Direct and Indirect Ways of Being Helpful in Online Peer Help-Giving Interactions

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Abstract

Past research conducted in in-person classrooms has demonstrated that helping behavior—requesting and giving help in academic settings—plays an important role in learning. However, little is known about peer-to-peer help-giving in online learning environments, and online students may find it difficult to receive the help they need to succeed. Specifically, we have little knowledge of the factors contributing to productive helping behavior in online spaces, as well as how these factors may support students' online learning experiences. Thus, the aim of the present study was to understand the conditions underlying effective peer help-giving in online college course discussion forums. To this end, we surveyed 88 college students about what they found helpful or unhelpful in examples of replies to requests for help posted to an online statistics college course discussion forum. A qualitative analysis of participants' written responses using a grounded theory approach yielded a model for assessing the helpfulness of peer help-giving replies within the discussion forum context. We learned that online help-giving replies could take the form of direct help—such as being elaborated, accurate, relevant, and/or understandable to the help-seeker—or indirect help—such as being encouraging, resource providing, calling to the community, and/or being concise. Our emergent online-specific model of academic help-giving contributes to existing theory by illustrating how peer help-giving replies can be structured to promote social, cognitive, and teaching presence in online communities of inquiry. Ultimately, these findings could inform practices that improve online learning opportunities for students.

Keywords: cooperative/collaborative learning, distance education and online learning, learning communities, post-secondary education

1. Introduction

In online learning environments, interactions among students allow them to develop multiple perspectives on a topic, collaborate on tasks, and form a connected community of learners (Anderson, 2004; Bature et al., 2020). As such, research has linked student–student interactions to increased learning and satisfaction in online spaces (Martin & Bolliger, 2018; Navarro & Shoemaker, 2000). Because the past few decades have seen a rise in the opportunities for interaction available to students enrolled in online courses (e.g., discussion forums, instant messaging, video conferencing), online instructors and students can now engage in a greater range of "teaching and learning methods, in particular peer and collaborative learning" (Juwah, 2006, p. 180). Furthermore, classrooms around the world recently experienced a dramatic increase in the use of online communicative tools due to the COVID-19 pandemic (Adedoyin & Soykan, 2020), and it is likely that this shift will result in the continued, broad use of opportunities to collaborate online, even in a post-COVID-19 world (Chandra & Palvia, 2021; Zhu & Liu, 2020).

Theorists have developed different conceptual models (e.g., Gao et al., 2009; Garrison et al., 1999) to help educators facilitate productive online, interactive learning environments. In particular, the Community of Inquiry (COI) model posited by Garrison et al. (1999) has permeated scholarship in online learning, given its theoretical generalizability to various online learning environments. Recently, Caskurlu et al. (2021) conducted a thematic synthesis highlighting the continued utility and prevalence of the COI model for understanding effective online instruction and learning. With the COVID-19 pandemic rapidly pushing instruction online, many scholars and instructors have relied on the COI model to inform their approach to course design and teaching (Grothaus, 2022; Homer, 2022; Lau et al., 2021). Over the years,

scholars have introduced several expanded articulations and branches of the COI model (Dikkers et al., 2013; Kozan & Caskurlu, 2018; Shea et al., 2012), some of which have also been studied in the context of remote pandemic instruction (post-2020) (Ng et al., 2022; Usmani, 2021).

Frameworks such as the COI model may be especially valuable for educators in asynchronous online learning environments, where interactions between students play a critical role in connecting students who are otherwise separated by time and space (Vonderwell et al., 2007). In this paper, we build on existing research in this area by focusing on a specific type of interactive behavior—*peer help-giving*—that is critical to the learning process and yet remains understudied in asynchronous online contexts (Huang & Law, 2022; Williams-Dobosz et al., 2021). Although research has demonstrated that online peer academic support is associated with improved learning outcomes such as achievement (Chu et al., 2017) and the use of self-regulated learning strategies (Lim et al., 2020), we still know little about the kinds of academic supports that are most helpful for students' learning. Generally, there is a need for research to expand our understanding of the kinds of asynchronous online interactions that equip students to learn effectively from each other (Pawan et al., 2003).

Several previous investigations (e.g., Hmelo-Silver, 2003; Hou & Wu, 2011; Pena-Shaff & Nicholls, 2004) have carefully laid out how peers interact with each other in online forums to support each other in knowledge construction. These investigations have explored a range of behaviors that involve both help-giving (e.g., answering other students' questions) and non-help-giving behaviors (e.g., expressing disagreement, giving instructions, facilitating discussions). However, although help-giving is a specific type of interactive behavior that has important implications for knowledge construction (e.g., by providing the help-seeker with a greater understanding of course material), help-giving can also support the online learning experience in

other ways by providing emotional support and creating connections between learners (e.g., through words of encouragement and reassurance). Additionally, these prior investigations that have targeted knowledge construction have not attended to how peers react to the help that is given in response to requests for help, and how these reactions might ultimately impact if and how knowledge is constructed. Given the potential importance of seeking and giving help in online discussion forums, understanding what students find helpful, as well as what they perceive as barriers to being helpful, could be used strategically to improve peer interactions in online discussion forums.

In the present study, we implement a grounded theory approach for qualitative analysis (Glaser & Strauss, 1967) within an interpretive research paradigm to develop a conceptual model outlining the conditions of effective peer help-giving behavior in an online, asynchronous college statistics course discussion forum (Twining et al., 2017). Specifically, we ask college students with prior college-level statistics course experience to share their perspectives on what they find helpful in examples of peer replies to requests for help posted to an introductory statistics course discussion forum. Given the importance of student–student interactions and the potential boon of providing useful help, the goal of this work is to build theory from empirical contributions about how students view the helpfulness of other students' help-giving responses in an asynchronous online context so that, ultimately, we can guide educators about how to facilitate helpful exchanges between peers in their online courses.

Two existing theories (Garrison et al., 1999; Webb, 1989) serve as the major theoretical frameworks guiding this work. First, we situate this work within Garrison et al.'s (1999) COI framework because the COI framework is among the most broadly used theories for understanding how instructors can foster productive interactions between their students in

asynchronous online learning environments (Fiock, 2020). Second, we also situate this work within Webb's (1989) theory of peer interaction and learning because this framework demonstrates why effective peer help-giving is a critical aspect of the collaborative learning process. We review these two theories in the following sections. We also discuss how these two theories, along with current literature in the field, intersect to highlight the importance of understanding helping behavior in online courses.

1.1. Communities of inquiry in online settings

Garrison et al. (1999) developed the COI framework to identify the essential components of successful asynchronous online learning communities composed of students and instructors. Within this framework, effective online learning is the product of three interrelated components: (a) *social presence*, or the ability of learners to project themselves socially and emotionally into online spaces; (b) *cognitive presence*, or "the extent to which the participants in any particular configuration of a community of inquiry are able to construct meaning through sustained communication" (Garrison et al., p. 89); and (c) *teaching presence*, or the proper design and facilitation of online educational experiences.

The COI framework has been highly influential in discussions of computer-supported education, and a robust body of empirical work has shown that each of the three presences plays an important role in creating successful online learning experiences (Garrison, 2017). For example, research has shown that social presence is related to improved course satisfaction and learning in online settings (Gunawardena & Zittle, 1997; Swan & Shih, 2005); cognitive presence is linked to both students' perceived and actual learning outcomes (Akyol & Garrison, 2011; Lee et al., 2022; Sadaf et al., 2021); and teaching presence allows for the development of a productive and connected community of online students (Shea et al., 2005). Additionally, the

three presences have been shown to be related to other learning behaviors that are important for success in online settings, including metacognition, motivation, and self-regulated learning (Kilis & Yıldırım, 2018). As such, many researchers continue to adopt the COI framework as the guiding theoretical lens for both quantitative (Lim & Richardson, 2021) and qualitative (Lim & Richardson, 2022) studies of computer-supported learning.

In this paper, we adopt the COI framework as our first theoretical framework because of our interest in understanding the types of student interactions that best support learning in asynchronous online settings. Guided by Garrison et al.'s (1999) work, we approach our research with the understanding that online educators should facilitate peer interactions that promote social, cognitive, and teaching presence alike. In this paper, we focus on a specific type of peer interaction—help-giving—that remains understudied in the context of online learning and may play an important role in the success of online students (Huang & Law, 2022; Williams-Dobosz et al., 2021).

1.2. Peer help-giving in collaborative learning environments

In both in-person and online educational settings, interactions between students yield opportunities for collaborative learning through helping interactions, where students struggling with course content request and receive help from their peers (Webb, 1989). Existing conceptualizations of helping behavior remain largely based on research conducted in in-person settings; among the most prominent of these models is Webb's (1989) theory of peer interaction and learning, which serves as the second major theoretical framework guiding the present study. Webb (1989) proposed that interactions between students yield opportunities for collaborative learning through *help-giving*, defined as the act of providing a response to a student's request for academic help. When students struggling with academic material receive effective help from

peers, they can "fill in gaps in their understanding, correct misconceptions, and strengthen connections between new information and previous learning" (Webb et al., 2002, p. 3). On the other hand, when students have negative experiences with receiving help from others, they fail to learn effectively and become discouraged from seeking further help in the future (Mare & Sohbat, 2002).

Empirical research examining the outcomes associated with peer help-giving in in-person classrooms has demonstrated that not all help is useful for students (Webb & Mastergeorge, 2003), which suggests that help-giving should meet certain conditions to be effective. Specifically, it has been proposed that replies to requests for help should be (a) elaborated (i.e., the help-giver should accompany an answer with a detailed explanation); (b) timely; (c) correct; and (d) relevant to the help-seeker's need (Webb, 1989). Among these conditions, elaboration is a key indicator of helpfulness that has received the most attention; multiple studies comparing the effects of non-elaborated and elaborated helping behaviors on learning in small-group settings have found that detailed explanations play a significant role in promoting student success in in-person contexts (e.g., Fuchs et al., 1997; Webb & Farivar, 1994).

Guided by Webb's (1989) theory of peer interaction and learning, we approach the present research with the understanding that (a) effective peer help-giving is a critical component of the collaborative learning process; and (b) peer help-giving should meet certain conditions to be effective for the help-seeker in question.

1.3. Online peer help-giving in a community of inquiry

Despite the existence of research on peer help-giving in in-person settings, we still know little about the factors contributing to productive peer help-giving behavior in asynchronous online spaces (Huang & Law, 2022; Williams-Dobosz et al., 2021). In a recent study of students'

online help-seeking behaviors, Huang and Law (2022) observed that compared to studies of online academic help-seeking, there are disproportionately few studies of online help-giving; the authors noted that "more studies are needed to understand and theorize peer help giving, especially in online learning environments" (p. 10).

Considering this gap in the literature, we believe online peer help-giving is critical to understand, for multiple reasons. First, in a thematic synthesis of existing research on students' online learning experiences, Caskurlu et al. (2021) observed that online, small-group, peer interactions have been found to support learning by promoting engagement, creating opportunities for sharing knowledge, and fostering social connections between students. However, the authors also found that such peer interactions can vary in their perceived quality and effectiveness, which suggests that online discussions may need to meet certain conditions to be optimally meaningful for students. Thus, although prior studies have highlighted interactive behaviors that are related to knowledge construction in online settings (e.g., Hmelo-Silver, 2003; Hou & Wu, 2011; Pena-Shaff & Nicholls, 2004), there remains a need to better understand the types of peer interactions that are perceived as helpful by students in online communities of inquiry.

Second, insight into the conditions underlying effective online peer help-giving could shed light on how social, cognitive, and teaching presences develop within an online community of inquiry. For example, research has shown that despite the often isolating and impersonal nature of computer-mediated communication, online students can build a sense of community with others when they collaborate with and feel well-supported by their peers and instructors (Chatterjee & Correia, 2020; Lin & Gao, 2020; Rovai, 2002). Such feelings of support may be especially important for those who are struggling with course material and seeking help from

others. Thus, effective online peer help-giving may contribute to social presence by connecting isolated students through supportive behaviors. Additionally, online peer help-giving may play an important role in promoting cognitive presence, due to the role that collaborative learning plays in knowledge construction in online settings (Kanuka & Garrison, 2004). Specifically, when online students receive the help they need to feel supported and succeed, they experience gains in cognitive presence because they develop knowledge about a course topic through communication with others. Finally, research shows that students are more likely to be reflective, social, and detailed in their online discussion forum posts when their online interactions are moderated by a peer or instructor (Vasodavan et al., 2020). Thus, insight into online peer help-giving would also support teaching presence by equipping instructors to model and facilitate quality online collaboration, thus promoting their students' successful learning outcomes (Haythornthwaite, 2006).

Third, online peer help-giving is also important to understand because it is possible that effective helping behavior looks different for computer-mediated online vs. in-person students. For example, the threaded and branching structure of some asynchronous online discussion forums can make it difficult for students to remain focused on one topic or conversation (Gao et al., 2013); hence, online students may uniquely benefit from peer help-giving messages that summarize content in a manner that is succinct and to the point. Additionally, compared to in-person students, those engaged in online learning tend to experience greater feelings of isolation due to the physical distance between students (Gillett-Swan, 2017); thus, it is also possible that online students may be especially in need of peer help-giving interactions that provide social support by making those involved feel as if they are not alone. Moreover, research has shown that college students often feel forced to take on a more independent, self-teaching role in online

vs. in-person settings (Xu & Jaggars, 2014), which indicates that online students may find it difficult to receive the help they need to succeed. Although previous studies have demonstrated that helpful online instructor feedback to student work should be specific, frequent, timely, balanced, specific, and encouraging (Bigatel et al., 2012; Fiock, 2020; Leibold & Schwarz, 2015), it remains unclear whether these conditions hold for help-giving responses from one's peers that are provided in the context of discussion forums. Thus, online educators—and students, themselves—would benefit from insight into productive asynchronous communicative practices, including the characteristics of peer help-giving that make students feel supported.

1.4. The present study

Our goal for the present research is to develop a conceptual model that identifies what students view as a helpful reply to a request for help posted to an asynchronous college statistics course discussion forum. Students unfamiliar with statistics often experience anxiety towards the subject (Edirisooriya & Lipscomb, 2021) and find it difficult to learn, due to its simultaneously abstract and applied natures (Watts, 1991). Additionally, existing studies exploring the influence of collaborative learning activities on student performance in undergraduate statistics have reported inconsistent findings (Curran et al., 2013; Delucchi, 2006), which suggests there is a particular need for research that identifies the conditions under which responses to requests for help are helpful vs. unhelpful in statistics courses. Moreover, research has shown that discussion forums, a common setting in which help is sought and given asynchronously online (Nor et al., 2012), provide ample opportunities for collaborative learning and knowledge construction through helping behavior (Ahmed et al., 2019; Sun et al., 2018). Thus, we believe that the introductory statistics course discussion forum context could be ideal for studying the phenomenon of online peer help-giving.

Although our work is grounded in major past theories of help-giving (Webb, 1989) and online peer interaction (Garrison et al., 1999), to our knowledge, no study has developed a conceptual model outlining the indicators of effective peer help-giving behavior in online course discussion forums. Thus, our research question is: *What do students find helpful in replies to requests for help posted to an online course discussion forum?*

2. Research Paradigm

A research paradigm is a set of philosophical assumptions that defines a researcher's worldview and approach to inquiry (Kivunja & Kuyini, 2017). When conducting the present research, we operated from an interpretive paradigm, which draws from individuals' perspectives and experiences to obtain a deep understanding of research phenomena (Thanh & Thanh, 2015). Interpretivism begins from the ontological position that social realities are constructed by human beings (Phothongsunan, 2010). In the case of the present study, we adopted the ontological view that individuals' online learning experiences are constructed throughout their interactions with others, their instructors, and the online learning environment (Swan, 2019). Gasson and Waters (2011) explain that, in an online community of learners, "knowledge is not merely transmitted optimally … It is received and interpreted in the context of community-specific genres and social expectations" (p. 96). This socially constructed nature of online learning is reflected in Garrison et al.'s (1999) COI framework, which conceptualizes social, cognitive, and teaching presence as products of online learning that are co-constructed and experienced by students and teachers alike.

Considering our ontological position, we prioritized individuals' subjective experiences in our approach to inquiry. Student perspectives can yield rich insight into phenomena relevant to the online learning experience (Vonderwell, 2003), and such insight is especially valuable in

the case of the present study, where our central phenomenon of interest (i.e., online peer help-giving) remains understudied. We also chose to ground this research in students' perspectives because studies have shown that among online students, perceived peer support is positively related to academic resilience (Permatasari et al., 2021), course satisfaction (Lee et al., 2011), and sense of community (Rovai, 2002). Thus, a greater understanding of what students perceive as helpful in online peer interactions may have implications for student learning, well-being, and success. Lastly, students may need to see others' help as trustworthy and useful before they are willing to apply the help they receive to their own work. Hence, although we recognize that online peer collaborative learning is a complex phenomenon that cannot be comprehensively understood solely by exploring perceptions of peer helping, we believe an important step towards fostering productive online peer help-giving behavior is to determine the types of help that students perceive as useful.

3. Approach

3.1. Method

Our research goal was to develop a conceptual model of online peer help-giving behavior that identifies indicators of helpfulness for replies posted to online course discussion forums, based on students' perspectives. To this end, we employed a grounded theory approach to qualitative analysis (Glaser & Strauss, 1967), which aims to derive a "general, abstract theory of a process, action, or interaction grounded in the views of participants" (Creswell & Creswell, 2018, p. 14). Our choice of research method followed from our research paradigm, as an interpretive paradigm "starts with and develops analyses from the point of view of the experiencing person" (Charmaz, 2006, p. 30). Specifically, qualitative grounded theory methods

offered us a systematic approach to conducting research that remained rooted in participants' beliefs and experiences.

3.2. Participants

To improve the trustworthiness of our findings, we sought to recruit participants with prior experience navigating the statistics course context in a college setting. Specifically, we recruited participants with at least a full semester's worth of college-level statistics experience, so that they would have familiarity with the statistical concepts referenced in the study materials and thus be equipped to assess the helpfulness of students' responses related to a variety of statistical concepts. The participants were 88 students at a large public university in the midwestern United States. All participants were recruited through the university's web-based study announcement board via convenience sampling, and upon completion of the study, participants received research credit that could be used to fulfill participation requirements set by a course in which they were enrolled. All students who participated in the study were included in analysis, and prior to completing the study, participants were informed of the research procedures, risks associated with participation, and steps taken by the research team to protect their confidentiality. We obtained informed consent for all participants and fully de-identified our data prior to implementing analyses.

3.3. Design

We used a cross-sectional survey design that was completed fully online during the 2020–2021 academic year, when most college courses around the globe were conducted online due to the COVID-19 pandemic. At the start of the survey, participants were informed of the study's aims and procedures and were instructed to imagine they were enrolled in an online introductory statistics course where students use a discussion forum to ask and answer questions.

Thus, participants completed a survey that focused on a course setting with which they were familiar (i.e., that of an introductory college-level statistics course).

During the study, participants were shown 10 examples of online peer help-seeking-and-help-giving exchanges. Participants were informed that these exchanges took place between two students enrolled in the course. Each example consisted of two forum posts: a request for help from a student (e.g., "I'm not sure why I keep getting #1 wrong. I did SQRT of .73 x .27 to find the SD, which gave me 1.") and a corresponding help-giving reply from a different student (e.g., "SQRT of (0.73 * 0.27) = 0.444, not 1. Hope that helps!"). Participants were instructed to assess the helpfulness of each help-giving reply ("How helpful is this response?") on a 5-point Likert scale, from *Not helpful* to *Very helpful*, and to explain the reasoning behind their choice via an open-ended text response ("Please use the space below to explain why you selected the level of helpfulness you did"). Participants were instructed to respond honestly, based on their own opinions about what would constitute a helpful or unhelpful response to the forum post shown.

To obtain a set of illustrative help-seeking-and-help-giving exchanges, we adapted 10 example exchanges from past forum posts of an actual introductory statistics course offered at the institution where our participants were enrolled. The course used both in-person and asynchronous online formats; however, all students who were enrolled in the course could seek and provide peer help via an asynchronous online course discussion forum. By adapting example messages from a course offered at the institution attended by our participants, we increased the likelihood that our study materials would accurately reflect a familiar learning context.

We sought to select example exchanges that would effectively represent the diversity of replies found in a semester of course messages (in the forum of the course, there were typically 600–1,000 messages during a regular semester). We chose our particular 10 example exchanges

for two main reasons. First, through an examination of existing forum posts, we determined that this number was sufficient to create an illustrative set of example exchanges that encompassed a range of help-giving behaviors. Specifically, the 10 examples reflected helping interactions that differed across four main dimensions: length (e.g., shorter replies vs. longer replies), the type of help sought (e.g., requesting help with a step-by-step procedure vs. clarifying a definition), the type of help given (e.g., direct answers vs. guidance that allows the help-seeker to solve the problem independently), and the nature of the content covered (i.e., a variety of introductory statistics topics were represented in our example exchanges). This approach aligns with prior models of peer interaction and learning (e.g., Webb, 1989), which emphasize how features related to both the nature of the help-seeker's question and the content and level of elaboration in the help-giver's reply influence students' experiences with help-giving.

Second, we also considered the practical constraints of our study design when adapting example exchanges. Although a larger number of example exchanges may have allowed for study materials with greater representativeness, we aimed to strike a balance between obtaining meaningful responses from participants, giving them the range of examples found in the original forum, and minimizing their burden during the survey process. To ensure feasibility, we conducted a pilot test of our survey with three student collaborators, which confirmed that participants could view and assess the 10 example exchanges within a reasonable timeframe of under an hour. Based on this feedback, we concluded that 10 examples would be a suitable number for our study.

Our use of a survey design served two main advantages. First, we were able to generate and analyze qualitative data from a relatively large number of participants, which was particularly helpful for understanding our understudied research phenomenon of online peer

help-giving. Second, our survey design allowed participants to engage with forum posts adapted from actual offerings of a statistics course from past semesters. Thus, our study design reflected authentically the online discussion forum environment in online courses, which in turn improved the likelihood that our findings could be applied to other course contexts. The full 10 examples of requests for help and replies to those requests, arranged in descending order by average helpfulness rating, can be found in the Appendix.

3.4. Analysis

Participants' written responses to the item "Please use the space below to explain why you selected the level of helpfulness you did" provided the input for grounded theory analysis, which involved iterative examinations of the data. To ensure that our resulting model reflected the perspectives of participants, all codes and categories were derived directly from the data in each step of analysis (Charmaz, 1996), rather than from the authors' preconceived notions about peer help-giving or previous work on helpfulness in educational settings.

First, the first author conducted a line-by-line coding of the data to obtain initial codes that concisely described the essence of participants' responses (Charmaz, 1996). The first author then reduced initial codes to a smaller set of focused codes related to our research question, by identifying codes that "subsume common themes and patterns" (Charmaz, 1996, p. 40) in several initial codes. Ultimately, the first author settled on eight focused codes corresponding to indicators of helpfulness that appeared particularly significant, came up repeatedly during initial coding, or captured a common idea conveyed in multiple initial codes (Charmaz, 1996). We provide examples of the line-by-line coding process in Table 1, as well as examples of how initial codes were translated and then reduced to focused codes.

Table 1

Initial (Step 1) to Focused (Step 2) Codes in Analysis – Examples

Example Order (see Appendix)	**Participant Response**	**Initial Codes**	**Focused Codes**
2	"It explains a scenario using a deck of cards[1] with replacement in a way that is very clear[2] and concise[3] but it could be better if the response also referenced replacement more generally[4]"	[1] explains concept using example [2] very clear [3] concise [4] does not explain concept more generally	[1, 4] elaboration [2] understandability [3] concise
5	"This shows the arithmetic error[1] while being kind[2] and supportive[3]"	[1] points out error [2] kind [3] supportive	[1] accuracy [2, 3] encouragement
4	"It is true[1] but I would try to explain further why that is the case[2]"	[1] true [2] needs further explanation	[1] accuracy [2] elaboration
8	"This student did not explain the problem at all to the other student[1], but at least directed that student on where to go to get the right answer[2]"	[1] does not address student's problem [2] directs student to right answer	[1] relevance [2] resource provision
9	"A response like this might alert the instructor that this is a topic that needs to be rediscussed since some students appear to be struggling[1]"	[1] alerts instructor to topic	[1] call to community

Note. Our focused codes were the 8 primary indicators of helpfulness that emerged from iterative examinations of the data: 1) elaboration, 2) accuracy, 3) relevance, 4) understandability, 5) encouragement, 6) resource provision, 7) call to community, and 8) concise.

Next, to assess the reliability of the coding scheme and thus improve the trustworthiness of our findings, the first and second authors compared each response in the data set to each of the eight focused codes. For each response, we assigned a value of "1" if the participant mentioned the relevant indicator of the code as a characteristic that either positively contributed to the helpfulness of an example reply (e.g., "I found this helpful because …") or would have positively contributed to the helpfulness of an example reply (e.g., "It could have used a more

concrete example of …"). For a given code, a response was assigned a value of "0" if the participant did not mention the relevant indicator of the code in their response. Additionally, each of the eight focused codes were separately applied to the data set; in other words, we allowed participant responses to be assigned a value of "1" for multiple codes. This was done to account for instances where participants referred to multiple indicators of helpfulness in a single response (e.g., "[T]his shows the arithmetic error while being kind and supportive."). The first and second authors coded approximately 20% of the data and obtained substantial agreement (Landis & Koch, 1977); all differences were discussed and reconciled. Table 2 reports Cohen's κ for each indicator, along with the percentage of participants who cited each indicator as positively contributing to the helpfulness of a reply at any point during the study.

Table 2

Focused Codes Obtained from Analysis

Focused Code	**Interrater Reliability (Cohen's κ)**	**Percentage Mentioned***
Relevance	.64	100.0%
Elaboration	.63	94.3%
Accuracy	.65	81.8%
Understandability	.73	72.7%
Resource provision	.75	62.5%
Concise	.89	55.7%
Encouragement	.81	46.6%
Call to community	.74	20.5%

* "Percentage Mentioned" corresponds to the percentage of participants who cited an indicator as positively contributing to the helpfulness of a reply at any point during the study (i.e., at least one of their 10 open-ended responses was assigned a value of "1" for that indicator during the coding process).

Finally, we considered whether we could group related codes into broad categories to identify the ways in which our obtained indicators of helpfulness were related to and different from one another. We used these broad categories, which will be described in detail in the Results and in Table 3, to assist us in drawing general conclusions about peer help-giving in online course discussion forums.

4. Results

Our analysis yielded two broad categories of indicators that were cited by participants as positively contributing to the helpfulness of online peer help-giving replies: *direct help* and *indirect help.* In the sections below, we describe the indicators and codes belonging to each category, as well as provide examples of participant responses that informed the identification of those codes. For each quoted response, the order of the corresponding example peer help-giving reply, based on the Appendix (e.g., Example 1), is provided for reference. Table 3 summarizes our final model of online helpfulness**.**

4.1. Direct help

Indicators of helpfulness in the *direct help* category were those that involved direct reference to course material or content. We included four indicators in this category: *elaboration*, *accuracy*, *relevance,* and *understandability*.

4.1.1. Elaboration

Elaborated replies were those that provided explanations by using examples, breaking down a problem into steps, or incorporating outside knowledge. Participants praised replies for being "detailed," "thorough," or "explaining the answer." As an example, one participant wrote, "I love how thoroughly they attempted to explain everything to the other student while using the example" (see Appendix, Example 7), and another wrote that in one help-giving reply, "the

example made it much easier to follow and helps apply it to an actual problem that the student might have" (Example 2). Conversely, participants noted when replies would have been enhanced by further explanation. For instance, in response to Example 6 (where the help-giver briefly provided the help-seeker with the rule for conducting significance tests), one participant wrote, "The post could have been more helpful if it explained why you reject the null hypothesis in some cases but not others," and another wrote that the answer "explains the barebones, but doesn't indicate why at all."

4.1.2. Accuracy

Accurate replies were those that provided a correct answer to the help-seeker's question. Participants wrote, "I think that this response gives a good overview on what a p-value is" (Example 1) and "Good tip and actually what is recommended" (Example 3). Conversely, participants criticized responses they perceived as being inaccurate; for instance, one participant wrote, "I think the response incorrectly explains what an observational experiment is" (Example 10), and another wrote, "The reply is incorrect" (Example 6).

4.1.3. Relevance

Relevant replies were those that answered all aspects of a help-seeker's question and avoided vague, overly specific, or unrelated information. For example, participants noted when a reply "answers the person['s] question entirely" (Example 10) or "directly [provides] the rule related to the topic" (Example 6). Conversely, participants criticized replies for failing to answer the help-seeker's question fully; for example, one participant wrote of one reply, "It kind of dodged the actual question a little bit" (Example 10).

4.1.4. Understandability

Understandable replies were those that were "clear" and "easy to understand" for the participant, given their level of background knowledge. Participants pointed out that it is not always enough for direct responses to requests for help to be elaborated, accurate, and relevant; peer help-giving responses also ought to convey course content in a manner that is comprehensible to the help-seeker. As such, participants praised responses for being "very clear" (Example 6) and "easy enough to understand as someone who may not know or remember much about statistics" (Example 1). Conversely, participants pointed out when a response seemed unclear, confusing, or inaccessible to either them or a potential help-seeker. One participant wrote, "This [response] seems helpful but I am not good at math so it's hard for me to understand the mathematical terms" (Example 5). In response to Example 1, another participant wrote:

> I think this definition works well as far as being correct, but would be much more helpful if it were put in simpler terms. Chances are, this student has already heard a more complex definition like the one given above, but they are looking for something more understandable.

4.2. Indirect help

Indicators of helpfulness in the category of *indirect help* were those that assisted the help-seeker without referencing course material or content. Four indicators were included in this category: *encouragement*, *resource provision*, *call to community,* and *concise*.

4.2.1. Encouragement

Encouraging replies provided empathy and reassurance to the help-seeker, possibly by conveying to the help-seeker that they were not alone, including a greeting or salutation, or using a positive tone. For example, one participant noted that a response that "helps one feel that they

are not alone … is very helpful in an online setting especially" (Example 9), and in response to a reply where the help-giver included "Hope that helps!" (Example 5), another participant wrote, "I appreciate that they had a kind greeting at the end! That always makes me feel better about posting in Q&A forums." Conversely, participants also reacted negatively when they felt that a response was "rude" or "passive aggressive" (Example 8).

4.2.2. Resource provision

Resource-providing replies directed the help-seeker to a resource (e.g., textbook) that may help them find the answer to their question. In response to an example reply that directed the help-seeker to a lecture video (Example 8), one participant wrote that this was "…a solid answer with direction on specifically where to find more information," and another wrote, "I actually love this answer because the professor could probably explain it in the video better than someone else could."

4.3.3. Call to community

Replies that involved a call to community brought wider attention to the importance of the help-seeker's question. For instance, in Example 9, the help-giver was unable to answer the help-seeker's question and simply expressed that they were "also confused" (see Appendix). Although participants generally expressed that they wished this help-giver had directly answered the help-seeker's question (e.g., one participant remarked, "This did not give the person answers") or provided an external resource (e.g., another participant wrote, "The person is not giving any helpful information either directing to any sources that may help"), some noted that such a reply can help by signaling to others that multiple students are struggling. For example, one participant noted, "A response like this might alert the instructor that this is a topic that

needs to be rediscussed," and another observed that such a reply can "can give a certain urgency to the forum."

4.3.4. Concise

Concise replies were those that were brief and avoided unnecessary wordiness. Participants praised responses for being "quick," "to the point," "direct," and "straightforward." For example, one participant wrote, "This answer was quick and to-the-point which was very helpful" (Example 6), and another praised an example for being "efficient in explaining what to do" (Example 3). Conversely, participants criticized responses for being "too wordy" (Example 10) or "a lot to read" (Example 7).

Table 3

Indicators of Helpfulness in Online Peer Help-Giving Replies

Category	Code	Description	Example Participant Response*
Direct Help	*Elaboration*	• Accompanies answer with a thorough, detailed explanation • Uses relatable examples, illustrations, and/or visualizations • Breaks problem down into steps • Provides multiple approaches to answering the problem • Supplements answer with outside knowledge • Provides information and suggestions that can be used in future situations and problems	"I like this response in that it used the example given in the initial question, elaborated on it, and explained." (Example 7)
	Relevance	• Answers (all aspects of) the question • Avoids information that is irrelevant to the help-seeker's question • Refers back to course content in the context of the question • Provides an appropriately focused response; avoids overly vague or specific terminology and concepts	"It has both the p-score definition as well as how it relates to the z-score therefore fully answering the individual's question." (Example 1)

Category	Code	Description	Example Participant Response*
	Accuracy	• Provides a correct answer to the help-seeker's question • Provides an answer that reflects course/instructor expectations	"I believe this response is helpful because they give the correct answer and show how they got it…" (Example 5)
	Understandability	• Provides a response that is clear and understandable to the help-seeker, given their level of background knowledge	"I actually didn't know the answer to this question, and this short simple answer was easy for me to understand." (Example 4)
Indirect Help	*Encouragement*	• Provides empathy and reassurance that the help-seeker is not alone in their struggle • Includes a kind greeting and/or salutation in the message • Avoids passive-aggressiveness, condescension, or an otherwise rude tone	"[T]his shows the arithmetic error while being kind and supportive." (Example 5)
	Resource Provision	• Directs the help-seeker to a resource (e.g., professor, lecture, website, textbook chapter, another student, etc.) that may help them find the answer to their question	"This is helpful because they are clearly directing the person to the answer for this specific question." (Example 8)
	Call to Community	• Brings attention to the importance of the help-seeker's question and alerts the students/instructors to the fact that there are multiple students struggling with a topic	"This did not give the person answers, but this alerts the professor that multiple people are confused on this subject." (Example 9)
	Concise	• Provides a response that is brief, straightforward, direct, and to-the-point	"The answer was very specific and was not too wordy or confusing. Answer was quick and to the point." (Example 1)

*For each example participant response, the number of the corresponding example help-giving reply referenced by the participant, based on the Appendix (e.g., Example 1), is displayed in parentheses.

5. Discussion

Peer help-giving interactions create ample opportunities for learning in both in-person and online learning environments; however, students do not always see peer interactions as contributing positively to their online learning experiences (Caskurlu et al., 2021). In this study, we sought to explore the conditions underlying effective peer help-giving interactions in asynchronous online settings. While others have looked at how peers contribute to knowledge generation in online settings (e.g., Hmelo-Silver, 2003; Hou & Wu, 2011; Pena-Shaff & Nicholls, 2004), our contribution points to how those interactions impact individuals' perceptions of support when they seek help from peers in online discussion forums. Specifically, with our research question, we asked what students find helpful in replies to requests for help posted to an online college course discussion forum, given that perceptions of peer support have been shown to have implications for resilience (Permatasari et al., 2021), satisfaction (Lee et al., 2011), and one's sense of community (Rovai, 2002). Guided by Garrison et al.'s (1999) COI framework and Webb's (1989) theory of peer interaction and learning, we used a grounded theory approach to qualitative analysis within an interpretive paradigm to propose a conceptual model outlining what students find helpful in responses to requests for help posted to online college course discussion forums. We found that online peer help-giving replies could take the form of direct help—such as being elaborated, accurate, relevant, and/or understandable to the help-seeker—or indirect help—such as being encouraging, providing external resources, calling to the community, and/or being concise. We expect these findings can help educators to create productive online learning environments, given that peer help-giving may play a pivotal role in promoting social, cognitive, and teaching presence within online communities of inquiry (Chatterjee & Correia, 2020; Haythornthwaite, 2006; Kanuka & Garrison, 2004; Lin & Gao, 2020; Rovai, 2002).

5.1. Direct help

The direct indicators of online helpfulness that emerged from analysis involved direct reference to course content and are among those that have been discussed in previous work on peer help-giving in in-person classrooms (see Webb & Mastergeorge, 2003). This finding suggests there is substantial overlap in the factors contributing to helpfulness in in-person and online settings, despite the different forms of communication that characterize the two learning environments. Thus, our results align with those presented in previous research indicating that "successful collaboration as described in face-to-face situations is possible in online learning environments" (Curtis & Lawson, 2001, p. 32).

We conducted this investigation in the context of an introductory statistics course, and we expect that elaborated responses may be particularly beneficial in the context of learning mathematics, in general, and statistics, in particular. Research has shown that a student stuck on a mathematics problem benefits from answers that explain how to arrive at a solution (Fuchs et al., 1997). Thus, our results suggest that instructors should encourage students to provide elaborated answers in online settings because similar techniques in in-person courses have been found to strengthen collaboration between students (Fuchs et al., 1999).

However, our findings show that other forms of direct help—such as accuracy, relevance, and understandability—are also important to help-seekers. This result aligns with previous work indicating that elaboration alone does not guarantee a helpful response to a request for help (Webb, 1989). Thus, to facilitate learning and promote cognitive presence in online courses, it will be important to teach students how to convey complex concepts in an accurate and clear way that matches the specific need and level of background knowledge of the help-seeker in question.

5.2. Indirect help

Our findings also suggest that indirect forms of helping, which have been understudied relative to direct forms of helping, can play a role in online helpfulness. For instance, although online communication presents its share of challenges for students engaged in collaborative learning (Gao et al., 2013; Haythornthwaite, 2006), it is possible that the online setting also presents unique opportunities for indirect peer help-giving through the provision of resources that are not typically readily available in in-person settings (e.g., external links). This finding is consistent with previous research that has identified the exchange of resources, such as sharing course materials and references, as forms of help-giving (Lee et al., 2021; Williams-Dobosz et al., 2021). Additionally, our findings highlight the importance of providing emotional support for students who may otherwise feel isolated in online environments. Although not explored within the current investigation, we hypothesize that such support may be particularly impactful for students belonging to populations historically underrepresented in college courses (Prabhu et al., 2021), who may experience a lack of a sense of belonging in online settings (Thomas et al., 2014).

The benefits of receiving an encouraging peer help-giving reply may extend beyond a feeling of connectedness to others: research shows that when students feel comfortable in a supportive learning environment, they are more likely to engage with peers and have favorable learning outcomes (Gasiewski et al., 2012; Prabhu et al., 2021). Given that students in online courses are generally less likely than students in in-person courses to interact with faculty and collaborate with one another (Dumford & Miller, 2018), it is possible that a greater emphasis on encouragement and empathy in collaborative learning environments may be an especially effective way to promote social presence in an online community of learners.

Interestingly, our participants wanted peer help-giving replies to be both elaborated and concise. It is possible that sufficient elaboration, where the help-giver provides the rationale and the steps underlying a provided solution, is the more crucial element in an online peer help-giving reply, given the high percentage of participants that mentioned elaboration in their open-ended responses (see Table 2). However, given that it can be difficult for students to remain focused on a single topic in threaded discussion forums (Gao et al., 2013), it is likely that being concise is also helpful. Thus, it is possible that our participants valued opposing characteristics in peer help-giving replies. Future work may wish to further explore this issue by examining the degree to which elaboration and concision are important to students seeking help in different contexts.

5.3. Online peer help-giving: Implications for theory, research, and practice

Taken as a whole, this study has important implications for theory, research, and practice. First, we build on Garrison et al.'s (1999) COI framework by shedding light on how online peer help-giving replies can be structured to promote social, cognitive, and teaching presence alike. Although recent work has comprehensively outlined effective practices for building online communities of inquiry, generally (e.g., Caskurlu et al., 2021; Fiock, 2020), our study is among the first to examine how online peer help-giving interactions can promote successful learning outcomes for students seeking help from others in online settings. Thus, our findings make valuable contributions to this research area, given that students struggling with course material are likely those who would benefit most from supportive behaviors leading to gains in social, cognitive, and teaching presence.

Within a community of inquiry, the co-construction of meaning is essential for promoting cognitive presence (Garrison et al., 1999). Help-givers play a critical role in this process, as they

facilitate learning by producing feedback, and our findings highlight the importance of both direct and indirect forms of help-giving. Direct forms of help provide help-seekers with explanations to their question; our results indicate that replies that are elaborated, relevant, accurate, and understandable may play especially important roles in promoting cognitive presence by equipping students to draw from their peers' knowledge and gain a deeper understanding of course material. Moreover, resource provision also contributes to cognitive presence because help-givers can identify and share materials they believe are relevant to the help requested.

However, our findings show that online help-giving has benefits beyond the collaborative construction of knowledge. Our coding scheme highlights how replies that are encouraging or call upon one's wider learning community may contribute to social presence because learners in a community of inquiry benefit from interactions that provide socio-emotion support (Garrison et al., 1999). Specifically, these indirect forms of help may enhance social presence by positively contributing to perceptions of emotional support, peer connectedness, and belonging (Jeng et al., 2023). Thus, our findings lend support to the notion that "cognitive presence by itself is not sufficient to sustain a critical community of learners. Such an educational community is nurtured within the broader social-emotional environment of the communicative transaction" (Garrison et al., 1999, p. 13). Moreover, since the "instructor plays a pivotal role in moving discussions toward the highest levels of cognitive presence" (Bangert, 2008, p. 54), our findings contribute to understandings of teaching presence by highlighting the types of collaborative learning behaviors online educators may wish to model and facilitate for their students. Finally, in general, help-givers who provide both direct and indirect forms of assistance to their peers keep communication channels open and move discourse along within their online learning

community, thus creating opportunities for interactions that promote all three presences. Ultimately, our findings show that direct and indirect forms of help are both valuable in a community of inquiry.

This work also contributes to theory by building on previous models of peer learning (e.g., Webb, 1989). Specifically, we developed an online-specific model of helpfulness that enhances our understanding of how students view peer help-giving in online contexts. Our model is a valuable contribution to the field because, just as students do not find all forms of peer help-giving to be effective in in-person settings (Webb, 1989; Webb & Mastergeorge, 2003), students may not find all types of peer interactions to be beneficial in online settings (Caskurlu et al., 2021; Schultz & Sandidge, 2022). When viewed in light of previous help-giving research (see Webb & Mastergeorge, 2003), our results show that there may be substantial overlap in the factors contributing to effective peer help-giving in online vs. in-person settings. However, our findings related to resource provision and encouragement also demonstrate that online settings may present both advantages (e.g., the possibility of using external links) and challenges (e.g., the oftentimes isolating nature of online learning) that influence the conditions underlying effective peer help-giving in such spaces. Broadly speaking, this work demonstrates the importance of developing online-specific theories of interaction and learning that account for the unique benefits and limitations of computer-mediated communication.

The inability to account for the helpfulness of students' help-giving replies has prevented much existing work on online learning from gaining a complete picture of students' discussion forum interactions. Thus, our work contributes to research by providing a model that can be implemented in future studies to assess the helpfulness of online messages and yield a fuller understanding of students' online learning behaviors. For instance, future work may explore how

the helpfulness of a student's response to a request for help may moderate or mediate the relationship between help-seeking and course performance. Additionally, future studies may examine how different peer help-giving behaviors promote social, cognitive, or teaching presence in online settings. In particular, it will be important for educators to understand how different forms of help-giving may impact students' sense of belonging to their learning community, as recent work has shown that sense of belonging may be linked to one's level of comfort in online discussions (Zengilowski et al., 2023), as well as what one finds helpful in online peer responses to requests for academic help (Jeng et al., 2023).

By furthering our understanding of online helping behavior, this work can inform the development of practices that facilitate helpful exchanges between peers in online environments. Given the challenges faced by students while collaborating online (Haythornthwaite, 2006), as well as the important role that instructors play in facilitating discussions between students in the online context (Anderson et al., 2001), we anticipate that research in this area will play a critical role in promoting students' successful learning outcomes online. For example, Webb and Mastergeorge (2003) proposed that in-person educators can promote effective peer help-giving by modeling expected helping behaviors, instructing students in how to explain course content to others, and developing classroom tasks (e.g., reciprocal questioning) that encourage students to provide detailed and understandable explanations of course content. Online educators may wish to use similar techniques to promote effective peer help-giving in course discussion forums. In this regard, researchers have found that online instructors can model productive discourse by using "gentle" expressions (e.g., "I wonder") instead of direct expressions (e.g., "I disagree") (Richardson et al., 2016). Thus, it may be beneficial for online instructors to receive professional development in fostering online discourse that is welcoming, constructive, and inclusive.

Lastly, educators may consider developing online peer mentoring programs that connect online college students enrolled in introductory courses with peer who have previously taken the same course in an online format. Online peer mentoring programs have been shown to be effective ways for students to develop comfort and competency with course material through peer support (Goodrich, 2021). Thus, such programs could allow students to experience the benefits of online peer help-giving interactions firsthand and encourage help-giving behaviors in the future.

5.4. Limitations

This work faces at least three limitations. First, in this study, we recruited participants who were not necessarily enrolled in a statistics course at the time of data collection. Thus, for practical reasons, we could not derive example exchanges from messages generated or viewed by the participants themselves. In other words, participants retroactively examined examples of peer help-giving exchanges involving other students, and this distance from the actual experience of requesting and receiving help may have influenced the results of the study. Specifically, it is possible that our participants did not have fully accurate judgments of whether a help-seeker's question was satisfactorily answered because the assessed example exchanges may not have been fully relevant to their experience. Second, by only using 10 examples of peer help-giving, this study was limited in its ability to represent the full range of help-seeking requests and help-giving replies found in a semester's worth of discussion forum posts. Additionally, our analysis focused on what participants, on average, described as helpful in example help-giving replies. This approach may have led to us underestimating the importance of certain types of helpfulness compared to others, depending on the specific nature of the help-seeker's request. Thus, future work could explore heterogeneity in what is perceived as helpful for help-seeking requests of

different natures. Lastly, our data were collected during the height of the COVID-19 pandemic, and it is possible that data collected during less stressful times might have left us with a different pattern of results. Nonetheless, this research makes valuable contributions to our understanding of peer help-giving in online settings and opens opportunities for future work in this area.

5.5. Directions for future research

Possibilities for future research include an exploration of whether the findings reported in this paper generalize to other online courses in other contexts (e.g., an online English course) or other forms of online communication (e.g., instant messaging). Such work would enable us to determine whether the conditions of effective peer help-giving that emerged from this study are context-specific (i.e., specific to the statistics and/or discussion forum context) or applicable to online learning more generally. Additionally, future research may explore whether *perceived* helpfulness translates to *actual* helpfulness. In other words, although we have uncovered characteristics that students commonly report as being helpful in peer help-giving replies, it remains to be seen whether forum replies that bear the characteristics identified in this investigation lead to improved learning outcomes for the students receiving them. Finally, future work may explore whether students belonging to certain backgrounds are more likely to find certain kinds of replies more helpful than others. For instance, it is possible that minoritized students are more likely than other students to value and benefit from encouraging peer help-giving responses in online STEM courses, given the isolation that minoritized students often feel in such settings (Charleston et al., 2014).

6. Conclusion

This investigation yielded insight about ways in which peer responses to requests for help in an online statistics course could be helpful. These direct and indirect ways of being helpful

both corroborate what we know about helpfulness in in-person settings and provide new, and potentially online-specific, ways of understanding helpfulness. Online learning, albeit now ubiquitous in response to a deadly pandemic, can be isolating and challenging for learners; a greater understanding of how students support each other, and each other's learning online, ultimately should help educators to improve online learning opportunities for their students.

Declarations of Competing Interest

None.

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References

Adedoyin, O. B., & Soykan, E. (2020). Covid-19 pandemic and online learning: The challenges and opportunities. *Interactive Learning Environments*, 1–13. https://doi.org/10.1080/10494820.2020.1813180

Ahmed, I., Mawasi, A., Wang, S., Wylie, R., Bergner, Y., Whitehurst, A., & Walker, E. (2019). Investigating help-giving behavior in a cross-platform learning environment. In S. Isotani, E. Millán, A. Ogan, P. Hastings, B. McLaren, & R. Luckin (Eds.), *Artificial intelligence in education* (Vol. 11625, pp. 14–25). Springer International Publishing. https://doi.org/10.1007/978-3-030-23204-7_2

Akyol, Z., & Garrison, D. R. (2011). Understanding cognitive presence in an online and blended community of inquiry: Assessing outcomes and processes for deep approaches to

learning: Cognitive presence in an online and blended community of inquiry. *British Journal of Educational Technology*, *42*(2), 233–250. https://doi.org/10.1111/j.1467-8535.2009.01029.x

Anderson, T. (2004). Toward a theory of online learning. In T. Anderson & F. Elloumi (Eds.), *Theory and practice of online learning* (pp. 33–60). Athabasca University Press.

Anderson, T., Rourke, L., Garrison, D. R., & Archer, W. (2001). Assessing teaching presence in a computer conferencing context. *Journal of Asynchronous Learning Networks*, *5*(2), 1–17.

Bangert, A. (2008). The influence of social presence and teaching presence on the quality of online critical inquiry. *Journal of Computing in Higher Education*, *20*(1), 34–61. https://doi.org/10.1007/BF03033431

Bature, I. J., Atweh, B., & Oreoluwa, F. (2020). Investigating the perception of senior secondary school students on the role of classroom engagement in mathematics problem solving. *Journal of Research in Science, Mathematics and Technology Education*, *3*(2), 73–105. https://doi.org/10.31756/jrsmte.323

Bigatel, P. M., Ragan, L. C., Kennan, S., May, J., & Redmond, B. F. (2012). The identification of competencies for online teaching success. *Journal of Asynchronous Learning Networks*, *16*(1), 59–78.

Caskurlu, S., Richardson, J. C., Maeda, Y., & Kozan, K. (2021). The qualitative evidence behind the factors impacting online learning experiences as informed by the community of inquiry framework: A thematic synthesis. *Computers & Education*, *165*, 104111. https://doi.org/10.1016/j.compedu.2020.104111

Chandra, S., & Palvia, S. (2021). Online education next wave: Peer to peer learning. *Journal of Information Technology Case and Application Research*, *23*(3), 157–172. https://doi.org/10.1080/15228053.2021.1980848

Charleston, L. J., Adserias, R. P., Lang, N. M., & Jackson, J. F. L. (2014). Intersectionality and STEM: The role of race and gender in the academic pursuits of African American women in STEM. *Journal of Progressive Policy and Practice*, *2*(3), 273–293.

Charmaz, K. (1996). Grounded theory. In J. A. Smith, R. Harre, & L. V. Langenhove (Eds.), *Rethinking methods in psychology* (pp. 27–49). SAGE Publications.

Chatterjee, R., & Correia, A.-P. (2020). Online students' attitudes toward collaborative learning and sense of community. *American Journal of Distance Education*, *34*(1), 53–68. https://doi.org/10.1080/08923647.2020.1703479

Chu, H.-C., Chen, J.-M., & Tsai, C.-L. (2017). Effects of an online formative peer-tutoring approach on students' learning behaviors, performance and cognitive load in mathematics. *Interactive Learning Environments*, *25*(2), 203–219. https://doi.org/10.1080/10494820.2016.1276085

Creswell, J. W., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). SAGE Publications.

Curran, E., Carlson, K., & Celotta, D. T. (2013). Changing attitudes and facilitating understanding in the undergraduate statistics classroom: A collaborative learning approach. *Journal of the Scholarship of Teaching and Learning*, *13*(2), 49–71.

Curtis, D. D., & Lawson, M. J. (2001). Exploring collaborative online learning. *Journal of Asynchronous Learning Networks*, *5*(1). https://doi.org/10.24059/olj.v5i1.1885

Delucchi, M. (2006). The efficacy of collaborative learning groups in an undergraduate statistics course. *College Teaching*, *54*(2), 244–248. https://doi.org/10.3200/CTCH.54.2.244-248

Dikkers, A. G., Whiteside, A. L., & Lewis, S. (2013). Virtual high school teacher and student reactions to the social presence model. *Journal of Interactive Online Learning*, *12*(3), 156–170.

Dumford, A. D., & Miller, A. L. (2018). Online learning in higher education: Exploring advantages and disadvantages for engagement. *Journal of Computing in Higher Education*, *30*(3), 452–465. https://doi.org/10.1007/s12528-018-9179-z

Edirisooriya, M. L., & Lipscomb, T. J. (2021). Gender influence on statistics anxiety among graduate students. *Journal of Research in Science, Mathematics and Technology Education*, *4*(2), 63–74. https://doi.org/10.31756/jrsmte.421

Fiock, H. S. (2020). Designing a community of inquiry in online courses. *International Review of Research in Open and Distributed Learning*, *21*(1), 136–153.

Fuchs, L. S., Fuchs, D., Hamlett, C. L., Phillips, N. B., Karns, K., & Dutka, S. (1997). Enhancing students' helping behavior during peer-mediated instruction with conceptual mathematical explanations. *The Elementary School Journal*, *97*(3), 223–249. https://doi.org/10.1086/461863

Fuchs, L. S., Fuchs, D., Kazdan, S., & Allen, S. (1999). Effects of peer-assisted learning strategies in reading with and without training in elaborated help giving. *The Elementary School Journal*, *99*(3), 201–219. https://doi.org/10.1086/461923

Gao, F., Wang, C. X., & Sun, Y. (2009). A new model of productive online discussion and its implications for research and instruction. *Journal of Educational Technology Development and Exchange*, *2*(1). https://doi.org/10.18785/jetde.0201.05

Gao, F., Zhang, T., & Franklin, T. (2013). Designing asynchronous online discussion environments: Recent progress and possible future directions: Designing asynchronous discussion environments. *British Journal of Educational Technology*, *44*(3), 469–483. https://doi.org/10.1111/j.1467-8535.2012.01330.x

Garrison, D. R. (2017). *E-learning in the 21st century: A Community of Inquiry framework for research and practice* (3rd ed.). Routledge.

Garrison, R. D., Anderson, T., & Archer, W. (1999). 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

Gasiewski, J. A., Eagan, M. K., Garcia, G. A., Hurtado, S., & Chang, M. J. (2012). From gatekeeping to engagement: A multicontextual, mixed method study of student academic engagement in introductory STEM courses. *Research in Higher Education*, *53*(2), 229–261. https://doi.org/10.1007/s11162-011-9247-y

Gillett-Swan, J. (2017). The challenges of online learning: Supporting and engaging the isolated learner. *Journal of Learning Design*, *10*(1), 20–30. https://doi.org/10.5204/jld.v9i3.293

Glaser, B. G., & Strauss, A. L. (1967). *The discovery of grounded theory: Strategies for qualitative research*. Aldine.

Goodrich, A. (2021). Online peer mentoring and remote learning. *Music Education Research*, *23*(2), 256–269. https://doi.org/10.1080/14613808.2021.1898575

Grothaus, C. (2022). Collaborative online learning across cultures: The role of teaching and social presence. *Qualitative Research in Education*, *11*(3), 298–326. https://doi.org/10.17583/qre.10474

Gunawardena, C. N., & Zittle, F. J. (1997). Social presence as a predictor of satisfaction within a computer-mediated conferencing environment. *American Journal of Distance Education*, *11*(3), 8–26. https://doi.org/10.1080/08923649709526970

Haythornthwaite, C. (2006). Facilitating collaboration in online learning. *Journal of Asynchronous Learning Networks*, *19*(1), 7–24.

Hmelo-Silver, C. E. (2003). Analyzing collaborative knowledge construction. *Computers & Education*, *41*(4), 397–420. https://doi.org/10.1016/j.compedu.2003.07.001

Homer, D. (2022). Mature Students' experience: A Community of inquiry study during a COVID-19 pandemic. *Journal of Adult and Continuing Education*, *28*(2), 333–353. https://doi.org/10.1177/14779714221096175

Hou, H.-T., & Wu, S.-Y. (2011). Analyzing the social knowledge construction behavioral patterns of an online synchronous collaborative discussion instructional activity using an instant messaging tool: A case study. *Computers & Education*, *57*(2), 1459–1468. https://doi.org/10.1016/j.compedu.2011.02.012

Huang, K., & Law, V. (2022). Help seeking from peers in an online class: Roles of students' help-seeking profiles and epistemic beliefs. *Journal of Educational Technology & Society*, *25*(3), 1–14.

Jeng, A., Bosch, N., & Perry, M. (2023). Sense of belonging predicts perceived helpfulness in online peer help-giving interactions. *The Internet and Higher Education, 57*, 100901. https://doi.org/10.1016/j.iheduc.2022.100901

Juwah, C. (2006). Interactions in online peer learning. In C. Juwah (Ed.), *Interactions in online education: Implications for theory and practice* (pp. 171–190). Routledge.

Kanuka, H., & Garrison, D. R. (2004). Cognitive presence in online learning. *Journal of Computing in Higher Education*, *15*(2), 21–39.

Kilis, S., & Yıldırım, Z. (2018). Investigation of community of inquiry framework in regard to self-regulation, metacognition and motivation. *Computers & Education*, *126*, 53–64. https://doi.org/10.1016/j.compedu.2018.06.032

Kozan, K., & Caskurlu, S. (2018). On the Nth presence for the community of inquiry framework. *Computers & Education*, *122*, 104–118. https://doi.org/10.1016/j.compedu.2018.03.010

Landis, J. R., & Koch, G. G. (1977). The measurement of observer agreement for categorical data. *Biometrics*, *33*(1), 159. https://doi.org/10.2307/2529310

Lau, Y., Tang, Y. M., Chau, K. Y., Vyas, L., Sandoval-Hernandez, A., & Wong, S. (2021). COVID-19 crisis: Exploring community of inquiry in online learning for sub-degree students. *Frontiers in Psychology*, *12*, 679197. https://doi.org/10.3389/fpsyg.2021.679197

Lee, D., Rothstein, R., Dunford, A., Berger, E., Rhoads, J. F., & DeBoer, J. (2021). "Connecting online": The structure and content of students' asynchronous online networks in a blended engineering class. *Computers & Education*, *163*, 104082. https://doi.org/10.1016/j.compedu.2020.104082

Lee, J., Soleimani, F., Irish, I., John Hosmer, I. V., Soylu, M. Y., Finkelberg, R., & Chatterjee, S. (2022). Predicting cognitive presence in at-scale online learning: MOOC and for-credit online course environments. *Online Learning*, *26*(1), Article 1. https://doi.org/10.24059/olj.v26i1.3060

Lee, S. J., Srinivasan, S., Trail, T., Lewis, D., & Lopez, S. (2011). Examining the relationship among student perception of support, course satisfaction, and learning outcomes in online

learning. *The Internet and Higher Education*, *14*(3), 158–163. https://doi.org/10.1016/j.iheduc.2011.04.001

Leibold, N., & Schwarz, L. M. (2015). The art of giving online feedback. *The Journal of Effective Teaching*, *15*(1), 34–46.

Lim, C. L., Ab Jalil, H., Ma'rof, A. M., & Saad, W. Z. (2020). Self-regulated learning as a mediator in the relationship between peer learning and online learning satisfaction: A study of a private university in Malaysia. *Malaysian Journal of Learning and Instruction*, *17*(1), 51–75.

Lim, J., & Richardson, J. C. (2021). Predictive effects of undergraduate students' perceptions of social, cognitive, and teaching presence on affective learning outcomes according to disciplines. *Computers & Education*, *161*, 104063. https://doi.org/10.1016/j.compedu.2020.104063

Lim, J., & Richardson, J. C. (2022). Considering how disciplinary differences matter for successful online learning through the Community of Inquiry lens. *Computers & Education*, *187*, 104551. https://doi.org/10.1016/j.compedu.2022.104551

Lin, X., & Gao, L. (2020). Students' sense of community and perspectives of taking synchronous and asynchronous online courses. *Asian Journal of Distance Education*, *15*(1), Article 1.

Mare, L. L., & Sohbat, E. (2002). Canadian students' perceptions of teacher characteristics that support or inhibit help seeking. *The Elementary School Journal*, *102*(3), 239–253.

Martin, F., & Bolliger, D. U. (2018). Engagement matters: Student perceptions on the importance of engagement strategies in the online learning environment. *Online Learning*, *22*(1), 205–222. https://doi.org/10.24059/olj.v22i1.1092

Navarro, P., & Shoemaker, J. (2000). Performance and perceptions of distance learners in cyberspace. *American Journal of Distance Education*, *14*(2), 15–35. https://doi.org/10.1080/08923640009527052

Ng, B. J. M., Han, J. Y., Kim, Y., Togo, K. A., Chew, J. Y., Lam, Y., & Fung, F. M. (2022). Supporting social and learning presence in the revised community of inquiry framework for hybrid learning. *Journal of Chemical Education*, *99*(2), 708–714. https://doi.org/10.1021/acs.jchemed.1c00842

Nor, N. F. M., Hamat, A., & Embi, M. A. (2012). Patterns of discourse in online interaction: Seeking evidence of the collaborative learning process. *Computer Assisted Language Learning*, *25*(3), 237–256. https://doi.org/10.1080/09588221.2012.655748

Pawan, F., Paulus, T. M., Yalcin, S., & Chang, C.-F. (2003). Online learning: Patterns of engagement and interaction among in-service teachers. *Language Learning & Technology*, *7*(3), 119–140.

Pena-Shaff, J. B., & Nicholls, C. (2004). Analyzing student interactions and meaning construction in computer bulletin board discussions. *Computers & Education*, *42*(3), 243–265. https://doi.org/10.1016/j.compedu.2003.08.003

Permatasari, N., Rahmatillah Ashari, F., & Ismail, N. (2021). Contribution of perceived social support (peer, family, and teacher) to academic resilience during COVID-19. *Golden Ratio of Social Science and Education*, *1*(1), 01–12. https://doi.org/10.52970/grsse.v1i1.94

Prabhu, N., Perry, M., Azevedo, R. F. L., Angrave, L., & Bhat, S. (2021). Study partners matter: Impacts on inclusion and outcomes. *Proceedings of the ASEE Annual Conference and Exposition.* https://peer.asee.org/37777

Richardson, J. C., Besser, E., Koehler, A., Lim, J., & Strait, M. (2016). Instructors' perceptions of instructor presence in online learning environments. *The International Review of Research in Open and Distributed Learning*, *17*(4). https://doi.org/10.19173/irrodl.v17i4.2330

Rovai, A. P. (2002). Building sense of community at a distance. *The International Review of Research in Open and Distributed Learning*, *3*(1). https://doi.org/10.19173/irrodl.v3i1.79

Sadaf, A., Kim, S. Y., & Wang, Y. (2021). A comparison of cognitive presence, learning, satisfaction, and academic performance in case-based and non-case-based online discussions. *American Journal of Distance Education*, *35*(3), 214–227. https://doi.org/10.1080/08923647.2021.1888667

Schultz, B., & Sandidge, C. (2022). Improving online discussion boards: What do students Ssy? *The Northwest ELearning Journal*, *2*(1). https://doi.org/10.5399/osu/nwelearn.2.1.5643

Shea, P., Hayes, S., Smith, S. U., Vickers, J., Bidjerano, T., Pickett, A., Gozza-Cohen, M., Wilde, J., & Jian, S. (2012). Learning presence: Additional research on a new conceptual element within the Community of Inquiry (CoI) framework. *The Internet and Higher Education*, *15*(2), 89–95. https://doi.org/10.1016/j.iheduc.2011.08.002

Shea, P., Swan, K., Li, C. S., & Pickett, A. (2005). Developing learning community in online asynchronous college courses: The role of teaching presence. *Journal of Asynchronous Learning Networks*, *9*(4), 59–82.

Sun, Z., Lin, C.-H., Wu, M., Zhou, J., & Luo, L. (2018). A tale of two communication tools: Discussion-forum and mobile instant-messaging apps in collaborative learning. *British Journal of Educational Technology*, *49*(2), 248–261. https://doi.org/10.1111/bjet.12571

Swan, K., & Shih, L. F. (2005). On the nature and development of social presence in online course discussions. *Online Learning*, *9*(3). https://doi.org/10.24059/olj.v9i3.1788

Thomas, L., Herbert, J., & Teras, M. (2014). A sense of belonging to enhance participation, success and retention in online programs. *The International Journal of the First Year in Higher Education*, *5*(2), 69–80. https://doi.org/10.5204/intjfyhe.v5i2.233

Twining, P., Heller, R. S., Nussbaum, M., & Tsai, C.-C. (2017). Some guidance on conducting and reporting qualitative studies. *Computers & Education*, *106*, A1–A9. https://doi.org/10.1016/j.compedu.2016.12.002

Usmani, S. (2021). COVID-19 pandemic and blended learning: A quantitative assessment of revised community of inquiry (RCoI) framework. *Journal of Education and Educational Development*, *8*(2). https://doi.org/10.22555/joeed.v8i2.544

Vasodavan, V., DeWitt, D., Alias, N., & Noh, M. M. (2020). E-moderation skills in discussion forums: Patterns of online interactions for knowledge construction. *Pertanika Journal of Social Sciences and Humanities*, *28*(4). https://doi.org/10.47836/pjssh.28.4.30

Vonderwell, S. (2003). An examination of asynchronous communication experiences and perspectives of students in an online course: A case study. *The Internet and Higher Education*, *6*(1), 77–90. https://doi.org/10.1016/S1096-7516(02)00164-1

Vonderwell, S., Liang, X., & Alderman, K. (2007). Asynchronous discussions and assessment in online learning. *Journal of Research on Technology in Education*, *39*(3), 309–328. https://doi.org/10.1080/15391523.2007.10782485

Watts, D. G. (1991). Why is introductory statistics difficult to learn? And what can we do to make it easier? *The American Statistician*, *45*(4), 290–291. https://doi.org/10.1080/00031305.1991.10475824

Webb, N. M. (1989). Peer interaction and learning in small groups. *International Journal of Educational Research*, *13*(1), 21–39. https://doi.org/10.1016/0883-0355(89)90014-1

Webb, N. M., & Farivar, S. (1994). Promoting helping behavior in cooperative small groups in middle school mathematics. *American Educational Research Journal*, *31*(2), 369–395. https://doi.org/10.3102/00028312031002369

Webb, N. M., Farivar, S. H., & Mastergeorge, A. M. (2002). Productive helping in cooperative groups. *Theory Into Practice*, *41*(1), 13–20. https://doi.org/10.1207/s15430421tip4101_3

Webb, N. M., & Mastergeorge, A. (2003). Promoting effective helping behavior in peer-directed groups. *International Journal of Educational Research*, *39*(1–2), 73–97. https://doi.org/10.1016/S0883-0355(03)00074-0

Williams-Dobosz, D., Jeng, A., Azevedo, R. F. L., Bosch, N., Ray, C., & Perry, M. (2021). Ask for help: Online help-seeking and help-giving as indicators of cognitive and social presence for students underrepresented in chemistry. *Journal of Chemical Education*, acs.jchemed.1c00839. https://doi.org/10.1021/acs.jchemed.1c00839

Xu, D., & Jaggars, S. S. (2014). Performance gaps between online and face-to-face courses: Differences across types of students and academic subject areas. *The Journal of Higher Education*, *85*(5), 633–659. https://doi.org/10.1353/jhe.2014.0028

Zengilowski, A., Lee, J., Gaines, R. E., Park, H., Choi, E., & Schallert, D. L. (2023). The collective classroom “we”: The role of students’ sense of belonging on their affective, cognitive, and discourse experiences of online and face-to-face discussions. *Linguistics and Education*, *73*, 101142. https://doi.org/10.1016/j.linged.2022.101142

Zhu, X., & Liu, J. (2020). Education in and after Covid-19: Immediate responses and long-term visions. *Postdigital Science and Education*, *2*(3), 695–699. https://doi.org/10.1007/s42438-020-00126-3

Appendix. 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]
2	"I am confused what 'with replacement' means. I can understand that rolling the dice is 'with replacement'. But why is this (drawing cards from a deck and returning the card to the deck between each draw) also counted as 'with replacement'?"	"'with replacement' means that whatever was drawn from the deck is returned to the deck. For example, I drew the Ace of Spades when randomly picking a card from the deck. Because it goes back into the deck, the Ace of Spades is still an option for the next draw."	4.31
10	"If evaluators are not aware of who was in the treatment group and who was in the control group, wouldn't this be considered an observational study rather than a designed experiment (since the researcher didn't decide who got the treatment)?"	"An observational study is when the subjects themselves or simply fate determines who gets the treatment and who doesn't. This wasn't the case in this experiment. Also, if the evaluators knew who was in the treatment and control groups, it could bias them when analyzing the results. The fact that they don't know who's in which group makes the experiment double-blind."	4.25
6	"How do I decide whether to reject a null hypothesis based on my p value? Please help.."	"If it's less than 5%, then yes, reject the null. If it's more than 5%, then no, don't reject the null."	4.24
7	"So I understand the main concept of correlation and that if, for example, the number of classes skipped correlates to a lower GPA, that would be a negative correlation. But why is it -.5 as opposed to -1?"	"I think it's because you have to remember if there is 'wiggle' room or not. In college, some students are able to skip a class or multiple classes for a course and still do relatively well (get an A/B). That's why the score is -0.5 because skipping class does not 100% mean you will have a low GPA. Sometimes skipping class means to study for an exam in another class you have that day, and those people catch up	4.13

Example Order[a]	Request for Help	Help-Giving Reply	Helpfulness Rating[b]
		on content over the weekend, or something similar."	
5	"I'm not sure why I keep getting #1 wrong. I did SQRT of .73 x .27 to find the SD, which gave me 1."	"SQRT of (0.73 * 0.27) = 0.444, not 1. Hope that helps!"	4.11
4	"I got 7.75 as my z score, but I'm unsure what p value it would have, since it's off the chart."	"For any z-score that is huge and off the chart, you can assume the p-value is going to be pretty much 0."	3.75
3	"How do you use the z score if it is not a z score that is found on the normal table?"	"Round to the closest number on the normal curve. You will only need to round to one decimal place, so the answer would most likely be the same because of the rounding."	3.68
1	"I'm confused. What exactly is a p-value? And how is it related to a z-score?"	"p-value is the probability of getting something more extreme than your value. Anything more extreme than your value is farther away from the middle of the distribution (and on the same side). If you draw a picture, you'll see that this is a tail of a distribution. So the p-value is the area of one of the tails corresponding to the z-score in the distribution."	3.61
8	"I'm confused on how you would find the average value of a draw for this question. I've tried doing what was recommended and I still can't seem to figure it out…"	"The professor specifically answered this question in class; check the lecture videos for Monday."	2.18
9	"How do you get the margin of error when calculating a confidence interval?"	"I am also confused on this. I cannot seem to find an equation in the book for it."	1.28

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.