Sense of Belonging Predicts Perceived Helpfulness in Online Peer Help-Giving Interactions

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Abstract

The present study explored how students' sense of belonging and demographic background may predict what one finds helpful in replies to requests for help posted to an online college course discussion forum. We surveyed college students enrolled in an introductory statistics course on their sense of belonging to their course community, as well as how helpful they found 20 examples of replies to requests for help posted to a statistics course discussion forum. We found that students reporting lower belonging to their course community judged help-giving replies to be, on average, less helpful for their learning, when compared to those reporting higher belonging to their course community. Additionally, students reporting lower belonging to their course community had a greater likelihood of mentioning social support as a criterion for effective peer help-giving. These findings point to the importance of exploring how help-giving replies can be structured to attend to the learning needs of students who may feel alienated in classroom environments.

Keywords: help-giving, discussion forums, sense of belonging, college student

1. Introduction

Over the past couple of decades, researchers have made significant contributions to our understanding of how students connect with their peers and instructors in online learning environments. It is well-established, for instance, that online students benefit from community, academic support, and peer interaction (Coomey & Stephenson, 2001; Martin & Bolliger, 2018; Navarro & Shoemaker, 2000; Sadera et al., 2009), and there is evidence that productive, learning-oriented exchanges between students are possible in online course settings (Curtis & Lawson, 2001; Jansson et al., 2021; Williams-Dobosz et al., 2021). Furthermore, studies have begun to shed light on the conditions under which students most effectively help and support one another online (Nandi et al., 2012), as well as steps that instructors can take to facilitate such connections in online course settings (Haythornthwaite, 2006; McInnerney & Roberts, 2004; Rovai, 2002; Yuan & Kim, 2014).

However, a facet of online learning communities that remains understudied is that of a student's *sense of belonging*, or one's subjective feeling of membership and fit, in their online learning community (Peacock & Cowan, 2019). Beyond the experience of being connected to other students through opportunities for interaction and engagement, a sense of belonging concerns the feeling that one is included and accepted by those around them. It is possible to experience connectedness without experiencing belonging because the former concerns a state of involvement (e.g., participating in course discussions), while the latter concerns a feeling (e.g., the impression that one is valued by other students) (Crisp, 2010). This fact, along with the demonstrated importance of feelings of belonging for learning in both in-person (Strayhorn, 2018) and online (Thomas et al., 2014) course settings, highlights the importance of studying how students experience belonging in the context of online course communities.

In this paper, we examine the association between sense of belonging to one's course community and the perceived effectiveness of peer help-giving interactions—where students respond to others' requests for help—in online settings. It is important that online students see their peer interactions as helpful for their learning because perceived support plays a critical role in promoting students' feelings of belonging in online academic settings (Peacock et al., 2020). While recent work has begun to demonstrate that students value and benefit from a sense of belonging to their online learning communities (Diep et al., 2017; Mohamad & Shaharuddin, 2014; Peacock et al., 2020; Peacock & Cowan, 2019; Swaggerty & Broemmel, 2017; Thomas et al., 2014), we still have little knowledge of how students experiencing lower and higher belonging to their course community perceive their online interactions with others.

Thus, the objective of the present study is to explore how college students with differing feelings of belonging to their course community perceive the effectiveness of online peer help-giving interactions in the context of a course discussion forum. In doing so, we hope to inform conceptualizations of online belonging and to help educators support students experiencing low belonging in online courses.

1.1. Sense of belonging in educational environments

Educational environments are "network[s] of interpersonal relationships structured to facilitate the achievement of educational goals" (Johnson, 1981, p. 5) that relate to students' socioemotional, behavioral, and academic development (Eccles & Roeser, 2011). That is, learning is a social endeavor (Johnson, 1981; Vygotsky, 1978), where student–student and student–teacher relationships allow students to "construct meaning and revise their thinking through interacting with others and negotiating and interpreting others' viewpoints, knowledge, and behavior in the context of their own" (Webb & Mastergeorge, 2003, p. 77). For this reason, a

complete understanding of the learning process requires an exploration of the mechanisms through which students most effectively relate to, learn from, and engage in discussions with others (Nussbaum, 2008). Such work is especially important in the context of online learning, where social interactions can often be difficult to facilitate (Kreijns et al., 2013), and students communicate with one another in ways that differ from in-person settings, due to separations based on time and place (Lim, 2017).

To this end, Hagerty et al.'s (1993) theory of human relatedness, which underlies the present study, provides a framework for understanding how individuals become involved with others. A key assumption underlying Hagerty et al.'s (1993) theory is that human development occurs within the context of relatedness—i.e., one's connections with other individuals, groups, objects, and environments. Within this framework, a sense of belonging—defined as one's "personal involvement in a system or environment so that persons feel themselves to be an integral part of that system or environment" (Hagerty et al., 1993, p. 294)—plays a central role in cultivating relationships that engender well-being and security, rather than alienation and discomfort. As such, various scholars have conceptualized a sense of belonging as a basic psychological need that supports human development throughout one's lifespan (Baumeister & Leary, 1995; Osterman, 2000; Strayhorn, 2018). Thus, we approach this research with the understanding that one's degree of belonging to educational environments influences their experiences with learning in those settings. We believe this holds true in online settings, as meaningful and productive online learning experiences are facilitated by trust, sociability, and a sense of community with other learners (Kreijns et al., 2013).

1.2. College students and sense of belonging

Research indicates that a strong sense of belonging to educational settings is related to vital learning outcomes, including performance, satisfaction, motivation, persistence, and overall well-being (King, 2015; Osterman, 2000). It is possible that belonging takes on a particularly vital role in the higher education context because college students are regularly navigating various spaces (e.g., classrooms, departments, campus organizations) and aspects of their identity (e.g., race, sexuality, religion) where they are hoping to find the acceptance and support of others (Ahn & Davis, 2020; Samura, 2018; Strayhorn, 2018). When that desire to belong remains unfulfilled, college students experience feelings of alienation and isolation (Strayhorn, 2018), which can lead to burnout (Lin & Huang, 2012) and overall dissatisfaction with one's college experience (Ponzetti Jr, 1990).

In this regard, it is possible that many college students' educational goals, such as self-actualization and the acquisition of knowledge, may not be possible without first meeting this basic need to feel a sense of belonging to university spaces (Strayhorn, 2018). Moreover, a large body of empirical work has demonstrated that students' sense of belonging to college settings predicts a variety of important outcomes, including motivation (Freeman et al., 2007), engagement (Gopalan & Brady, 2020), academic success (de Beer et al., 2009; Fong et al., 2019), retention (Han et al., 2017), mental health (Gopalan & Brady, 2020; Hagerty et al., 1996), and overall well-being (Suhlmann et al., 2018).

1.3. Sense of belonging in online courses

Although numerous studies have explored college students' sense of belonging in in-person contexts, little is known about belonging and its associated outcomes in online courses (Peacock et al., 2020). While the value of belonging in online contexts has been implicitly recognized in research examining the importance of community in online learning environments

(Rovai, 2002; Rovai & Wighting, 2005; Swan, 2002), researchers and educators still have a limited understanding of the factors influencing—and outcomes associated with—the feeling that one does or does not fit in with their online course community.

This is an especially important area of research for at least two reasons. First, the online learning environment can be an isolating one where students frequently feel disconnected from others due to the geographical distance and, oftentimes, lack of synchronous communication between individuals (Anderson, 2004; Aragon, 2003). This relative isolation yields a low sense of belonging for online students because they miss out on opportunities to form interpersonal relationships and become involved in a campus community (Peacock et al., 2020; Thomas et al., 2014), both of which are central to sense of belonging for in-person college students (Vaccaro & Newman, 2016).

Second, in online learning environments, students communicate with peers and instructors in ways that differ from in-person settings. While online students are stripped of many social affordances of an in-person classroom environment, they are also equipped with a different set of communicative tools—including discussion forums, virtual whiteboards, and web conferencing (Juwah, 2006; Lim, 2017)—that allow them to connect to and relate with others from afar (Mishra & Juwah, 2006). Thus, an online-specific exploration of how students experience belonging to their course communities, considering the affordances of online communicative tools, is necessary to support the well-being of these students.

1.4. Online peer help-giving interactions and belonging

Existing work suggests that online course discussion forums—which students often use to seek and provide help to one another in online settings (Nor et al., 2012; Williams-Dobosz et al., 2021)—may be useful tools for maintaining online students' feelings of belonging to their

course community (Thomas et al., 2014). Research on college students in in-person settings has shown that discussions of course content outside of class facilitate "a merging of students' social and academic interactions" (Hurtado & Carter, 1997, p. 334) that is beneficial for students' sense of belonging to their university (Hoffman et al., 2002; Hurtado & Carter, 1997). When online students are given such opportunities to obtain and provide help with course material, similarly, they can connect with one another by exchanging knowledge and information (Mohamad & Shaharuddin, 2014). Thus, a low sense of belonging to one's online course community may predict a greater need and desire for meaningful online peer interactions that alleviate feelings of isolation.

However, not all types of online peer interactions are equally effective in maintaining students' feelings of belonging to their course community. For example, feedback, when provided in a disrespectful or off-putting manner, can alienate students and lessen their feelings of belonging (Peacock et al., 2020); and, generally speaking, students reporting a lower sense of belonging to their course community are less likely than other students to see their online peer interactions as helpful or contributing to their knowledge of course material (Diep et al., 2017). Conversely, supportive peer interactions that provide help and resolve difficulties play an important role in maintaining students' sense of belonging to their course community (Mohamad & Shaharuddin, 2014; Peacock et al., 2020).

Thus, educators and students would benefit from an understanding of what students experiencing a low sense of belonging to their course community find helpful in online peer interactions with others. Existing research on peer help-giving in both in-person (Webb, 1989) and online (Jeng et al., 2023, in preparation) learning environments has proposed that responses to students' requests for help should be detailed, accurate, and relevant to the help-seeker's need.

However, there has been minimal work investigating what counts as effective peer support for particular groups of students; e.g., those experiencing a low sense of belonging to their course community. This is a concerning gap in the literature, given that the effectiveness of a peer help-giving interaction depends on not only characteristics of the help-giving reply in question, but also the help-seeker's ability to understand, accept, and implement the help received (Webb, 1989; Webb & Mastergeorge, 2003). In other words, the degree of sense of belonging that a student brings into an online space may play a role in determining what sorts of peer interactions they consider to be most beneficial for their learning.

1.5. Social support and belonging

In both in-person and online settings, individuals can support one another socially by providing emotional support (which involves empathy, reassurance, and kindness), instrumental support (which involves concrete help with a task), or informational support (which involves providing guidance) (Helgeson, 2002). Peer social support has been shown to be related to motivation and well-being in both in-person (Nicpon et al., 2006; Wentzel et al., 2010) and online (McLoughlin, 2002; Vayre & Vonthron, 2017, 2019) course settings, and students who feel they belong in college settings also tend to feel socially well-supported by their peers (Hagerty et al., 1996; Hale et al., 2005). It is possible that students experiencing low sense of belonging are especially in need of socially supportive peer interactions that serve an emotional, community-building function, as such interactions go beyond discussions of course content alone to alleviate students' feelings of alienation and isolation (Peacock et al., 2020).

In a qualitative exploration of students' experiences with online course belonging in the discussion group context, Peacock et al. (2020) found that "informal connection with learners … seemed distinctly supportive, giving learners the feeling that they were not alone in their

struggles" (p. 27). For these reasons, when engaged in online interactions with others, students experiencing lower belonging to their learning community may be more likely than their peers to notice, appreciate, and benefit from messages that signal encouragement, empathy, and kindness. However, to our knowledge, no study to date has examined whether socially supportive online peer interactions that serve an emotionally supportive function are particularly valuable for students experiencing low belonging to their course community.

1.6. The present study

Existing work highlights the importance of creating meaningful online peer interactions that are perceived as helpful by those who may otherwise feel alienated in online learning environments. However, we do not know how a student's sense of belonging to their course community may be related to what they find helpful in their online interactions with their peers. While existing work has taken steps towards illuminating communicative practices that are helpful for students in online course settings, generally (Leibold & Schwarz, 2015; Nandi et al., 2012; Theobald & Bellhäuser, 2022), it remains unclear whether students with differing degrees of belonging to their course community have different criteria or standards for what constitutes a helpful online peer interaction. Specifically, despite the demonstrated importance of social support that serves an emotionally supportive function for learners, it remains unclear whether students with a lower, as opposed to higher, sense of belonging to their course community are more likely to see social support as a valuable component of online peer interactions.

For this reason, in the present study, we seek to examine the association between sense of belonging to one's course community and what one finds helpful in online peer help-giving interactions. To this end, our research questions (RQs) are as follows:

1. RQ1: How do students with differing sense of belonging rate the helpfulness of online peer interactions in a college course discussion forum?
2. RQ2: Are students with lower sense of belonging more likely than students with higher sense of belonging to value social support in online peer interactions in a college course discussion forum?

To address RQ1, we examined how students with differing degrees of belonging rated the helpfulness of various examples of online peer help-giving interactions. We hypothesized that students with lower sense of belonging would find online peer interactions to be, on average, less helpful for their learning than students with higher sense of belonging, thus allowing us to examine whether students with differing degrees of belonging to their course community diverge in what they find helpful in online interactions with others.

To address RQ2, we examined how students described their criteria for effective peer help-giving, when prompted to explain what they found helpful or unhelpful in various examples of online peer help-giving interactions. We hypothesized that students with lower sense of belonging would be more likely than students with higher sense of belonging to mention social support as a contributor to helpfulness, thus providing evidence that socially supportive peer interactions may be particularly valuable for those experiencing low belonging to their course community. Although we recognize that social support can serve emotional, instrumental, and informative functions alike (Helgeson, 2002), we choose to focus on emotional social support in the present study because the feeling of being emotionally supported, encouraged, and cared for may be especially important for students' sense of belonging to educational settings (Allen et al., 2018; Inoue et al., 2020; Meyers et al., 2019; Peacock et al., 2020).

2. Methods

2.1. Participants and procedure

We recruited participants via voluntary response sampling from an introductory statistics course taught at a large public university in the midwestern United States. The course is normally taught both in-person and online. During the Fall 2021 semester, approximately two-thirds of all students in the course were enrolled in the online version of the course. The course instructor distributed information about the study to all students, who had the option of completing the study for extra credit. The instructor was not a member of the research team. We restricted data collection to the last month of the semester so that participants would be familiar with most statistical concepts referenced in the study, and so that they would have an opportunity to build their sense of belonging to the course community.

The research protocol was approved by the university's Institutional Review Board, and informed consent was obtained for all participants. Participants completed the study online in one session, at their own pace, and during a time of their own choosing. We used a repeated measures survey design that involved multiple measures of perceived helpfulness—how helpful one finds an example of a reply to a request for help posted to an online course discussion forum—for each participant. We employed a repeated measures design to (a) allow participants to assess the helpfulness of a diverse set of peer help-giving interactions, thus yielding results applicable to a wide range of online interactions; and (b) improve statistical power by controlling for factors that contribute to variability between participants and example help-giving replies.

Prior to beginning the survey, participants were informed of the study's aims and procedures, as well as the fact that the survey would focus on a course setting with which they were familiar: an online introductory statistics course where students use a discussion forum to

ask and answer questions. The survey asked each participant to view and assess the helpfulness of 20 examples of online help-seeking-and-help-giving exchanges adapted from forum posts from an actual statistics course. We sought to include examples of help-giving that characterized the range of replies found in a semester of forum messages, specifically in the nature of the academic help and social support given, so that our work would accurately reflect the discussion forum context experienced by students enrolled in a large introductory statistics course. However, even despite our efforts to include a diverse and authentic range of help-giving examples in the present study, it is unlikely that these examples spanned all the different possible forms of support provided by students in online statistics course discussion forums. Thus, we believe our reported results should be interpreted with the knowledge that they are informed by our study's specific set of help-giving example replies. In this regard, Appendix A contains the 20 examples of requests for help and replies to those requests used in this study.

Each example consisted of two discussion forum posts: a request for help from a student and a corresponding help-giving reply. We instructed participants to (a) rate each help-giving reply with the prompt "How helpful is this response?", on a scale from 1 = *Not helpful* to 5 = *Very helpful*; and (b) explain the reasoning behind their choice via an open-ended text response with the prompt "Please use the space below to explain why you selected the level of helpfulness you did." We instructed participants to respond honestly, based on their own opinions about what would constitute a helpful or unhelpful response to the forum post shown. At the end of the survey, participants completed a measure assessing their sense of belonging to their course community, as well as a demographic questionnaire that collected information on their race/ethnicity, gender, and year in school. Participants had the option of responding with "Prefer not to say" when completing the demographic questionnaire.

While an over-reliance on self-report measures can interfere with the credibility of one's findings (Paulhus & Vazire, 2007), we considered the use of a survey design to be appropriate, for multiple reasons. First, our central research phenomenon of interest, college students' sense of belonging, is a subjective feeling that cannot be directly assessed in terms of observed behaviors and outcomes (Crisp, 2010). Second, existing research has directly linked students' perceived levels of support to their mental health (Zhou et al., 2013), persistence (Nicpon et al., 2006), and sense of belonging (Hagerty et al., 1996); thus, we considered participants' self-reported beliefs about what constitutes effective online peer support as providing meaningful information for educators that could have implications for students' motivation and well-being. Third, there is a lack of existing research on what students with differing degrees of course community belonging find helpful in online peer interactions; thus, to obtain rich data, we sought to employ a study design that would allow students to freely articulate, on their own terms, which factors they believe contribute to an effective online peer help-giving interaction.

Originally, 240 students completed the survey. We excluded 10 students who exhibited response bias by either providing the same rating for all help-giving examples or the same word-for-word explanation for more than 50% of open-ended responses (an indication that the participant was copying-and-pasting most of their responses, rather than authentically engaging with the study materials), as well as an additional 7 students who were missing demographic information on at least one variable.

The removal of participants with missing data can result in biased estimates and loss of statistical power (Roth, 1994). However, we chose to remove participants with missing demographic data because we considered it important to control for race/ethnicity, gender, and year in school as potential confounders in analysis, especially given that belonging is

experienced differently for students of different demographic backgrounds (Vaccaro & Newman, 2016). Additionally, research suggests that if the percentage of participants removed is small (e.g., less than 5%), then the bias and loss of power introduced by listwise deletion is likely negligible (Graham, 2009). Moreover, there is evidence that listwise deletion performs as well as other methods of handling missing data when dealing with second-level variables (i.e., participant-level variables, in the case of the present study) when testing mixed-effects models (see "2.3. Analysis," below) (Gibson & Olejnik, 2003).

The final sample consisted of the remaining 223 participants; thus, we analyzed a total of 4,460 sets of participant ratings and responses for the present study. The data described in this article are available online (Jeng et al., 2022). Table 1 contains the demographic breakdown of our sample.

2.2. Measures

2.2.1. Dependent variables

2.2.1.1. Helpfulness rating

We converted each participant's helpfulness ratings—in response to the item "How helpful is this response?"—to a numeric score out of 5, where a higher score indicated a higher level of perceived helpfulness (1 = *Not helpful*, 5 = *Very helpful*). In Appendix A, the 20 example help-giving exchanges are arranged in descending order by mean helpfulness rating, across all participants, with the most helpful example first and the least helpful example last. The order in which participants viewed and responded to the 20 examples can also be found in Appendix A.

2.2.1.2. Mentions of social support

We created a binary variable to capture whether a participant's open-ended text response included a mention of social support (0 = does not mention social support, 1 = mentions social support). We determined participants' mentions of social support by their highlighting the importance of being empathic, supportive, kind, positive, respectful, or encouraging in the help-giving replies. In our study, participants could mention social support by either (a) identifying a help-giving example as helpful when social support was perceived to be present; or (b) identifying a help-giving example as unhelpful when social support was perceived to be lacking, weak, or ineffective. Thus, participants could highlight the importance of social support even in situations where they perceived the examples of social support included in our study materials to be insufficient or unhelpful. For each open-ended response, we assigned a value of "1" if the participant mentioned social support as a characteristic that positively contributed to the helpfulness of an example reply (e.g., "This is very thorough and gives an example. It is also very positive which is encouraging and something that I would appreciate") or would have positively contributed to the helpfulness of an example reply (e.g., "They were able to give insight, but it wasn't said in the kindest way").We assigned a response a value of "0" if the participant did not mention social support (e.g., "It is straightforward and answers the question"). Two members of the research team coded the same 300 responses and obtained substantial agreement, Cohen's $\kappa = .89$ (Landis & Koch, 1977); all differences were discussed and reconciled. Each coder then independently coded approximately 50% of the remaining participant responses.

In addition to capturing participants' mentions of social support, generally, we also wished to determine the extent to which each example help-giving reply was perceived to be socially supportive or unsupportive. Thus, we completed an additional round of coding, using

participant responses that were previously coded as having social support, to differentiate between instances where a participant mentioned social support as something that was present or lacking in an example help-giving reply (two members of the research team coded the same 100 responses, obtained substantial agreement [Cohen's $\kappa = .87$], and reconciled all differences).

2.2.2. Independent variables

2.2.2.1. Sense of belonging to one's course community.

We used a six-item Likert-type scale adapted from Goodenow's (1993) Psychological Sense of School Membership (PSSM) scale to assess participants' sense of belonging to their introductory statistics course community. Although the PSSM scale was originally designed to assess students' sense of belonging in school, generally, past work has successfully adapted PSSM scale items to assess students' sense of belonging in the context of a specific class (Freeman et al., 2007). In the original version of the PSSM scale, participants indicated their level of agreement (1 = *Strongly disagree,* 5 = *Strongly agree*) to statements related to their experiences with belonging in school (e.g., "I feel like a real part of this school"). To adapt these items to assess sense of course community belonging, we rewrote each statement to target participants' experiences with belonging in their statistics course (e.g., "I feel like a real part of this class"). Appendix B contains the six-item scale used in this study. Previous work examining the factor structure of the PSSM scale (Ye & Wallace, 2014) found these six items measure a single latent construct corresponding to a general sense of identification with and participation in the school context. Cronbach's α for the scale was .78, which indicates acceptable internal consistency (Bland & Altman, 1997). We used each participant's mean score for analysis; a higher score indicated higher sense of belonging to one's course community.

2.2.2.2. Demographics

We controlled for participant demographic background by including race/ethnicity, year in school, and gender as independent variables in analysis. Race/ethnicity was dummy coded into four variables (Asian or Asian American, Black or African American, Hispanic or Latino, and Other), with White as the baseline group for comparison. Year in school was dummy coded into three variables (sophomore, junior, and senior), with freshman as the baseline group for comparison.

Gender was coded as a binary variable, with woman/non-binary as the baseline group for comparison. While identifying as a woman is not the same as identifying as non-binary, the number of non-binary-identifying students in our sample was too small to analyze separately. To assess the potential impact of grouping women and non-binary students together on our results, we performed all analyses twice: once on a full dataset that included non-binary participants, and once on a partial dataset that excluded our non-binary-identifying participants; we found that our overall findings remained the same, regardless of approach. Thus, we considered our decision to group women and non-binary students together to be appropriate, given our sample.

2.2.2.3. Response length

We controlled for participant response length by including the total number of characters used in an open-ended response as an additional predictor in analysis. This step was taken to account for the possibility that participants providing shorter open-ended text responses were less likely to mention social support while completing the survey, simply because they were listing fewer reasons for selecting the helpfulness ratings they did.

2.3. Analysis

To account for the repeated measures design used in this study, we conducted a mixed-model analysis of the data with maximum likelihood estimation (MLE), using the *lme4,*

lmerTest, performance, and *effectsize* packages in R version 4.0.3 (Bates et al., 2015; Ben-Shachar et al., 2020; Kuznetsova et al., 2017; Lüdecke et al., 2021; R Core Team, 2020). Mixed-effects modeling expands on standard multiple regression by accounting for interdependencies in data that violate regression's assumption of independent observations (Cnaan et al., 1997). This expansion is accomplished by constructing models that include both *random effects,* or variation in a dependent variable attributable to interdependencies within levels of one or more grouping variables; and *fixed effects*, or influences on the mean value of a dependent variable, holding other predictors constant (Garson, 2019).

In this study, we accounted for interdependencies arising from two sources: participant and help-giving example. First, each participant assessed the helpfulness of 20 different example help-giving replies, so multiple responses from the same participant could not be regarded as independent of one another. Second, we expected variations in helpfulness rating and mentions of social support also to be clustered by help-giving example because the examples shown to participants varied widely in the nature of the help given. Thus, mixed-effects modeling equipped us to explore the fixed effects of belonging on helpfulness rating and mentions of social support while also accounting for variation in our dependent variables attributable to clustering within participant and example.

For our two dependent variables, we constructed separate mixed models with random intercepts, based on our RQs of interest. In both models, we chose to treat helpfulness rating, sense of course community belonging, and response length as continuous variables; although we measured helpfulness ratings and sense of course community belonging using Likert-type instruments, research indicates that ordinal data with at least five categories can be treated as continuous with minimal problems (Johnson & Creech, 1983; Norman, 2010). To avoid

multicollinearity, all variables treated as continuous were mean centered prior to implementing analyses. Assessing the Variance Inflation Factor (VIF) for each fixed effect in both models using a cut-off of VIF > 6 (Keith, 2019), we determined there was no multicollinearity among our predictors of interest.

First, we constructed Model 1, a linear mixed-effects model that includes helpfulness rating as the dependent variable, participant and example as random effects, and sense of course community belonging, race/ethnicity, gender, and year in school as fixed effects. Model 1 allowed us to examine the association between sense of course community belonging and helpfulness rating, after accounting for demographic background and clustering attributable to participant and example (thus answering RQ1).

Second, we constructed Model 2, a logistic mixed-effects model that includes mentions of social support as the dependent variable, participant and example as random effects, and sense of course community belonging, race/ethnicity, gender, year in school, and response length as fixed effects. Model 2 allowed us to examine the association between sense of course community belonging and one's likelihood of mentioning social support as a message characteristic that positively contributes to online helpfulness, after accounting for demographic background, open-ended response length, and clustering attributable to participant and example (thus answering RQ2).

Finally, prior to analysis, we calculated intraclass correlation coefficients (ICCs) for both models to determine the proportion of variance in our outcome variables attributable to random effects (Garson, 2019). We obtained ICCs of .49 for Model 1 and .67 for Model 2. In other words, approximately half of the variation in helpfulness rating and two-thirds of the variation in the logit of mentions of social support could be attributed to random effects. These large ICCs

verify that our data violated regression's assumption of independent observations; based on this finding, we considered the use of mixed-effects modeling to be necessary to avoid biased estimates of fixed effects and account for non-independence in our data.

3. Results

Before addressing the two research questions that motivated this investigation, we first provide descriptive statistics regarding the means, standard deviations, and strength of association between response-level (helpfulness rating, mentions of social support, response length) and participant-level (sense of belonging, race/ethnicity, year in school, gender) variables included in analysis. We also discuss the degree to which different help-giving examples were perceived as having or lacking social support.

3.1. Descriptive statistics

Participants, on average, found help-giving examples to be moderately helpful ($M = 3.67$, $SD = 1.38$) and reported a moderate-to-high sense of belonging to their course community ($M = 3.93$, $SD = 0.75$). In total, 276 open-ended responses (6.19%) included mentions of social support, and the mean participant response length was 75.09 characters ($SD = 52.88$). There was little evidence of a correlation between helpfulness ratings and mentions of social support at the response level ($r = -.02$, $p = .11$), an indication that it was appropriate for us to address our two research questions using separate statistical models (Tybout et al., 2001). Response length had a small negative correlation with helpfulness rating ($r = -.06$, $p < .001$) and small-to-moderate positive correlation with mentions of social support ($r = .10$, $p < .001$). We present correlations between participant-level variables included in analysis in Table 2.

We include the percentage of participants who identified each help-giving example as benefiting from (or lacking) social support in Appendix A. Of the 276 open-ended responses that

included mentions of social support, 221 identified social support as something that positively contributed to the helpfulness of the example in question, and 55 identified social support as something lacking that would have positively contributed to the helpfulness of the example in question. The help-giving example replies that participants most frequently identified as being socially supportive were those that provided motivational support (e.g., "Don't worry, I was also confused on this for a while!") or assured the help-seeker they were not alone in their struggle (e.g., "I am having the same problem, so you're definitely not alone there").

3.2. RQ1: How do students with differing sense of belonging rate the helpfulness of online peer interactions in a college course discussion forum?

As a global test of Model 1, we performed a likelihood ratio test (LRT) to determine whether the fixed effects included in Model 1 explained a significant amount of variance in helpfulness rating, after accounting for interdependencies attributable to participant and example. Results indicated that Model 1 provided significantly better fit for the data than a null model that includes helpfulness rating as the dependent variable, participant and example as random effects, and no fixed effects ($\chi^2[9] = 40.35$, $p < .001$). Thus, we considered Model 1 to be well-fitted to the data.

We also constructed a model with interaction terms to test for interaction effects between belonging and race/ethnicity, belonging and gender, and belonging and year in school. The addition of these interaction terms led to a non-significant increase in the amount of explained variance in helpfulness rating ($\chi^2[8] = 9.36$, $p = .31$). This finding indicates that the relationship between belonging and helpfulness rating was not moderated by demographic background. Thus, we excluded interaction terms from our final analysis of Model 1.

The marginal R^2 (i.e., the proportion of variance in our dependent variable explained by fixed effects alone) for Model 1 indicated that fixed effects explained 1.6% of the variance in helpfulness rating. We present fixed effects estimates associated with Model 1 in Table 3. We provide values for partial eta-squared (η_p^2) in Table 3 as measures of effect size for fixed effects (Cohen, 1988). Sense of belonging to one's course community significantly predicted helpfulness rating with a medium-to-large effect size ($p < .001$, $\eta_p^2 = .11$), after controlling for demographic background and clustering attributable to random effects. As hypothesized, students experiencing a lower sense of belonging to their course community found forum replies to be, on average, significantly less helpful for their learning, when compared to those experiencing a higher sense of belonging to their course community. No significant associations between demographic background and helpfulness rating were observed.

3.3. RQ2: Are students with lower sense of belonging more likely than students with higher sense of belonging to value social support in online peer interactions in a college course discussion forum?

As a global test of Model 2, we performed an LRT to determine whether the fixed effects included in Model 2 explained a significant amount of variance in the logit of mentions of social support, after accounting for interdependencies attributable to participant and example. Results indicated that Model 2 provided significantly better fit for the data than a null model that includes mentions of social support as the dependent variable, participant and example as random effects, and no fixed effects ($\chi^2[10] = 56.75$, $p < .001$). Thus, we considered Model 2 to be well-fitted to the data.

As was the case with Model 1, we constructed a model with interaction terms to test for interaction effects between belonging and demographic background. The addition of these

interaction terms led to a non-significant increase in the amount of explained variance in the logit of mentions of social support for Model 2 ($\chi^2[8] = 7.60$, $p = .47$). Thus, the relationship between belonging and mentions of social support was not moderated by demographic background, and we excluded interaction terms from our final analysis of Model 2.

The marginal R^2 for Model 2 indicated that fixed effects alone explained 4.7% of the variance in the logit of mentions of social support. We present fixed effects estimates associated with Model 2 in Table 4. To improve the interpretability of our findings, we provide odds ratios (*OR*) in Table 4 as measures of effect size for fixed effects; odds ratios represent the change in one's odds of mentioning social support, given different categories or values of a predictor of interest. Sense of belonging to one's course community significantly predicted likelihood of mentioning social support ($p = .04$), after controlling for demographic background and clustering attributable to random effects. Specifically, a 1 *SD* increase in sense of course community belonging corresponded to a 22% decrease in odds of mentioning social support. Thus, as hypothesized, students experiencing lower sense of belonging to their course community were significantly more likely to mention social support when explaining what they find helpful in online peer interactions in a college course discussion forum, when compared to those experiencing a higher sense of belonging to their course community.

Additionally, students identifying as men had 47% less odds of mentioning social support in their open-ended responses than students identifying as women or non-binary ($p = .03$), and students identifying as Black or African American had 60% less odds of mentioning social support in their open-ended responses than students identifying as White ($p = .04$). No other significant associations between demographic background and likelihood of mentioning social support were observed. Finally, response length also significantly predicted likelihood of

mentioning social support ($p < .001$), where longer open-ended responses were significantly more likely than shorter responses to include mentions of social support.

4. Discussion

4.1. General discussion

With the increased prevalence of online learning, there is a corresponding greater need to find ways of supporting students who feel alienated and isolated in online settings. The goal of the present study was to examine the association between a student's sense of belonging to their course community and what they find helpful in online peer help-giving interactions taking place in a college course discussion forum. With our first research question, we asked whether students experiencing differing degrees of course community belonging differed in how they rated the helpfulness of online peer help-giving interactions. We found that on average, participants experiencing a lower sense of belonging to their course community judged example forum replies to be less helpful for their learning, when compared to those experiencing a higher sense of belonging to their course community.

With our second research question, we sought to shed light on the kinds of peer support that students experiencing lower course community belonging might specifically find helpful. To this end, we asked whether students experiencing differing degrees of course community belonging differed in their likelihood of mentioning the importance of social support, when explaining what they found helpful or unhelpful in online peer help-giving interactions. We found that participants with lower sense of course community belonging had significantly greater odds of mentioning social support in their open-ended responses.

4.1.1. Diverging standards of helpfulness

The results associated with our first research question align with previous research proposing that peer support plays a central role in maintaining college students' feelings of belonging in both in-person (Hurtado & Carter, 1997) and online (Peacock et al., 2020) academic settings. Past work has shown that students who feel they belong in college settings are also those who feel supported by their peers (Hoffman et al., 2002), and the present study supports this perspective by demonstrating that those with a higher sense of belonging to their learning community have an overall more positive evaluation of other students' attempts to provide academic help. However, we were unable to determine the direction of causality that characterizes this relationship between belonging and perceived helpfulness (see "4.2. Limitations," below).

Our findings also suggest that students experiencing lower and higher belonging to their course community evaluate online peer help-giving interactions differently. Although previous research has shown that a student's sense of belonging is associated with the perceived quality of their online interactions (Diep et al., 2017), we found that this relationship between belonging and perceived helpfulness held even when students were evaluating the same instances of academic support, as opposed to solely their own personal experiences with online peer interaction. That is, our work suggests that students with low belonging to their course community are not necessarily missing out on the helpful interactions other students get to experience, but rather that they find help-giving replies to be, on average, less helpful for their learning. Thus, we propose that students with differing degrees of belonging to their course community may have diverging criteria or standards for what constitutes an effective online help-giving reply.

Overall, this finding is concerning because online students already experiencing alienation and isolation may not be well-served by help-giving replies that other students would typically consider to be helpful. For this reason, we believe that researchers ought to be concerned with how educators can provide alienated students with not only more support, but also the right kinds of support these students specifically find helpful. We hope that future research will illuminate what sorts of supports are most likely to be helpful for these students.

4.1.2. The role of social support

The results associated with our second research question suggest that social support may have elevated importance for students who do not feel like they are a real part of their course community. That is, in addition to experiencing less social support than their peers (Hagerty et al., 1996; Hale et al., 2005), students with lower belonging to their learning community may be especially likely to see social support as valuable in their learning-oriented peer interactions with others. It is possible that a greater need for social support causes these students to be attuned to the importance of encouragement, empathy, and kindness in online course settings. Thus, we propose that each help-seeker's unique needs play an important role in determining what they perceive as helpful in their interactions with others.

Additionally, specific to the context of this study, our work complements previous research reporting that supportive behaviors aimed at building a student's sense of self-efficacy may improve overall performance for students engaged in online statistics learning (Huang et al., 2020). Although online course discussion forums are often seen primarily as tools for sharing information and knowledge (Sun et al., 2018), we found that social support may also have a place in such settings, especially for those who do not feel like a real part of their class. Thus, educators may wish to model and promote help-giving behaviors in discussion forums that not

only discuss course content, but also encourage, empathize with, and show kindness to other students.

Although not the direct focus of this study, we also found that gender predicted likelihood of mentioning social support, where participants identifying as women or non-binary were more likely than participants identifying as men to cite the importance of social support in their open-ended responses. It is possible our woman-identifying participants were more appreciative of socially supportive messages in part because socially constructed gender roles that associate masculinity with greater technological skill (i.e., greater skill with computers) cause women to experience greater feelings of anxiety about the online learning process, when compared to men (Abdous, 2019; Huffman et al., 2013). In addition, research has indicated that compared to men, women engage in using more social and polite language across a variety of contexts (e.g., Newman et al., 2008), which may have also contributed to their greater appreciation of socially supportive messages in this study.

Furthermore, we found that students identifying as Black or African American were less likely than students identifying as White to mention the importance of social support in their responses. This was a surprising finding, given that social support plays an important role in persistence for Black and African American college students (Gloria et al., 1999), and these students regularly experience less social support than their White peers at predominantly White institutions, due to racial discrimination (Jay & D'Augelli, 1991; Prelow et al., 2006). This finding may indicate that our results are, at least to some degree, context-specific; i.e., it is possible that, compared to White students, participants identifying as Black and African American, on average, saw less of a need for social support in peer discussion forum interactions, compared to other domains. For example, past work has shown that Black and

African American students at predominantly White institutions are particularly likely to draw from and rely on faculty relationships as a primary source of social support (Baker, 2013).

Although students identifying as men or African American were less likely than other students to mention social support, it may be that the examples of social support included in this study did not seem authentic or beneficial to these students, or that the socially supportive replies were not instrumental in providing actual help with course content. Thus, our results should not necessarily be taken as evidence that students in these demographic groups place less value on peer social support, relative to other students. In fact, overall, a relatively small percentage of participants mentioned social support when explaining why they selected the helpfulness ratings they did (see Appendix A). This result suggests that, generally, our help-giving examples may not have been perceived as socially supportive by participants. Thus, we believe our findings with respect to RQ2 should be interpreted with the understanding that the example help-giving replies used in this study may not have been the most effective possible measures for understanding perceptions of social support. Future research should continue to explore how different forms of social support may take on varying degrees of importance in different settings for specific groups of students.

Interestingly, we found that helpfulness ratings and mentions of social support were uncorrelated at the response level. It is possible that we obtained this result because our measure of social support captured both instances where participants praised the presence of social support in a help-giving message and instances where participants critiqued a lack of social support in a help-giving message. Furthermore, certain examples of help-giving replies may have been relatively strong in their ability to provide social support but relatively weak in their ability to provide task-related help (e.g., Example 16 in Table A.1), thus hindering our ability to isolate

perceived social support's impact on helpfulness ratings through a correlation statistic. Additionally, it is also possible that social support and helpfulness ratings were uncorrelated because some students do not see social support as important to the overall helpfulness of a help-giving reply.

Moreover, it should be noted the two help-giving example that yielded the most mentions of social support as a positive feature from participants (Examples 16 and 17 in Table A.1) had the 2nd highest and 2nd lowest overall helpfulness ratings, respectively, of any example replies in this study. In the latter case, participants rated the help-giving reply negatively largely because the example help-giver could not offer a solution to the help-seeker's question (e.g., one participant wrote, "It shows that the first student isn't the only one struggling, but it still doesn't answer the question"). This finding suggests that social support, while valuable for students experiencing alienation and isolation, may only be able to do so much to help someone struggling with academic material. Thus, we argue that social support should, when possible, still be accompanied by task-related help in peer help-giving interactions. However, it will be important for future studies to identify the degree to which students find social support to be helpful, as well as the kinds of social supports that are most helpful for students belonging to diverse populations.

4.1.3. The message and the student considered

Taken together, our findings show that one cannot expect to evaluate the effectiveness of an online help-giving reply accurately without considering attributes of both the help-giving message in question (e.g., the presence or absence of social support) and the student receiving the reply (e.g., their sense of belonging to their course community). It should also be noted that for our two statistical models tested in this study, clustering of the data within participant and

help-giving example together accounted for approximately one-half to two-thirds of the variation in our dependent variables of interest. This result further suggests that, within our sample, the participants' characteristics and experiences, as well as characteristics of the example forum messages, themselves, contributed substantially to participants' opinions about the helpfulness of these messages. For these reasons, we endorse Webb and Mastergeorge's (2003) view that effective helping behavior depends on both the help-giver and help-seeker in question. Researchers should similarly keep both dimensions of helping behavior in mind as they seek to explore the conditions of effective online help-giving in future work.

4.2. Limitations

This work faces multiple limitations. First, although this study uncovered an association between belonging and perceived helpfulness, we were unable to establish the direction of causality of this relationship. On one hand, it is possible that a lower sense of belonging to one's course community results in more negative views towards help-giving because students who feel excluded by their classmates do not trust academically oriented peer interactions to be valuable for their learning. However, on the other hand, it is also possible that a more negative view of other students' attempts to provide help contributes to one's feelings of alienation from their peers, thus resulting in lower belonging. Specifically, if a student finds others' help-giving efforts to be ineffective, they may infer that they will not fit in well with their peers, which can in turn have negative consequences for their long-term experiences with belonging (Walton & Brady, 2017).

Second, past research has shown that sense of belonging is a complex phenomenon that is experienced differently by privileged and minoritized students (Vaccaro & Newman, 2016), and there is also evidence that belonging may take on unique dimensions for online students

(Peacock et al., 2020)**.** Thus, it is possible that our measure of course community belonging—which broadly defined belonging as a general feeling of fit in course settings—failed to capture the nuances of how different students navigate feelings of belonging in online settings. Considering this fact, further research should be conducted to determine how students of different backgrounds define and experience belonging to online realms.

Third, we were unable to examine how non-binary-identifying students uniquely experience belonging and perceive the support of others in online spaces. It will be important for researchers and educators to find ways of providing effective support for non-binary-identifying students, given that these students exhibit concerns over being left without the support of others in online settings (Oinas et al., 2022). Future work should thus highlight non-binary students' experiences with online belonging and learning by surveying a larger sample of students or adopting a qualitative approach.

Finally, this work faces limitations with respect to generalizability. Specifically, because students participated voluntarily in this study and were all enrolled in the same course, we may not have obtained a sample that is representative of college students in general. Also, the fact that relatively few students mentioned social support in their open-ended responses may indicate that our help-giving examples were generally not perceived as socially supportive; thus, we caution against generalizing our findings on social support beyond the types of forum exchanges included in this study. Furthermore, a relatively small number of participants identified as Black or African American. Thus, this demographic group's observed low likelihood of mentioning social support in their open-ended responses should not necessarily be generalized as a characteristic of Black or African American students, broadly.

4.3. Implications

This study has implications for theory, research, and practice. First, our findings support previous work proposing that theoretical conceptualizations of online learning should be revised to account for the role that belonging to online communities plays in shaping students' online learning experiences (Peacock & Cowan, 2016, 2019). Ultimately, a framework that does not consider how one's sense of belonging to online spaces informs their learning, peer interactions, and help-giving behaviors may limit research intended to further educators' understanding of the online learning process.

Second, this study provides an approach to study design and data analysis that can be adopted by future researchers to investigate students' perceptions of online course materials. In this study, participants directly engaged with a body of online discussion forum posts and justified their evaluations of those posts. Thus, the study procedure yielded more direct insight into participants' perceptions of discussion forum interactions than what would have otherwise been obtained through a measure asking students to report their overall or general impression of an online course community (e.g., Arbaugh et al., 2008; Diep et al., 2017). At the same time, by accounting for the random effect of help-giving example through mixed-model analysis, we also were able to derive findings that accounted for variations in perceived helpfulness between examples used in this study. Thus, our study approach allowed for both direct participant engagement with specific help-giving examples and findings that are potentially applicable to multiple discussion forum contexts.

Finally, this research will be important for online educators because students who lack belonging in college settings are already at risk of having decreased academic engagement and success (Gopalan & Brady, 2020). It appears that, in the online realm, these students also may not see themselves as receiving the academic and social support they need from others to

succeed or trust the support offered from their peers. Thus, it could be critical for online instructors to promote their students' feelings of belonging by welcoming course-related discussions, modeling effective collaborative helping behavior, and facilitating socially supportive peer interactions in their online learning environments.

4.4. Directions for future research

This study presents at least two promising avenues for future work exploring the interplay between sense of belonging, help-giving, and online learning. First, future research should aim to identify factors contributing to students' sense of belonging to online course communities. Although we have suggested that students with a low sense of belonging to their course community may be those with insufficient social support, we still know little about the characteristics and circumstances that cause some students, but not others, to feel a sense of isolation in online learning environments. Further insight in this area could help researchers identify why students with low belonging to their course community find peer help-giving interactions less helpful than others do. Second, future research should further explore how online help-giving replies can be crafted to attend to the needs of online students with low belonging to their course community. Although we examined students' perceptions of helpfulness across a range of help-giving replies in the present study, future research may wish to look more closely at specific help-giving strategies that may or may not be helpful for students with lower and higher belonging to their online course community. Such research could yield strategies for facilitating peer interactions that are helpful to students experiencing alienation in such settings.

5. Conclusion

Online learning environments are often isolating for students, and this feeling of isolation may be exacerbated when students also feel they do not belong to their online course community. To explore how students' sense of belonging to their course community is related to their learning, this investigation shed light on the relationship between belonging and the perceived effectiveness of online peer help-giving interactions. We found that students experiencing low belonging to their course community judged help-giving replies to be less helpful for their learning and were especially likely to bring up the importance of peer social support in help-giving interactions. These results suggest that the productivity of online helping behavior depends on one's feeling of fit and membership to their course community. By creating welcoming course environments and attending to the specific learning needs of those experiencing low belonging to their learning community, educators may be able to help these students receive the support they need to learn most effectively in online courses.

Declarations of Competing Interest

None.

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Tables

Table 1

Participant Demographic Breakdown

	N	**%**
Year in school		
Freshman	108	48.43
Sophomore	71	31.84
Junior	29	13.00
Senior	15	6.73
Gender		
Man	52	23.32
Woman	166	74.44
Non-binary	5	2.24
Race/ethnicity		
Asian or Asian American	59	26.46
Black or African American	21	9.42
Hispanic or Latino	33	14.80
Other	10	4.48
White	100	44.84
Total	223	100.00

Table 2

Correlations Between Participant-Level Variables Included in Analysis

Variable	1	2	3	4	5	6	7	8
1. Sense of Belonging	—							
2. Asian or Asian American	.09	—						
3. Black or African American	-.11	—	—					
4. Hispanic or Latino	-.06	—	—	—				
5. Other Race	.004	—	—	—	—			
6. Sophomore	-.02	-.26***	.08	-.01	-.01	—		
7. Junior	-.15*	-.05	.01	.03	.11	—	—	
8. Senior	-.15*	.08	.10	-.01	-.06	—	—	—
9. Man	-.16*	.08	.04	.01	-.12†	-.01	.10	.06

†$p < .10$, *$p < .05$, ***$p < .001$.

Table 3

Fixed Effects Estimates from Mixed Model Analysis – Model 1

Fixed effect	*B*[a]	*SE B*	*t*	*B* 95% *CI*	β[b]	η_p^2
(Constant)	-0.01	0.21	-0.07	[-0.44, 0.42]	-0.01	<.001
Race/ethnicity						
Asian or Asian American	-0.12	0.07	-1.88†	[-.26, 0.01]	-0.09	.02
Black or African American	0.11	0.09	1.15	[-0.08, 0.29]	0.08	.01
Hispanic or Latino	0.07	0.08	0.91	[-0.08, 0.23]	0.05	.004
Other	0.24	0.13	1.81†	[-0.01, 0.49]	0.17	.01
Gender						
Man	-0.04	0.06	-0.62	[-0.16, 0.09]	-0.03	.002
Year						
Sophomore	0.03	0.06	0.56	[-0.09, 0.16]	0.02	.001
Junior	0.13	0.08	1.58†	[-0.03, 0.30]	0.10	.01
Senior	-0.04	0.11	-0.44	[-0.26, 0.17]	-0.03	.001
Sense of belonging	0.19	0.04	5.31***	[0.12, 0.27]	0.10	.11

Note. Dependent variable is helpfulness rating (HR).

[a] *B* is the unstandardized fixed effect estimate.

[b] Partially standardized effect estimates—which represent the change in a dependent variable in SD units, given an unstandardized 1-unit increase in a predictor—are reported for categorical predictors (race/ethnicity, gender, and year in school); i.e., β represents the SD difference in HR between categories. The fully standardized effect estimate—which represents the change in a dependent variable in SD units, given a 1 SD increase in a predictor—is reported for sense of belonging; i.e., β is the SD change in HR, given a 1 SD increase in sense of belonging.

†$p < .10$, *$p < .05$, ***$p < .001$.

Table 4

Fixed Effects Estimates from Mixed Model Analysis – Model 2

Fixed effect	*B*[a]	*SE B*	Wald	*OR*	*OR* 95% *CI*
(Constant)	-4.60	0.63	-7.35***	0.01	[0.00, 0.03]
Race/ethnicity					
Asian or Asian American	-0.34	0.29	-1.20	0.71	[0.40, 1.25]
Black or African American	-0.91	0.44	-2.09*	0.40	[0.17, 0.95]
Hispanic or Latino	-0.43	0.34	-1.30	0.65	[0.33, 1.25]
Other	-0.70	0.58	-1.21	0.50	[0.16, 1.54]
Gender					
Man	-0.66	0.30	-2.24*	0.52	[0.29, 0.92]
Year					
Sophomore	0.06	0.26	0.22	1.06	[0.63, 1.77]
Junior	0.02	0.37	0.06	1.02	[0.50, 2.11]
Senior	0.23	0.47	0.49	1.26	[0.50, 3.13]
Sense of belonging	-0.24	0.12	-2.06*	0.78	[0.62, 0.99]
Response length	0.52	0.08	6.32***	1.68	[1.43, 1.98]

Note. Dependent variable is logit of mentions of social support (MSS).

[a] For Model 2, predictors treated as continuous (i.e., sense of belonging, response length) were standardized prior to analysis (i.e., *B* is the change in the logit of MSS, given a 1 SD change in the predictor's value). For all other predictors, *B* is the difference in the logit of MSS between categories.

$^{\dagger}p < .10$, $*p < .05$, $***p < .001$.

Appendix A. Help-seeking and help-giving examples

Table A.1

Help-Seeking/Help-Giving Exchanges Assessed by Participants

Example Order[a]	Request for Help	Help-Giving Reply	Helpfulness Rating[b]	Percentage Identified as Socially Supportive[c]	Percentage Identified as Lacking Social Support[d]
12	I am trying to find the z-score for my percentile, but I keep getting stuck.	Remember that the percentage given is the "middle area". The easiest way to find the z-score is to look at the percentile that you were given in the problem and figure out how far away that is from the 50th percentile. For example, if I was given the 60th percentile in the problem, I would look at how far 60 is away from 50, which is 10 and then double it, since you are looking for the middle area. So then you would be looking for what z-score corresponds to an area of 20 on the standard normal table and that would be your answer. I hope this helps! :)	4.68	14.80%	0.00%
17	Can someone explain what I have to do to find the regression line equation? I'm stuck on question 2.	The principle behind it is that you essentially need to find the equation (y=mx+b) of the regression line. First, the slope(m): multiply the r you're given by (SD of y)/(SD of x). Second, the y-intercept(b): plug m, x, and y into y=mx+b. You already have one (x,y) pair	4.66	2.24%	0.00%

Example Order[a]	Request for Help	Help-Giving Reply	Helpfulness Rating[b]	Percentage Identified as Socially Supportive[c]	Percentage Identified as Lacking Social Support[d]
		from the previous problem. Solve for b, and then you have the whole equation!			
9	I'm not sure what to look for on the chi-squared table when finding the p-value.	Don't worry, I was also confused on this for a while! First, you need to find the table row that corresponds to your degrees of freedom (using the first column). Then, follow the numbers in that row across until you land on the number closest to your chi-square statistic. Your approximate p-value will be in the top row of the column that you land on. For my HW, I had a df of 4 and chi-square of 13, so my p-value was .01.	4.64	25.56%	0.00%
20	How do you find outliers using a box plot?	You will need to: 1) calculate the IQR for your data (Q3-Q1), 2) add 1.5*IQR to Q3 (if IQR is 50 and Q3 is 200, then Q3+1.5*IQR = 200+75 = 275), 3) subtract 1.5*IQR from Q1 (if Q1 is 150, then Q1-1.5*IQR = 150-75 = 75). Any values above Q3+1.5*IQR or below Q1-1.5*IQR will be outliers. So in my case, any values above 275 and below 75 are outliers. Someone else may be able to explain this more clearly than I can by using a visual.	4.52	0.45%	0.45%
19	I don't know where to start for finding the	The equation for confidence interval is sample% +/- z-score multiplied by the SE% (which, as a reminder, is SD /	4.36	0.00%	0.00%

Example Order[a]	Request for Help	Help-Giving Reply	Helpfulness Rating[b]	Percentage Identified as Socially Supportive[c]	Percentage Identified as Lacking Social Support[d]
	confidence interval for this problem.	sqrt(n) * 100%). For example, using my numbers: 95% CI = 24% +/- 2(1.2636) =(21.5, 26.5).			
18	How do you find the average of the residuals of a regression line?	For any regression line, the average of the residuals will always be 0 (see p.28 of our textbook for more info on this).	4.35	0.00%	0.00%
5	Hi, I really don't understand how we're supposed to find the median from a histogram. This is really unclear to me.	From the histogram, you can create a chart (like the one I have attached below) and then find where 50% falls. In the example we used in class, 50% occurred at the 40 hour mark. In other words, 50% of people worked less than 40 hours and 50% worked more than 40 hours.	4.31	0.45%	0.00%
8	How do you find RMSE?	RMSE=sqrt(1-r^2).	4.25	0.00%	0.00%
14	Can someone explain what I need to conduct a t-test, for question 4?	If y'u're having trouble, you could go online and watch the lecture video again while trying to follow along, if you can. But in this problem, you need to calculate a couple things: 1. SD+ (like another comment said, use [sqrt(n/n-1)] x SD). 2. Test statistic (calculate observed-expected and divide that by your standard error). 3. Degrees of freedom ('t's n-1)	4.21	0.45%	4.04%
1	How do you calculate the z statistic for a two-sample z test?	You use the formula z= (observe– -expected)/SE.	3.84	0.00%	0.00%

Example Order[a]	Request for Help	Help-Giving Reply	Helpfulness Rating[b]	Percentage Identified as Socially Supportive[c]	Percentage Identified as Lacking Social Support[d]
6	How do you figure out the expected value (for question 2)? I'm confused.	To find the expected value, you multiply the total size of your sample by the likelihood that your outcome of interest will occur. For instance, if a bag of nuts contained 50% cashews, with 200 nuts in the bag in total, how many cashews would you expect there to be in the bag?	3.81	0.00%	0.00%
13	How do you find degrees of freedom for a t-test?	The degrees of freedom is the same as n. It is important because it will affect the shape of your t-distribution when performing a t-test. For more information, the professor goes through the steps for a t-test in Monday's lecture video.	3.56	0.00%	0.90%
2	Why am I getting this wrong? I thought that if the p-value is more than a certain value, we can reject the null.	If the p-value is more than 5, you DON''T reject the null. That''s the rule.	3.51	0.00%	15.25%
15	Are confounders only applicable to observational studies? And must casual links have immediate factors that explain a control and a treatment?	Confounders are not limited to observational studies, as they can be present in any experiment.	3.21	0.00%	0.45%
11	For question b on the HW, how do you find	Q1 is the bottom of the rectangle, as it represents the 25th percentile, and Q3 is the top of the rectangle, as it represents	3.16	0.00%	0.45%

Example Order[a]	Request for Help	Help-Giving Reply	Helpfulness Rating[b]	Percentage Identified as Socially Supportive[c]	Percentage Identified as Lacking Social Support[d]
	Q1 and Q3 on the boxplot?	the 75th percentile. But I'm also confused on this question because I'm not sure how to use that to find the IQR.			
10	How do you solve 1c: "Draw one student at random, what is the chance that the student is either a girl or blonde?"	The textbook does a great job of explaining how to solve this kind of problem on p.94.	3.11	0.00%	1.35%
3	How do I find outliers on a box plot?	Each vertical line in the boxplot represents a percentile, in 25% increments: 25% of the data lies between the minimum and Q1, between Q1 and the median, between the median and Q3, and between Q4 and the maximum. Hope this makes sense, and feel free to let me know if you still have any questions :)	3.09	16.59%	0.45%
7	I need help with questions 4 and 5 on the HW. I can't seem to figure out how to get the z score.	Oh yeah, those were tough! See page 152 in the workbook; it helped me a lot :)	3.07	4.93%	0.45%
16	I don't understand how my answer is wrong... I did the same exact thing as the textbook and it says it is wrong???	I am having the same problem, so you're definitely not alone there.	1.69	25.56%	0.00%

Example Order[a]	Request for Help	Help-Giving Reply	Helpfulness Rating[b]	Percentage Identified as Socially Supportive[c]	Percentage Identified as Lacking Social Support[d]
4	How do I find the SE? I am getting 4.41 but apparently it is wrong.	I am having the same issue. Anyone able to help???	1.35	8.07%	0.90%

Note. Examples were exact or slightly modified versions of real question-answer exchanges pulled from past statistics course forums.

[a] "Example Order" corresponds to the order in which example help-giving exchanges were presented to participants during the study.

[b] Participants rated the helpfulness of each help-giving reply on a 5-point Likert scale with the following options: *Not helpful*, *Slightly helpful*, *Somewhat helpful*, *Helpful*, and *Very helpful*. We obtained mean helpfulness ratings by converting each helpfulness rating to a numeric score (where 1 = *Not helpful* and 5 = *Very helpful*) and calculating the mean score for each example, across all participants.

[c] "Percentage Identified as Socially Supportive" corresponds to the percentage of participants who identified social support as a message characteristic that positively contributed to the helpfulness of the reply.

[d] "Percentage Identified as Lacking Social Support" corresponds to the percentage of participants who identified social support as a message characteristic that would have positively contributed to the helpfulness of the reply.

Appendix B. Sense of course community belonging measure

Rate the following statements in terms of how true each one is for you in this course, on a scale from not at all true to completely true:

(1 = *Not at all true,* 5 = *Completely true*)

1. I feel like a real part of this class.
2. *Sometimes I feel as if I don't belong in this class.
3. I am included in lots of activities in this class.
4. *I feel very different from most other students in this class.
5. *I wish I were in a different class.
6. I feel proud of belonging to this class.

* = item is reverse scored