for different sources; some seek formal help from teachers, while others turn to fellow students for help (Karabenick, 2003). Further, learners may aim for different goals in obtaining help (Nelson-Le Gall, 1985). Those aiming for executive goals count on the help to complete a task, e.g., getting a direct answer to a multiple-choice question. On the other hand, those with instrumental goals focus on getting just enough assistance to complete a task by themselves; instead of a direct answer, they may ask for a hint so that they can find out the answer on their own. Research has studied the relationships among the aforementioned learner factors in help seeking. It was found that help-seeking avoidance is negatively correlated with instrumental goals while positively correlated with help-seeking threat and executive goals (Karabenick, 2003; Pajares et al., 2004).

Traditionally, help seeking has been studied in the classroom setting. With an increasing role of modern technologies in education, researchers have started to examine help seeking in interactive learning environments (e.g., Aleven et al., 2003; Roll et al., 2014) and more recently, in online education. The myriad of help sources (e.g., instructors, peers, online resources) and channels (e.g., emails, synchronous meetings, discussion boards) renders a complex picture of help seeking in online education, which can be different from traditional classroom settings. For instance, it was found that online students feel less threatened in seeking help than those in the classroom (Kitsantas & Chow, 2007; Qayyum, 2018). Further, while students in classrooms are more likely to seek informal help from peers (Karabenick & Knapp, 1991), online students appear to have mixed preferences (Mahasneh et al., 2012; Makara & Karabenick, 2013; Qayyum, 2018).

A few research gaps exist in the current literature on help seeking. First, most research to date focuses on examining the relationship between learners' help-seeking profiles and learning outcomes. Richardson et al.'s (2012) meta-analysis suggested that help seeking has a small positive correlation with GPA. More recent literature further supported the connections between help seeking and academic performance (Martin-Arbos et al., 2021; Wu, 2021). A body of research generally highlights the positive effects of instrumental help from formal sources (e.g., instructors), as well as the negative effects of help-seeking threat, executive help seeking, and avoidance tendency (Karabenick, 2003; Kitsantas & Chow, 2007; Ryan & Pintrich, 1997; Schenke et al., 2015). What is less known is the connection between learners' help-seeking profiles and their engagement in help seeking, e.g., learners' behaviors in seeking help. Second, most research on help seeking is restricted to the face-to-face setting, which may not apply to the online environment (Bartholome et al., 2006; Er et al., 2015). For instance, in contrast to previous research, a study suggested the positive effect of informal help in online education (Goda et al., 2013); additionally, a more recent study on MOOC students found that those who were more inclined to seek help were less likely to do well in passing assessments (Kizilcec et al., 2017). In consideration of the research gaps, it was the intent of this study to examine the relationship between students' help-seeking profiles and their behaviors in seeking informal help from peers in an online class.

## 2.2. Online discussions as a source and a traceable record of peer help

Online discussion boards play a significant role in online education for a variety of purposes, including being a source of help. By interacting and discussing with peers, knowledge is constructed through peer scaffolding (Ge & Land, 2004; Hmelo-Silver et al., 2011), which could potentially promote both social and cognitive presence in an online class (Garrison et al., 2000). On the other hand, seeking help from peers on a discussion board may also pose threats to those who do not want to appear "dumb" before others (Kim et al., 2018).

It has been critiqued that most research on help seeking relies on learners' self-reports, which could deviate from actual help-seeking behaviors (Cross et al., 2017; Mahasneh et al., 2012). On the other hand, online discussion boards afford a means of tracking learners' posting behaviors as a manifestation of help seeking (Karabenick & Berger, 2013). Indeed, the recent rise of learning analytics has enabled researchers to examine a variety of factors in online education through online discussion analytics (Martínez et al., 2020; Wise et al., 2014; Xie & Huang, 2014). Examining computer science students' help seeking through their posting behaviors (question and response posts) on a discussion forum, Bull et al. (2001) found the forum to be helpful to all students, including those who posted questions, responded to posts, or merely read the posts. More recently, in comparing a regular discussion forum with one that allowed students to invite friends or experts to participate in problem-solving tasks, Chao et al. (2018) found that the latter led to more participation in help seeking in terms of questioning, subscribing, commenting, and viewing activities. Similarly, Huang and Law (2018) implemented a peer-help discussion forum in an online class and found a significant relationship between students' course grades and their number of help-giving, but not help-seeking, discussion posts.

What has not been examined is the relationship between learners' help-seeking profiles (attitudes, tendencies, and goals) and their help-seeking posting behaviors in online discussions. Moreover, such a relationship is likely to be influenced by learners' fundamental beliefs about the nature of knowledge and knowing, i.e., their EB. The next section introduces EB and its potential roles in help seeking.

## 2.3. Epistemic beliefs and their roles in help seeking

Hofer and Pintrich (1997) defined EB as "individuals' beliefs about the nature of knowledge and the process of knowing" (p. 117). They suggested two dimensions of EB: beliefs about the nature of knowledge (certainty and simplicity of knowledge), and beliefs about the nature of knowing (source of knowledge and justification of knowing). EB is often depicted as a continuum ranging from "naïve" to sophisticated (Greene et al., 2018;

Schommer, 1990). An individual with naïve EB may, for example, believe that knowledge only comes from authority and is unchanging. Evidence is clear that sophisticated EB is generally linked to deep cognitive engagement, productive study strategies, and positive learning outcomes (DeBacker & Crowson, 2006; Greene et al., 2018; Greene & Yu, 2016).

EB has been identified as an antecedent of self-regulation that affects learners' goal setting in a learning situation and their subsequent use of learning strategies (Muis, 2008). Specifically, Muis and Franco (2009) found that naïve EB predicted performance goal orientations, which, in turn, negatively predicted the effective use of study strategies. Although Muis and Franco (2009) did not incorporate help seeking as a learning strategy in their model, it is plausible that EB might play a similar role in help seeking which is a self-regulated learning strategy (Pintrich & deGroot, 1990). Concerning the possible relationship between EB and help seeking, Aleven et al. (2003) postulated that EB might affect learners' perceived values of, engagement in, and approaches to help seeking. For example, learners with naïve EB may overestimate their knowledge status, which may affect their awareness of the need for help and engagement in help seeking (Aleven et al., 2003). There is some empirical evidence supporting these arguments. For instance, Bartholome et al. (2006) studied learners' use of help features in an interactive learning environment and found that learners with more sophisticated EB made more use of the help features. Hao et al. (2016) found that EB predicted computer science students' help seeking from teachers or online resources, but not that from peers.

In addition to its potential impact on help-seeking behaviors, EB may also affect the relationship between learners' help-seeking profiles and help-seeking behaviors. Specifically, for learners who show an avoidance tendency to seek help, if they hold sophisticated EB, they are likely to adopt a mastery goal for learning (Winbert et al., 2019). As such, despite the avoidance tendency, they may still decide to seek help to develop a genuine understanding. On the other hand, for those who have a similar avoidance tendency but hold naïve EB, their EB may lead them to adopt performance goals (Muis & Franco, 2009; Winbert et al., 2019). Accordingly, to avoid showing incompetence in front of others, these learners may not seek help. Taken together, we postulate the potential role of EB in moderating the relationship between learners' help-seeking profiles and behaviors, which the current study set out to investigate.

### 2.4. The present study

In summary, the literature review above identified a few research gaps. First, most research on help seeking examined the relationship between help-seeking profiles and learning outcomes in the classroom setting. More research is needed to examine the connection between learners' help-seeking profiles and actual help-seeking behaviors in online education. Secondly, there is a lack of understanding regarding the roles of EB in help seeking: how it might affect learners' help-seeking behaviors and moderate the relationship between the behaviors and learners' help-seeking profiles. In closing the gaps, this study implemented a peer-help discussion forum in a completely online class and sought to answer the following research questions:

- What is the relationship between students' help-seeking profiles and their posting behaviors in the peer-help discussion forum?
- What is the relationship between students' EB and their posting behaviors in the peer-help discussion forum?
- Does students' EB moderate the relationship between their help-seeking profiles and posting behaviors in the peer-help discussion forum?

## 3. Method

### 3.1. Participants and context

Forty-nine students (30 females and 19 males) at a U.S. southern university voluntarily participated in the study. The participants were recruited from two online sections of a course offered by the university's program in information technology services. The participants' ages ranged between 21 and 52, including 40 seniors (82%), 7 juniors (14%), and 2 Master's students (4%). The reported ethnicities are as follows: White 34 (69%), African American 13 (27%), and other 2 (4%). The course focused on Microsoft Office Suite for business communications and operations. Throughout the semester, students worked on 19 projects that required them to apply software skills to business practices. Specific guidelines were provided for each project. To complete a project, students had to review course materials, understand the business needs in the project scenario, apply software skills, and troubleshoot any emerging issues in the process.

While students were individually accountable to complete all the projects, a peer-help discussion forum was set up on the course's Blackboard Learning Management System to encourage collaborative learning. Specifically, students were asked to use the forum to seek or offer help regarding their projects. With a minimum contribution of three total posts by the end of the semester, the students could earn three percent of the course grade. The modest requirement was designed to avoid the situation where students participated only for the sake of earning points. Students were informed that the instructor would generally respond to a request for help if others did not respond within 24 hours. In the actual implementation, the instructor sometimes responded earlier when she deemed necessary. The peer-help forum was piloted in the same course the previous year. Students provided positive feedback regarding its helpfulness, and their actual participation far exceeded the minimum requirement (Huang & Law, 2018).

### 3.2. Instruments

Students' help-seeking profiles were measured with a 13-item questionnaire of five subscales: instrumental help-seeking goal, executive help-seeking goal, formal versus informal help seeking, help-seeking threat, and avoidance of help seeking. The items were adapted from Karabenick (2003). Specifically, the references in the original items about getting help from "this class" were modified as getting help from the peer-help forum. For instance, the original item, "Even if the work was too hard to do on my own, I wouldn't ask for help with this class," was revised to "Even if the work was too hard to do on my own, I wouldn't ask for help on the forum." Students rated their agreement with each item on a 5-point scale, ranging from "1-Not at all true of me" to "5-Very true of me." Karabenick (2003) reported the subscales to be in the acceptable range of internal consistency. The instrument has been administered in studies on college students, and the relationships among the subscales were confirmed by significant correlations, which supported the convergent validity of the instrument (Finney et al., 2018; Karabenick, 2003).

*Table 1*. Subscales and sample items for help-seeking profiles and epistemic beliefs

| Instruments | Subscales | Example items |
| --- | --- | --- |
| Help-seeking profiles | Instrumental help seeking | If I have trouble understanding a project, I would post to the Forum to see if someone could help me understand the general ideas |
| | Help-seeking threat | I would feel like a failure if I ask for help on the Forum |
| | Help-seeking avoidance | Even if the work was too hard to do on my own, I wouldn't ask for help on the Forum |
| | Formal vs informal help seeking | In this class, the instructor would be a better source of help than the Forum |
| Epistemic beliefs | Certainty of knowledge | Principles in this field are unchanging |
| | Source of knowledge | If you read something in a textbook for this subject, you can be sure it is true |
| | Justification of knowing | Correct answers in this field are more a matter of opinion than fact |
| | Attainability of truth | If scholars try hard enough, they can find the answers to almost anything |

Students' EB was measured with the Discipline-Focused Epistemological Beliefs Questionnaire (Hofer, 2000), which is one of the most widely used instruments for EB. Eighteen items measured four dimensions: certainty of knowledge, source of knowledge, justification of knowing, and attainability of truth. Participants rated their agreement with each statement on a 5-point scale ranging from "1-Completely disagree" to "5-Completely agree." The items were scored in such a way that lower scores indicated more sophisticated beliefs. The instrument was found to have a reasonable reliability (Hofer, 2000; Muis et al., 2014). In Cazan's (2013) study on the validity of the instrument, exploratory factor analysis yielded the same four subscales, and significant correlations were found between the instrument and another EB inventory, which supported convergent validity of the instrument. Table 1 lists the subscales and sample items for each instrument. The complete instruments are presented in Appendix A.

### 3.3. Procedure

Participants were recruited from their respective classes following the regulations of the university's institutional review board. Each week throughout the semester, students reviewed learning materials and completed assigned

projects. They also used the peer-help discussion forum throughout the 15 weeks of the course to ask questions and give help. Towards the end of the semester, the participants completed a web-based survey. The survey had three parts: Part 1 recorded students' demographic information, Part 2 measured their help-seeking profiles, and Part 3 measured their EB.

### 3.4. Data collection and analysis

In addition to the data collected from the 3-part survey, students' participation data in the peer-help forum were also collected. Specifically, all the posts in the forum were collected and each students' numbers of initial posts and response posts were counted (Bull et al., 2001; Chao et al., 2018). Figure 1 illustrates an example initial post and its subsequent response posts. In initial posts, students were likely to ask questions, whereas response posts involved mostly student interactions surrounding the questions.

*Figure 1*. A screenshot of the peer-help forum showing initial and response posts (student names are masked)
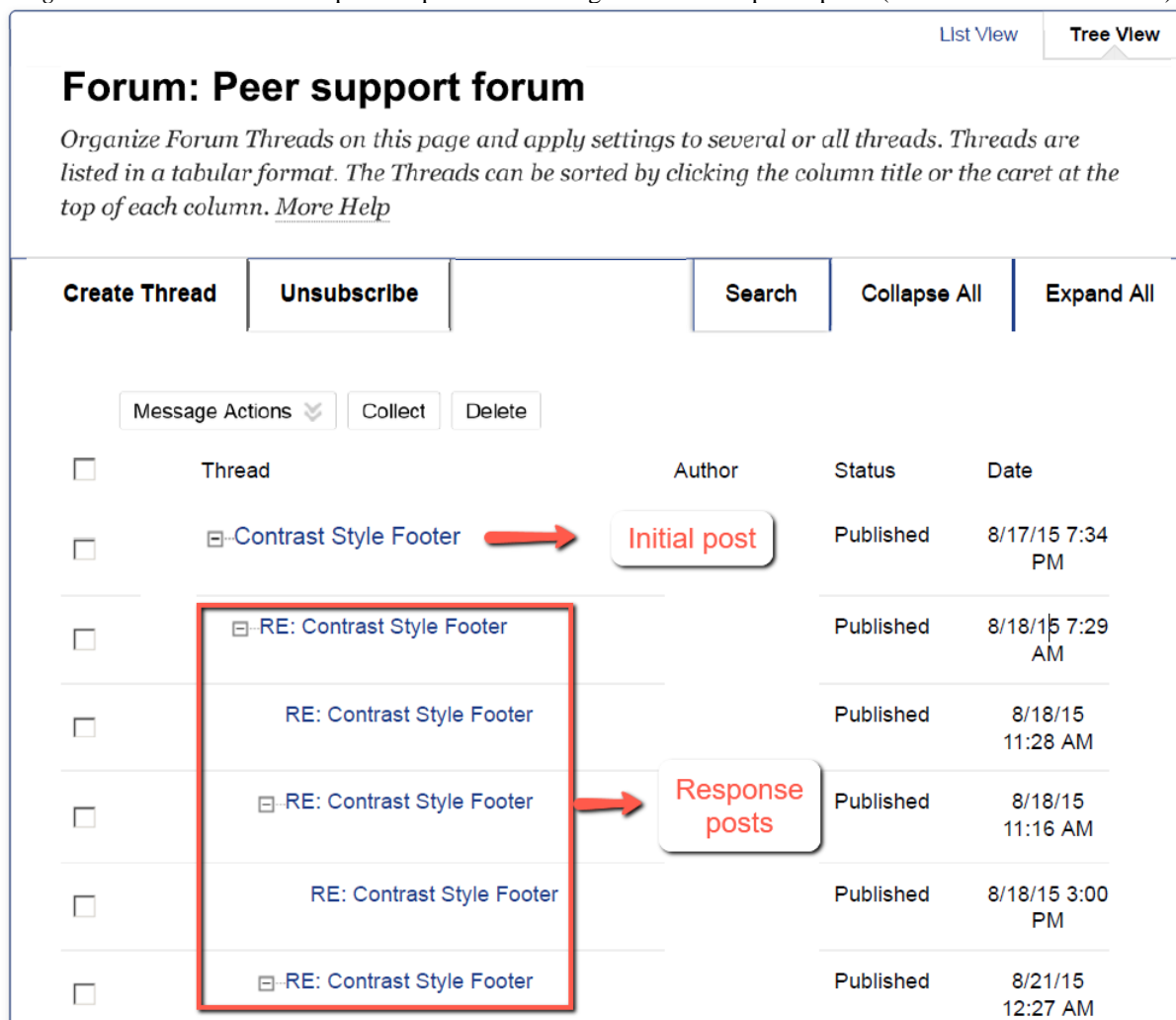


Data analysis was performed in three steps. In the first step, the reliability of all the scales was calculated. All the scales had acceptable Cronbach *a* ranging from .62 to .97, except the subscale of executive help-seeking goal (Cronbach $\alpha$ = .16), which was subsequently dropped from further analysis. The second step generated the descriptive and correlation statistics of the variables. In the last step, multiple regression analyses were conducted to answer the research questions.

## 4. Results

Table 2 presents the descriptive statistics of the variables. The correlations among the variables are presented in Table 3. On average, students posted 13.25 messages to the forum (including initial and response posts), which far exceeded the minimum requirement of three posts to receive the full credit.

*Table 2*. Descriptive statistics of help-seeking profiles, EB, and number of forum posts

| Variable | Mean | *SD* | Min | Max |
|---|---|---|---|---|
| Help Seeking | | | | |
|     Instrumental help seeking | 3.89 | 1.02 | 1.00 | 5.00 |
|     Help-seeking threat | 1.46 | .85 | 1.00 | 5.00 |
|     Help-seeking avoidance | 1.44 | .66 | 1.00 | 5.00 |
|     Formal vs. informal help seeking | 2.82 | .86 | 1.33 | 4.67 |
| Epistemic beliefs | | | | |
|     Certainty of knowledge | 2.98 | .68 | 1.63 | 4.63 |
|     Source of knowledge | 3.31 | .72 | 1.50 | 5.00 |
|     Justification of knowing | 3.24 | .69 | 1.50 | 5.00 |
|     Attainability of truth | 4.20 | .76 | 2.00 | 5.00 |
| Number of posts | | | | |
|     Initial posts | 4.52 | 4.84 | 0.00 | 21.00 |
|     Response posts | 8.73 | 10.27 | 0.00 | 64.00 |

*Table 3*. Correlations among help-seeking profiles, EB, and number of forum posts

| Variable | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| 1. Instrumental help seeking | 1.00 | -.41** | -.58** | -.28** | .10 | .20 | .16 |
| 2. Help-seeking threat | | 1.00 | .71** | .19 | .03 | -.22 | -.25 |
| 3. Help-seeking avoidance | | | 1.00 | .37** | .14 | -.36* | -.40** |
| 4. Formal vs. informal help seeking | | | | 1.00 | .03 | -.05 | .12 |
| 5. Epistemic beliefs | | | | | 1.00 | .04 | -.40** |
| 6. Number of initial posts | | | | | | 1.00 | .24 |
| 7. Number of response posts | | | | | | | 1.00 |

*Note. N = 49; *$p < .05$, **$p < .01$.

To test the effects of students' help-seeking profiles and EB on their participation in peer help, a series of regressions were conducted. To do so, interaction terms were first created by multiplying EB and the help-seeking profile subscales (Cohen et al., 2003). Next, we mean standardized all the independent variables to prevent possible multicollinearity, especially among the interaction terms (Cohen et al., 2003). Further, multicollinearity diagnostic tests were conducted, and the results showed that multicollinearity was not a significant issue (VIF < 10; Hair et al., 2006). Graphical analyses were conducted to confirm the assumptions of linearity, normality, and homoscedasticity. Finally, the results also suggested independence of observations (1 < Durbin-Watson statistics < 3; Field, 2005).

Two separate stepwise regressions were conducted with the dependent variables being the number of initial posts and the number of response posts, respectively (Cohen et al., 2003). The first regression model tested the effects of students' help-seeking profiles and EB on their numbers of *initial* posts. Neither the main-effect nor the interaction-effect models were significant ($p > .05$), with the $R^2$ ranging from .143 to .231.

The second regression tested the effects of students' help-seeking profiles and EB on their numbers of *response* posts. The first model, which tested the main effects of help-seeking profiles on the number of response posts, was not significant, $R^2 = .189$, $F(4, 44) = 2.567$, $p > .05$ ($f^2 = .233$). In the second model, EB was added as an additional predictor, which was found to predict significantly over and above help-seeking profiles, $\Delta R^2 = .100$, $\Delta F(1, 43) = 6.023$, $p < .05$ ($f^2 = .406$). EB was a significant predictor: $t(43) = -2.454$, $p < .05$. In the third model, four interaction terms were added as additional predictors, i.e., the interactions between EB and the four help-seeking profile subscales (instrumental help seeking, help-seeking threat, help-seeking avoidance, and formal vs. informal help seeking). The model was found to predict significantly over and above the main-effect model, $\Delta R^2 = .235$, $\Delta F(4, 39) = 4.799$, $p < .01$ ($f^2 = 1.096$). Specifically, three significant predictors emerged: EB, $t(38) = -2.159$, $p < .05$; EB x Formal Help Seeking, $t(38) = -4.101$, $p < .01$; and EB x Help-Seeking Avoidance, $t(38) = 2.287$, $p < .05$. Results of the multiple regressions are shown in Table 4.

*Table 4*. Results of multiple linear regression analyses predicting number of response posts

| Variables | Model 1 Help-Seeking Profiles $\beta$ (*t*-value) | Model 2 Help-Seeking Profiles & EB $\beta$ (*t*-value) | Model 3 Main and interaction effects $\beta$ (*t*-value) |
|---|---|---|---|
| Instru_HS | -.793 (-.456) | .132 (1.688) | -.396 (-.257) |
| HS_Threat | .996 (.413) | 1.217 (.097) | 1.143 (.534) |
| HS_Avoid | -8.392 (-2.357*) | -6.785 (-1.974) | -4.403 (-1.454) |
| Formal_HS | 3.958 (2.170*) | 3.24 (1.76) | 1.000 (.615) |
| EB | | -6.862 (-2.454*) | -6.506 (-2.159*) |
| EB x Instru_HS | | | 3.508 (1.031) |
| EB x HS_Threat | | | -8.881 (-1.031) |
| EB x HS_Avoid | | | 18.810 (2.287*) |
| EB x Formal _HS | | | -10.809 (-4.101**) |
| *F* | 2.567 | 3.493* | 4.62** |
| *Δ F* | | 6.023* | 4.799** |
| Model adjusted $R^2$ | .116 | .206* | .413** |
| *Δ $R^2$* | | .090* | .207** |

*Note*. Instru_HS: Instrumental Help Seeking; HS_Threat: Help-Seeking Threat; HS_Avoid: Help-Seeking Avoidance; Formal_HS: Formal vs. Informal Help Seeking; EB: Epistemic Beliefs. $N = 49$; $^*p < .05$, $^{**}p < .01$.

*Figure 2*. The relationship between formal help seeking and number of response posts as a function of EB
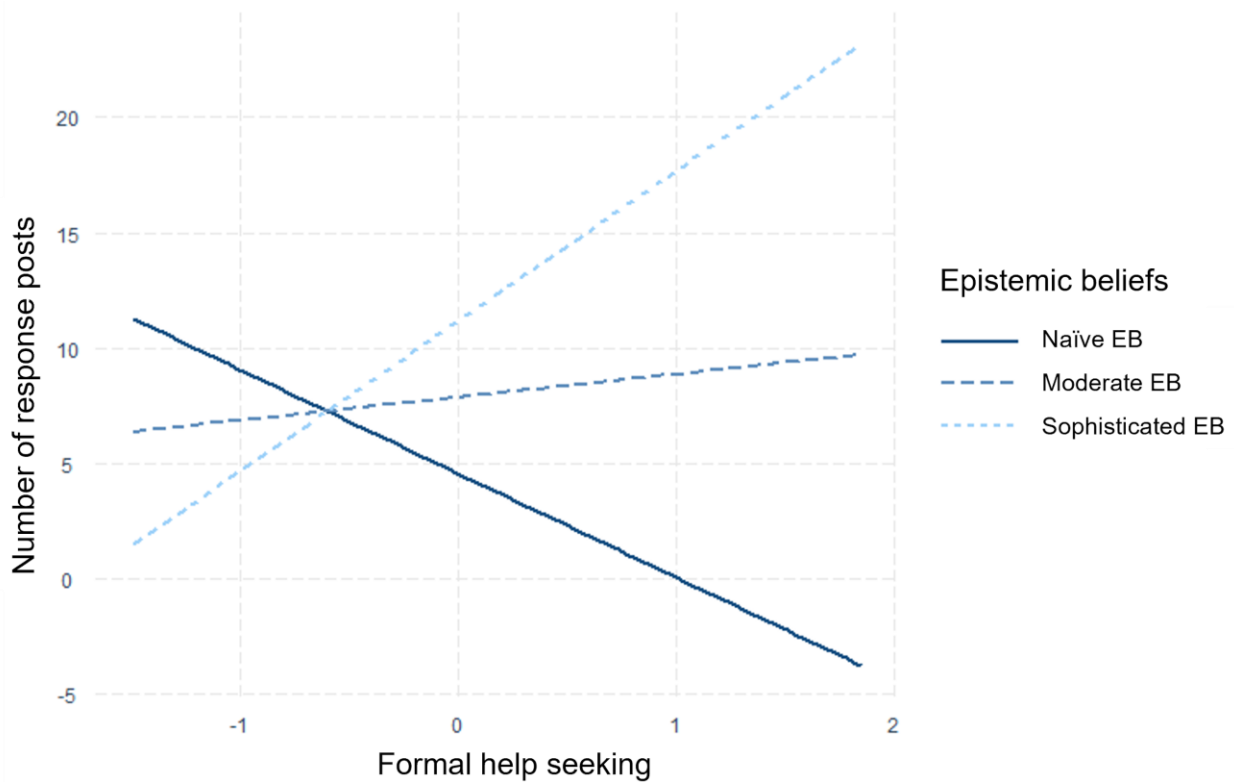


Figure 2 illustrates the significant interaction between EB and formal help seeking. As shown, formal help seeking had a different impact on the number of response posts as a function of students' EB. For those with sophisticated EB, the more they perceived the instructor as a formal source of help, the more likely they were to respond to peers' posts. However, for those with naïve EB, the more they identified with the instructor as a formal source of help, the less likely they chose to respond.

Figure 3 illustrates the significant interaction between EB and help-seeking avoidance. Similarly, the help-seeking avoidance tendency had a different impact on students' response posts depending on their levels of EB. For those with sophisticated EB, the more they reported an avoidance tendency, the less likely they were to respond to others' posts. On the other hand, those with naïve EB showed an opposite trend - the more they reported an avoidance tendency, the more likely they would respond.

*Figure 3*. The relationship between help-seeking avoidance and number of response posts as a function of EB
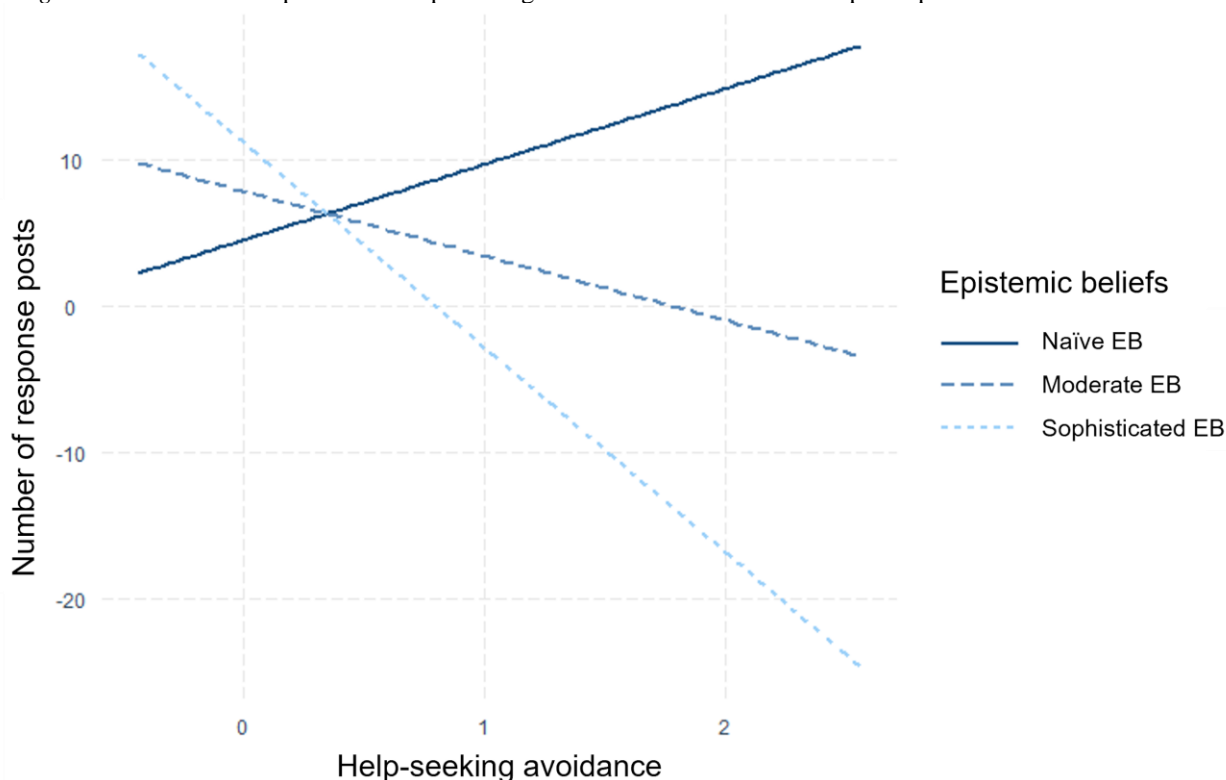


## 5. Discussion

In the context of a peer-help discussion forum in an online course, this study set out to examine the relationship between students' help-seeking profiles and their actual participation analytics in peer help. Further, students' EB was also investigated regarding their impact on peer-help participation, and their potential moderating role in the relationship between help-seeking profiles and peer-help behaviors.

### 5.1. Lack of evidence: Direct impact of help-seeking profiles on peer-help behaviors

For the first research question regarding the relationship between students' help-seeking profiles and their actual participation in peer help, the current study found that the help-seeking profile alone did not influence students' peer-help posting behaviors. In other words, students' perceived help-seeking threat, preferred sources of help, avoidance tendencies, and instrumental help-seeking goals did not directly affect their participation behaviors in the peer-help discourse, which included both initial posts and responses to others.

Taking advantage of the learning analytics afforded by an online discussion forum to trace peer-help behaviors, this study was among the first to examine such a relationship in an online setting, yet our finding suggests a lack of direct relationship, which implies that learners' help-seeking profiles may not manifest in their peer-help participation. Comparing our findings with the previous research, we see an interesting misalignment. Empirical evidence from the past suggested a positive relationship between help-seeking profiles and academic performance (Karabenick, 2003; Kitsantas, 2007; Ryan & Pintrich, 1997; Schenke et al., 2015). These positive relationships may imply that students with adaptive help-seeking profiles indeed seek help, which, in turn, improves their performance. However, our study was not able to find evidence between help-seeking profiles and actual peer-help behaviors, which suggests that help-seeking behaviors may not be the direct mechanism for students with adaptive help-seeking profiles to achieve positive performance. Indeed, Kizilcec et al. (2017) study found a negative relationship between MOOC students' inclination to seek help and their academic performance.

## 5.2. Impact of EB on peer-help posting behaviors

Regarding the second research question about the impact of EB on students' peer-help posting behaviors, our study confirmed the impact: EB emerged as a significant predictor of the number of peer-help response posts. Specifically, those with more sophisticated EB posted significantly more responses than those with less sophisticated beliefs.

The finding aligns with Bartholome et al. (2006) which found that learners with more sophisticated EB made more use of the help features in an interactive learning environment. However, the finding is different from Hao et al. (2016), which did not find EB to predict students' use of peer help. The difference might be due to Hao's et al. (2016) use of students' self-reported participation data, in contrast to our study's examination of the actual participation.

The finding is not surprising, given that sophisticated EB is characterized by an identification with the constructive nature of knowledge and knowing (King & Kitchener, 2004). Although such beliefs were not pronounced in the students' number of initial posts (likely help seeking), these beliefs nonetheless positioned epistemologically sophisticated students to be more open in responding to peers' posts, thereby contributing to the collaborative inquiry. Considering our earlier study that reported a significant relationship between students' numbers of help-giving posts and course grades (Huang & Law, 2018), we reason that those with more sophisticated EB were more likely to respond to peers' posts, which might be associated with better performance.

This finding also expands the literature on EB by offering evidence for the impact of EB on learners' willingness to react or respond to peer-help discourses. The existing literature pointed to a significant correlation between EB and academic performance (Greene et al., 2018; Greene & Yu, 2016) and offered further evidence to suggest that the impact mechanism is through learners' use of study strategies such as elaboration, critical thinking, metacognitive self-regulation, and rehearsal (Muis & Franco, 2009). Our study suggests learners' participation in peer help as an additional mechanism in the learning process that might contribute to the impact of EB on academic performance. Our finding further implies that compared with help-seeking profiles, online learners' EB is more likely to have a direct impact on their participation in peer help. Thus, learners' EB should be an important factor to consider in the design and delivery of online education.

## 5.3. Moderating role of EB in help-seeking posting behaviors

Regarding the third research question about the moderating role of EB in the relationship between help-seeking profiles and peer-help posting behaviors, our findings suggest that two dimensions of help-seeking profiles, formal help seeking and avoidance tendency, were significantly related to peer-help responses (but not initial posts) through the moderation of EB. Thus, although help-seeking profiles did not directly affect peer-help posting behaviors, they did exert an indirect influence with the moderation of students' EB.

Specifically, depending on students' EB, the two dimensions of help-seeking profiles each had a differential impact on students' number of response posts in the peer-help forum. The first dimension, *formal help seeking*, indicates students' tendencies to seek help from formal sources such as the instructor. For students who held more naïve EB, the greater their tendency for formal help, the less likely they were to respond to peers' posts. These students might believe that knowledge was quite certain, and the instructor held the authority of knowledge. As such, they might have placed more value in getting the right solution than the knowledge-building inquiry process leading to the solution (Aleven et al., 2003). Comparatively, epistemologically more sophisticated students displayed a different trend. Despite a greater tendency to seek the instructor for help, these students were nonetheless more likely to respond to peers' posts. The finding appears contradictory on the surface. However, part of the reason might lie in the fact that in contrast to initial discussion posts that more likely involved one seeking help, response posts were more likely to involve one offering help or to joining a conversation. Thus, despite their perception of the instructor as a better source of help, these students' sophisticated EB might have led them to see the need to participate in the peer-help forum as an established norm for help seeking in the course. Our earlier study (Huang & Law, 2018) of the same class in the previous year may also shed some light into the findings. The students from the previous class indicated in interviews that they had helped peers in the forum to promote a sense of "student camaraderie" which they felt "often lacking in an online course" (Huang & Law, 2018). While we could not tie these students to their levels of EB, these opinions might represent the reason why epistemologically more sophisticated students chose to respond to peers' posts.

The second dimension, *avoidance tendency*, indicates one's tendency to avoid seeking help. For students who held more naïve EB, the greater their tendency to avoid help seeking, the more likely they would respond to peers in the forum. This finding can be explained in two aspects. First, as discussed earlier, response posts were less intended for help seeking. Second, past research found that naïve EB predicted performance goals (Muis & Franco, 2009; Winbert et al., 2019) and was associated with an overestimate of one's understanding (Schommer, 1990; Schommer et al., 1992). Taken together, it is likely that despite their avoidance of seeking help, students with naïve EB were more likely to demonstrate their understanding in the forum by responding to others' posts, which is an indication of the performance goal orientation. Comparatively, students with more sophisticated EB tended to aim for mastery learning rather than for impressing others with their performance (Winberg et al., 2019). For these students with an avoidance tendency, one possibility was that they had a more realistic estimate of their own understanding. As such, they were less likely to respond to others if they were unsure of their knowledge. Huang and Law (2018) also found that some students were not willing to offer help because they "do not want to mislead (others)," which might explain the students' reasoning for a lack of participation. Epistemologically sophisticated students who did not have an avoidance tendency, on the other hand, would not hesitate to post initial messages to seek help and subsequently join the conversations with peers, which led to more response posts.

## 6. Conclusion

This study advances our understanding of help seeking from peers as an informal source of help that has a positive impact in online learning (Goda et al., 2013; Wu, 2021). Building on past research that took advantage of online discussions to study various aspects of online learning (Martínez et al., 2020; Wise et al., 2014; Xie & Huang, 2014), the current study implemented online discussions to facilitate and investigate learners' actual peer-help behaviors. The study extended the existing research that primarily focused on learning outcomes and relied on learners' self-reported data. While there were attempts to examine the relationship between EB and help-seeking behaviors (Bartholome et al., 2006; Hao et al., 2016), our study represents the first attempt to simultaneously model the relationships among help-seeking profiles, EB, and online peer-help behaviors. The findings highlight the important role of learners' EB in online peer help, which warrants further investigation.

One perspective to understand help seeking is through the lens of self-regulation (Pintrich, 2000). While Muis and Franco (2009) advanced a self-regulated learning framework that delineated EB's role in learners' goal setting and subsequent use of self-regulation strategies, our study adds to the framework by examining help seeking as one of the self-regulation strategies and providing empirical evidence for the relationship between EB and help seeking.

Further, the different findings between the numbers of initial posts and response posts prompted us to consider help giving as the other side of help seeking since the initial posts were more likely to seek help, whereas response posts were more intended to offer help. In the traditional paradigm of education, the instructor is often the main source of help, and help seeking from the instructor is connected to positive learning outcomes (Karabenick, 2003; Kitsantas & Chow, 2007; Ryan & Pintrich, 1997; Schenke et al., 2015). Yet, with the constructivist paradigm, collaborative learning becomes more and more prevalent (Jeong et al., 2019). Collaborative learning necessitates both help seeking and help giving among peers, while our understanding of help giving is disproportionate to that of help seeking. With the affordance of online learning, it becomes easier to capture and examine both help seeking and help giving. More studies are needed to understand and theorize peer help giving, especially in online learning environments.

Our study yields practical implications for online education. Help seeking is an important self-regulation strategy, especially in online education (Karabenick, 2011; Pintrich & DeGroot, 1990). While learners' help-seeking profiles bear significant importance in help seeking, our findings suggest learners' EB as an important consideration if we are to encourage meaningful and productive peer help. To develop online learners' EB, learning activities should emphasize justification and reconciliation of objectivity and subjectivity (Cartiff et al., 2021). Online instructors should also communicate to students the importance of informal help and peer discourse, while fostering a climate for achieving mastery in learning. Epistemologically more sophisticated students should be encouraged to participate more in peer help for the benefit of building a supportive knowledge community, and guidance and mechanisms should be provided for these students to feel more comfortable to contribute. Finally, this study joins many other studies in suggesting the importance of EB in education, especially in online education (Huang et al., 2019; Greene et al., 2018; Greene & Yu, 2016). Actions should be taken to consider learners' EB in designing instruction. Meanwhile, promoting learners' EB should be a priority for educational research and practice.

This study has several limitations that future research should address. First, while the small sample size was sufficient with a medium to large effect size (the three regression models with $f^2$ = .23, .41, and 1.10; Cohen, 1992), it could present weaker statistical power for the regression analyses. Future studies may use a larger sample size that would also enable the examination of the subscales of EB. Second, while the peer-help forum was intended for help seeking among peers, the availability of the instructor on the forum could have made an undue influence on students' use of the forum. Third, the two instruments in this study used different pronouns (you and I), which may have caused confusions in responding to the questions. Fourth, future studies could include students' performance data, goal orientations, and peer-help access data for a more comprehensive understanding of peer help and its impact. Finally, future research should also examine how help-seeking profiles may affect help seeking from sources other than an established peer-help forum.

# References

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.

Bartholome, 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*, 113-129.

Bull, S., Greer, J., McCalla, G., & Kettle, L. (2001). Help-seeking in an asynchronous help forum. In *Proceedings of Workshop on Help Provision and Help Seeking in Interactive Learning Environments*. International Conference on Artificial Intelligence in Education.

Cartiff, B. M., Duke, R., & Greene, J. (2021). The Effect of epistemic cognition interventions on academic achievement: A Meta-analysis. *Journal of Educational Psychology, 113*(3), 477-498.

Cazan, A-M. (2013). Validity of Discipline Focused Epistemological Beliefs Questionnaire (DFEBQ) on a Romanian sample. *Procedia - Social and Behavioral Sciences, 78*, 713-717.

Chao, P. Y., Lai, K. R., Liu, C. C., & Lin, H. M. (2018). Strengthening social networks in online discussion forums to facilitate help seeking for solving problems. *Educational Technology & Society, 21*(4), 39–50.

Cohen, J. (1992). A Power primer. *Psychological Bulletin*, 112(1), 155-159. https://doi.org/10.1037/0033-2909.112.1.155

Cohen, J., Cohen, P., West, S.G., & Aiken, L. (2003). *Applied multiple regression/correlation analysis for the behavioral sciences*. Lawrence Erlbaum Associates.

Cross, S., Waters, Z., Kitto, K., & Zuccon, G. (2017). Classifying help seeking behaviour in online communities. In *Proceedings of LAK 2017*. https://doi.org/10.1145/3027385.3027442

DeBacker, T., & Crowson, M. (2006). Influences on cognitive engagement: Epistemological beliefs and need for closure. *British Journal of Educational Psychology, 76*, 535-551

Er, E., Kopcha, T. J., & Orey, M. (2015). Exploring college students' online help-seeking behavior in a flipped classroom with a web-based help-seeking tool. *Australasian Journal of Educational Technology, 31*(5), 537–555.

Field, A. (2005). *Discovering statistics using SPSS*. Sage Publications.

Finney, S. J., Barry, C. L., Horst, S. J., & Johnston, M. M. (2018). Exploring profiles of academic help seeking: A Mixture modeling approach. *Learning and Individual Differences, 61*, 158-171.

Garrison, D. R., Anderson, T., & Archer, W. (2000). Critical inquiry in a text-based environment: Computer conferencing in higher education. *The Internet and Higher Education, 2*(2-3), 87–105. https://doi.org/10.1016/S1096-7516(00)00016-6

Ge, X., & Land, S. M. (2004). A Conceptual framework for scaffolding ill-structured problem-solving processes using question prompts and peer interactions. *Educational Technology Research and Development, 52*(2), 5–22.

Goda, Y., Yamada, M., Matsuda, T., Kato, H., Saito, Y., & Miyagawa, H. (2013). Effects of help seeking target types on completion rate and satisfaction in e-learning. In *Proceedings of INTED 2013* (pp. 1399–1403).

Greene, J. A., Cardiff, B. M., & Duke, R. F. (2018). A Meta-analytic review of the relationship between epistemic cognition and academic achievement. *Journal of Educational Psychology, 110*(8), 1084-1111.

Greene, J. A., & Yu, S. B. (2016). Educating critical thinkers: The Role of epistemic cognition. *Policy Insights from the Behavioral and Brain Sciences, 3*(1), 45-53.

Greer, J., McCalla, G., Cooke, J., Collins, J., Kumar, V., Bishop, A., & Vassileva, J. (2000). Integrating cognitive tools for peer help: The Intelligent intranet peer help-desk project. In S. P. Lajoie (Ed.). *Computers as cognitive tools (Vol. 2): No more walls* (pp. 69-96). Erlbaum.

Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. (2006). *Multivariate data analysis* (6ᵗʰ ed.). Pearson Prentice Hall.

Hao, Q., Wright, E., Barnes, B., & Branch, R. M. (2016). What are the most important predictors of computer science students' online help-seeking behaviors? *Computers in Human Behavior, 62*, 467-474.

Hmelo-Silver, C. E., Jordan, R., Liu, L., & Chernobilsky, E. (2011). Representational tools for understanding complex computer-supported collaborative learning environments. In S. Puntambekar, G. Erkens, & C. Hmelo-Silver (Eds.), *Analyzing Interactions in CSCL: Methods, Approaches and Issues* (Vol. 12, pp. 83-106). Springer US.

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

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

Huang, K., & Law, V. (2018). Learners' engagement online in peer help. *American Journal of Distance Education, 32*(3), 177-189.

Huang, K., Law, V., & Lee, S. J. (2019). The Role of learners' epistemic beliefs in an online community of inquiry. *British Journal of Educational Technology, 50*(4), 1882-1895.

Jeong, H., Hmelo-Silver, C. E., & Jo, K. (2019). Ten years of computer-supported collaborative learning: A Meta-analysis of CSCL in STEM education during 2005-2014. *Educational Research Review, 28*, 1-17.

Karabenick, S. A. (2003). Seeking help in large college classes: A Person-centered approach. *Contemporary Educational Psychology, 28*, 37-58.

Karabenick, S. A. (2011). Methodological and assessment issues in research on help seeking. In B. J. Zimmerman & D. H. Schunk (Eds.), *Handbook of self-regulation of learning and performance* (pp. 267-281). Routledge.

Karabenick, S. A., & Berger, J. (2013). Help seeking as a self-regulated learning strategy. In H. Bembenutty, T. J. Cleary, & A. Kitsantas (Eds.). *Application of self-regulated learning across diverse disciplines: A tribute to Barry J. Zimmerman* (pp. 237-262). Information Age Publishing.

Karabenick, S. A., & Knapp, J. R. (1991). Relationship of academic help seeking to the use of learning strategies and other instrumental achievement behavior in college students. *Journal of Educational Psychology, 83*, 221–230.

Kim, S., Zhang, K., & Park, D. (2018). Don't want to look dumb? The role of theories of intelligence and humanlike features in online help seeking. *Psychological Science, 29*(2), 171-180.

King, P., & Kitchener, K. (2004). Reflective judgment: Theory and research on the development of epistemic assumptions through adulthood. *Educational Psychologist, 39*(1), 5–18.

Kitsantas, A., & Chow, A. (2007). College students' perceived threat and preference for seeking help in traditional, distributed, and distance learning environments. *Computer Science Education, 48*(3), 383–395.

Kizilcec, R. F., Perez-Sanagustín, M., & Maldonado, J. J. (2017). Self-regulated learning strategies predict learner behavior and goal attainment in massive open online courses. *Computers & Education, 104*, 18-33.

Mahasneh, R. A., Sowan, A., & Nassar, Y. H. (2012). Academic help-seeking in online and face-to-face learning environments. *E-Learning and Digital Media, 9*(2), 196–210. https://doi.org/10.2304/elea.2012.9.2.196

Makara, K. A., & Karabenick, S. A. (2013). Characterizing sources of academic help in the age of expanding education technology: A New conceptual framework. In S. A. Karabenick & M. Puustinen (Eds.), *Advances in help-seeking research and applications: The role of emerging technologies* (pp. 37–72). Information Age Publishing.

Martín-Arbós, S., Castarlenas, E., & Dueñas, J. (2021). Help-seeking in an academic context: A Systematic review. *Sustainability, 13*. https://doi.org/10.3390/su13084460

Martínez, J. P. C., Catasús, M. G., & Fontanillas, T. R. (2020). Impact of using learning analytics in asynchronous online discussions in higher education. *International Journal of Educational Technology in Higher Education, 17*. https://doi.org/10.1186/s41239-020-00217-y

Muis, K. R. (2008). The Role of epistemic beliefs in self-regulated learning. *Educational Psychologist, 42*(3), 173-190.

Muis, K. R., Duffy, M. C., Trevors, G., Ranellucci, J., & Foy, M. (2014). What were they thinking? Using cognitive interviewing to examine the validity of self-reported epistemic beliefs. *International Educational Research, 2*(1), 17-32.

Muis, K. R., & Franco, G. M. (2009). Epistemic beliefs: Setting the standards for self-regulated learning. *Contemporary Educational Psychology, 34*, 306-318.

Nelson-Le Gall, S. (1985). Help-seeking behavior in learning. *Review of Research in Education, 12*, 55–90.

Pajares, F., Cheong, Y. F., & Oberman, P. (2004). Psychometric analysis of computer science help-seeking scales. *Educational and Psychological Measurement, 64*(3), 496-513.

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). Academic Press.

Pintrich, P. R., & de Groot, E. V. (1990). Motivational and self-regulated learning components of classroom academic performance. *Journal of Educational Psychology, 82*(1), 33–40.

Qayyum, A. (2018). Student help-seeking attitudes and behaviors in a digital era. *International Journal of Educational Technology in Higher Education, 15*(17). https://doi.org/10.1186/s41239-018-0100-7

Richardson, M., Abraham, C., & Bond, R. (2012). Psychological correlates of university students' academic performance: A Systematic review and meta-analysis. *Psychological Bulletin, 138*(2), 353-387.

Roll, I., Baker, R. S. J. d., Aleven, V., & Koedinger, K. R. (2014). On the benefits of seeking (and avoiding) help in online program-solving environments. *The Journal of the Learning Sciences, 23*, 537-560.

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., Pintrich, P. R., & Midgley, C. (2001). Avoiding seeking help in the classroom: Who and why? *Educational Psychology Review, 13*(2), 93–114. https://doi.org/10.1023/A:1009013420053

Schenke, K., Lam, A. C., Conley, A. M., & Karabenick, S. A. (2015). Adolescents' help seeking in mathematics classrooms: Relations between achievement and perceived classroom environmental influences over one school year. *Contemporary Educational Psychology, 41*, 133-146.

Schommer, M. (1990). Effects of beliefs about the nature of knowledge on comprehension. *Journal of Educational Psychology, 82*, 498–504.

Schommer, M., Crouse, A., & Rhodes, N. (1992). Epistemological beliefs and mathematical text comprehension: Believing it is simple does not make it so. *Journal of Educational Psychology, 84*, 435–443.

Winberg, T. M., Hofverberg, A., & Lindfors, M. (2019). Relationships between epistemic beliefs and achievement goals: Developmental trends over grades 5-11. *European Journal of Psychology of Education, 34*, 295-315.

Wise, A. F., Zhao, Y., & Hausknecht, S. N. (2014). Learning analytics for online discussions: Embedded and extracted approaches. *Journal of Learning Analytics, 1*(2), 48-71.

Wu, J. -Y. (2021). Learning analytics on structured and unstructured heterogeneous data sources: Perspectives from procrastination, help-seeking, and machine-learning defined cognitive engagement. *Computers & Education, 163*. https://doi.org/10.1016/j.compedu.2020.104066

Xie, K., & Huang, K. (2014). The Role of beliefs and motivation in asynchronous online learning in college-level classes. *Journal of Educational Computing Research, 50*(3), 317-343.

# Appendix A

*Help seeking scales*

1. If I were having trouble understanding a project, I would post to the Forum to see if someone could help me understand the general ideas.
2. Getting help from the Forum would be one of the first things I would do if I were having trouble with a project.
3. The purpose of seeking help from the Forum would be to succeed without having to work as hard.
4. Getting help from the Forum would be a way of avoiding doing some of the work.
5. I would feel like a failure if I ask for help on the Forum.
6. I would not ask for help on the forum to let others find out that I needed help.
7. Seeking help on the Forum would be an admission that I am just not smart enough to do the work on my own.
8. If I didn't understand something in this class I would guess rather than asking for help on the Forum.
9. Even if the work was too hard to do on my own, I wouldn't ask for help on the Forum.
10. I would rather do worse on an assignment I had trouble with than seeking help from the Forum.
11. If I were to seek help in this class I would directly ask the instructor rather than posting to the Forum.
12. I would prefer seeking help on the forum rather than directly asking the instructor. (rev)
13. In this class, the instructor would be better to get help from than would the Forum.


*Discipline Focused Epistemological Beliefs Questionnaire*

1. Truth is unchanging in this subject.
2. In this subject, most work has only one right answer.
3. Sometimes you just have to accept answers from the experts in this field, even if you don't understand them.
4. All professors in this field would probably come up with the same answers to questions in this field.
5. If you read something in a textbook for this subject, you can be sure it is true.
6. Most of what is true in this subject is already known.
7. In this subject, it is good to question the ideas presented. (rev)
8. Correct answers in this field are more a matter of opinion than fact.
9. If scholars try hard enough, they can find the answers to almost anything.
10. Experts in this field can ultimately get to the truth.
11. Principles in this field are unchanging.
12. If my personal experience conflicts with ideas in the textbook, the book is probably right.
13. There is really no way to determine whether someone has the right answer in this field.
14. Answers to questions in this field change as experts gather more information. (rev)
15. All experts in this field understand the field in the same way.
16. I am more likely to accept the ideas of someone with first-hand experience than the ideas of researchers in this field.
17. I am most confident that I know something when I know what the experts think.
18. First-hand experience is the best way of knowing something in this field.