Strengthening Social Networks in Online Discussion Forums to Facilitate Help Seeking for Solving Problems

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ABSTRACT

Help seeking is regarded as an important learning strategy that reflects students' metacognitive and domain-specific skills and knowledge. This study developed a proactive online discussion forum that strengthens social networks in an online discussion forum to facilitate help seeking for problem solving. This forum allowed students to proactively invite friends or potential experts to participate in problem solving. A quasi-experimental approach was conducted with a sample of 37 students. The students' behaviors of problem solving, ego network patterns of problem solving, and perceptions of help seeking were addressed as dependent variables to assess the effect of the proactive online discussion forum. The analysis results revealed that the students in the experimental group exhibited more frequent participation in problem solving, and showed more positive attitudes towards help seeking. The results also indicated that the experimental group demonstrated more in-depth participation patterns of ego networks. The findings provide some evidence for the effectiveness of the proactive online discussion forum in terms of promoting students' participation in problem solving and their attitudes towards help seeking.

Keywords

Online discussion forum, Ego network, Help seeking, Online social network

Introduction

Help seeking has been advocated as an important learning strategy that reflects students' metacognitive and domain-specific skills and knowledge (Aleven, Stahl, Schworm, Fischer, & Wallace, 2003; Newman, 2002). It involves identifying a problem, expressing the need for help, and receiving assistance from others (Newman, 2002; Schunk, 2004). Among the forms of help-seeking, students asking for help in order to learn independently and exhibit self-determination to solve their problems could benefit self-regulation and learning outcomes (Cheng & Tsai, 2011; Melrose, 2006). However, during typical academic terms, the majority of college students reported that they faced challenges or difficulties when seeking help with academic problems (Karabenick & Knapp, 1988). In such cases, some students may exert little effort to solve their academic problems, give up prematurely, or persist unsuccessfully on their own (Newman, 2002). For help seekers, the costs and threat of seeking needed help from others becomes a major determinant of their help-seeking intentions, their help-seeking purposes, and their preferred sources of assistance (Karabenick, 2003). The students' help seeking difficulties may emphasize the cost and threat of help seeking, which may in turn initiate the avoidance of help seeking or may lead to executive help seeking behaviors in which students' intention is to have someone else solve a problem on their behalf (Karabenick & Knapp, 1991). Given that students are encouraged to be more autonomous and responsible for their learning (Schunk, 2004), their help-seeking difficulties may be a barrier to acquiring needed resources during the process of solving academic problems.

Research shows that the learning environments that assist students to identify their problems and seek help from capable peers may enhance students' motivation to study, or may promote their performance in studying subjects (Melrose, 2006). Among the learning environments, online discussion forums such as WebCT or phpBB, which have been widely incorporated in courses to help students solve problems, could enhance the process of acquiring, sharing and exchanging knowledge among students, and hence may improve the process of help seeking and learning outcomes (Cheng, Paré, Collimore, & Joordens, 2011). Although online discussion forums have demonstrated potential for supporting students to help one another in the resolution of academic problems, the opportunity and quality of learning through online discussion largely depends on student participation and meaningful interaction among the members of the forum (Cheng et al., 2011; Guzdial & Turns, 2000; Hew & Cheung, 2008). Moreover, research has shown that only a few students would like to share their questions with others or to give comments on questions in online discussion forums (Wan & Johnson, 1994). The lack of knowledge sharing in online discussion forums may be due to the dilemmas of knowledge sharing (Cabrera & Cabrera, 2002). One of the dilemmas is that individuals attempt to maximize their self-interests and benefits in a

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community, which makes them inclined not to contribute and can consequently lead to collective damage (Cabrera & Cabrera, 2002). In such dilemmatic cases, the interdependent relationship that requires joint cognitive and emotional engagement by help-seeker and help-giver(s) hardly emerges naturally. Networks that maintain connections among relevant people (e.g., friends or family members) may provide a basic structure or potential helpers to promote such seeker-giver relationship. In addition, the help seekers' decision to ask questions and the help givers' willingness to respond to the questions play significant roles in successful help seeking processes (Gall, 1985). Difficulties such as help seekers' inability to ask for help or help givers' perceived irrelevance to the seekers' help may thus impede students' participation in online discussion (Balaji & Chakrabarti, 2010; Guzdial & Turns, 2000), and therefore hinder students' engagement in help seeking processes such as giving help or receiving assistance from others in online discussion forums.

The use of social networking sites (e.g., Facebook or MySpace) has become increasingly ubiquitous among students. These sites assist users in connecting with relevant people (e.g., friends, family members or classmates) and in sharing information with these people (Hew, 2011; Lockyer & Patterson, 2008). In these social networking sites, the connections between a person and relevant others (e.g., friends or family members) are maintained by online social networks, which can serve as a major resource for a person to seek assistance (Gourash, 1978; Park, Lee, & Kim, 2012). The online social networks sustaining meaningful relationships among connected people have the potential to facilitate students' help seeking and giving for solving problems in online discussion forums. Given the potential of the online social networks and the difficulties that hinder students' engagement in help seeking processes, the purposes of this study were twofold. First, a proactive online discussion forum that strengthens online social networks in an online discussion forum to facilitate help seeking for problem solving was developed. Instead of passively waiting for responses from others, the proactive online discussion forum allowed individual learners to proactively send messages to friends or potential experts to invite advice, and to maintain a social network for solving problems. The second purpose was to explore the effect of the proactive online discussion forum on students' participation in problem solving and students' perceptions of help seeking with the proactive online discussion forum.

Related work

Help seeking with online discussion forum systems

An online discussion forum system is a computer-based application that provides an online learning environment to support discussion and debate relevant to the course materials among students and teachers (Cheng et al., 2011; Guzdial & Turns, 2000; Hew & Cheung, 2008). Several studies have adopted online discussion forum systems to support students in seeking help online for academic problem solving (e.g., Balaji & Chakrabarti, 2010; Bull, Greer, McCalla, & Kettel, 2001). To solve their problems with online discussion forums, help seekers should formulate questions based on their problems and expect that potential helpers such as capable peers or teachers would give useful advice regarding their questions. In such situations, the help seekers' (questioners') and help givers' (peers') participation is a requirement of the problem solving collaboration (Bull et al., 2001; Cheng et al., 2011; Guzdial & Turns, 2000; Hew & Cheung, 2008). However, motivating students to participate in and contribute to online discussion for help seeking and giving help is challenging (Balaji & Chakrabarti, 2010). According to Cabrera and Cabrera's (2002) knowledge sharing dilemmas, individuals may tend not to share their knowledge in a virtual community because the process of knowledge sharing may involve significant costs (e.g., making that knowledge available to others) and, more important, because individuals' refusal to share knowledge with others may appear to be the most advantageous strategy in securing their benefit within a knowledge sharing context (Liu, Lin, Chang, & Chao, 2014). Considering such dilemmatic situation, resolving the dilemmas of knowledge sharing becomes a major issue of assisting help seeking in an online discussion forum. Social capital theory provides some viewpoints that may contribute to the resolution of knowledge sharing dilemmas: establishing or utilizing the relationship of trust among community members to assist help seeking and giving. The social capital theory stresses that an individual can draw on resources from other members of the network to which the individual connects (Ellison, Steinfield, & Lampe, 2007). In this sense, individual's help-seeking in an online discussion forum can be improved if the members are willing to share knowledge or to interact with others. Inter-personal factors can influence the individuals' willingness to share resources in virtual communities. For example, the experience of insecurity among members in an online learning environment may hinder members from sharing knowledge or participating in learning activities (Liu et al., 2014). On the other hand, mutual trust among members (e.g., friends) improves interactions and is critical to the success of knowledge sharing (Chow & Chan, 2008). Since it is important and useful for community members to seek help from more expert learners (Gall, 1985), recommending members with expertise to help seekers may also enhance the share of knowledge in virtual communities (Zhang, Ackerman, & Adamic, 2007).

Therefore, considering supports that invites trustworthy or competent members such as friends or expert learners to engage in help-seeking processes may improve members' willingness to participate in discussion for problem solving in an online discussion forum. In addition, the difficulties or costs of seeking help in a learning environment may impact students' attitudes toward, decision to, and purposes of seeking help (Karabenick, 2003). Hence, students' perceptions of help seeking including instrumental or executive help-seeking and the threat or avoidance of help-seeking were employed in this study to explore the effects of an online discussion forum.

Participation in academic problem solving using online discussion forums

According to Wenger (1999), participation refers to "a process of taking part and also to the relations with others that reflect this process. It suggests both action and connections" (p. 55). In this regard, both the behavior of students' problem solving and their connections with others could represent students' participation in help seeking using an online discussion forum. Students' problem solving in such an online discussion forum involves questioning, commenting on questions, and viewing comments. These activities are fundamental and crucial to the usefulness and effectiveness of the forum for students to solve their problems (Cheng et al., 2011; Hew & Cheung, 2008). Among the activities, questioning is considered a fundamental cognitive process that may be initiated by questioners when they suffer from contradictions, anomalous information, uncertainty, or obvious gaps in their knowledge (Otero & Graesser, 2001). It also serves as a strategy that an active help seeker would employ to elicit help (Nelson-Le Gall, 1981). With regard to giving comments to questions, the activity requires commenters to synthesize their idea for the comments and to phrase their idea, which could benefit learners' construction of knowledge (Cheng et al., 2011; Guzdial & Turns, 2000). The viewing comments activity involves reading posts from others or from the readers themselves. It helps readers to keep up with the discussion or to monitor the status of interesting questions (Guzdial & Turns, 2000; Hew & Cheung, 2008). Given the importance of problem solving activities, it is suggested that the core design of any online discussion forum should consider support for cultivating problem solving activities to facilitate students' participation in help seeking.

Social network analysis

Social networks are believed to enable individuals to develop norms of trust and reciprocity, which are necessary for successful engagement in collective activities (Valenzuela, Park, & Kee, 2009). They could represent social connections between people and reflect the qualitative aspect of participation in collective activities. Social network analysis, which is designed to express patterns of relationships among members of social systems, could be adopted to assess students' participation patterns in the online discussions (Rabany, Takaffoli, & Zaïane, 2012). Participants' log files including information about the activity of the participants in the discussion forums are typically used to extract the social network underlying the discussion threads. Among the different types of social network, ego networks help understand variation in the behavior of individual participants (Bodin & Prell, 2011; Hanneman & Riddle, 2005). An ego network is a part of a social network that consists of a focal actor, all of his relations to other people, and the relationships among these people (Wasserman & Faust, 1994). The ego network characteristics, including the size of the ego network or the strength of the ties, may reflect students' help seeking activities and their participation in problem solving (Gourash, 1978; Liccardi et al., 2007). The size of ego networks, referring to the number of network members, has a direct impact on the interaction among its members (Zhu, 2006). A larger size suggests more diverse interaction among network members (Fahy, Crawford, & Ally, 2001). The average strength of ego network ties reflects the responsiveness and attentiveness of members to each other (Fahy et al., 2001). Higher average strength of ego network ties means stronger connections among participants, which represents more responsive connections in terms of information sharing (e.g., giving comments) or emotional support (e.g., showing likes). The combination of characteristics of ego networks exhibited by students in their problem solving activities represents students' ego network patterns of problems solving. Considering social network analysis has the potential of understanding students' patterns of participating in problem solving activities in an online discussion forum (Rabany et al., 2012), analyzing students' ego network patterns of problem solving activities (e.g., subscribing to others' questions, commenting on others' questions, viewing comments made by others, and liking comments made by others) can be helpful in understanding students' participation in problem solving activities in an online discussion forum. Additionally, given the importance of the network size and strength of ego networks, it is suggested that the facility of participation in academic problem solving using online discussion forums should consider support for the growth of ego networks or enhancing the strength of the network ties.

Based on the aforementioned concerns, designing an online discussion forum system for help seeking should consider the students' difficulties in seeking potential helpers, and should also deliberate on facilities that stimulate meaningful interaction among students for academic problem solving. To this end, this study develops a proactive online discussion forum that strengthens online social networks in an online discussion forum. The proactive online discussion forum allowed individual learners to proactively send messages to friends or potential experts to invite advice for solving problems. This study further explored the effects of the proactive online discussion forum on students' participation in problem solving and perception of help seeking in terms of students' behaviors, ego network patterns, and attitude toward help seeking. The research questions in this study include:

- What are the effects of the proactive online discussion forum on students' participation in problem solving?
- What are the effects of the proactive online discussion forum on students' ego network patterns of problem solving?
- What are the effects of the proactive online discussion forum on students' perception of help seeking for problem solving?

Method

Participants and the learning task

This study included 37 Vietnamese graduate students (15 males and 22 females) with basic level of English proficiency in a university in Taiwan. All participants were randomly assigned to either the experimental or control group. In all, 19 participants (8 males and 11 females) in the experimental group were asked to study material about Basic English grammar on a proactive online discussion forum where they could subscribe and respond to the questions that were raised by the other students. This group of students could also send invitation emails to their friends or experts for discussion of the inviters' questions. On the other hand, 18 participants (7 males and 11 females) in the control group studied the same material on another online discussion forum, which had the same features as the experimental group's proactive online discussion forum except for the function of sending invitation emails to students' friends or to the experts recommended by the forum. The material was written in English and presented in the format of PowerPoint slides. All participants were free to ask their questions in English or Vietnamese regarding the contents of the slides on their respective online help forums and expected responses from other participants to the posted questions.

The proactive online discussion forum

As shown in Figure 1, the proactive online discussion forum consists of three main parts: question categories, discussion, and question menus. The top of Figure 1 shows three different categories of questions: self-asked, unsubscribed, and subscribed. The questions asked by a student him/herself are referred to as self-asked questions. Questions asked by other students were initially categorized as unsubscribed. Once a student subscribed to an unsubscribed question, it was then referred to as a subscribed question. To the left of Figure 1 is the area for the discussion of questions. This area includes a question, a PowerPoint slide, and a set of comments. Each question asked by a student was associated with one PowerPoint slide. As shown in Figure 1, a student marked on a PowerPoint slide and asked the following question: "In the yellow block, can I use 'when' instead of 'as'?" To the right of Figure 1 is the menu that allowed the students to subscribe to or unsubscribe from a question. When a student subscribed to a question, the online discussion forum system continued sending notification emails to the student to inform him/her of the arrival of new comments on that question.

The proactive online discussion forum strengthened online social networks connecting with friends and recommended experts. With the online social networks, students were free to send invitation emails to their friends or potential experts. An invitation email consists of an inviter, the content of a question, the author of the question, and the role of the invitee. As shown in Figure 2, a student posted a question and invited friends to discuss the question. In this case, the inviter is the author of the question, and the role of the invitees is *friend*. The student had to add friends into the networking structure before being able to invite them to the discussion. Other members of the online help forum who received invitation emails could decide whether to subscribe to the question or merely leave it unsubscribed. On the other hand, the forum recommended potential experts to the author of a question based on members' expertise regarding the PowerPoint slides. The members' expertise was calculated based on peer assessment of members' comments on questions. For example, one student received many likes on his/her comments to questions associated with a PowerPoint slide; therefore, the forum was more likely to recommend that student as a potential expert for solving problems related to that particular PowerPoint

slide. Students could also send invitation emails to the recommended potential experts. In such a case, the inviter is the author of the question, and the role of the invitees is *expert*.

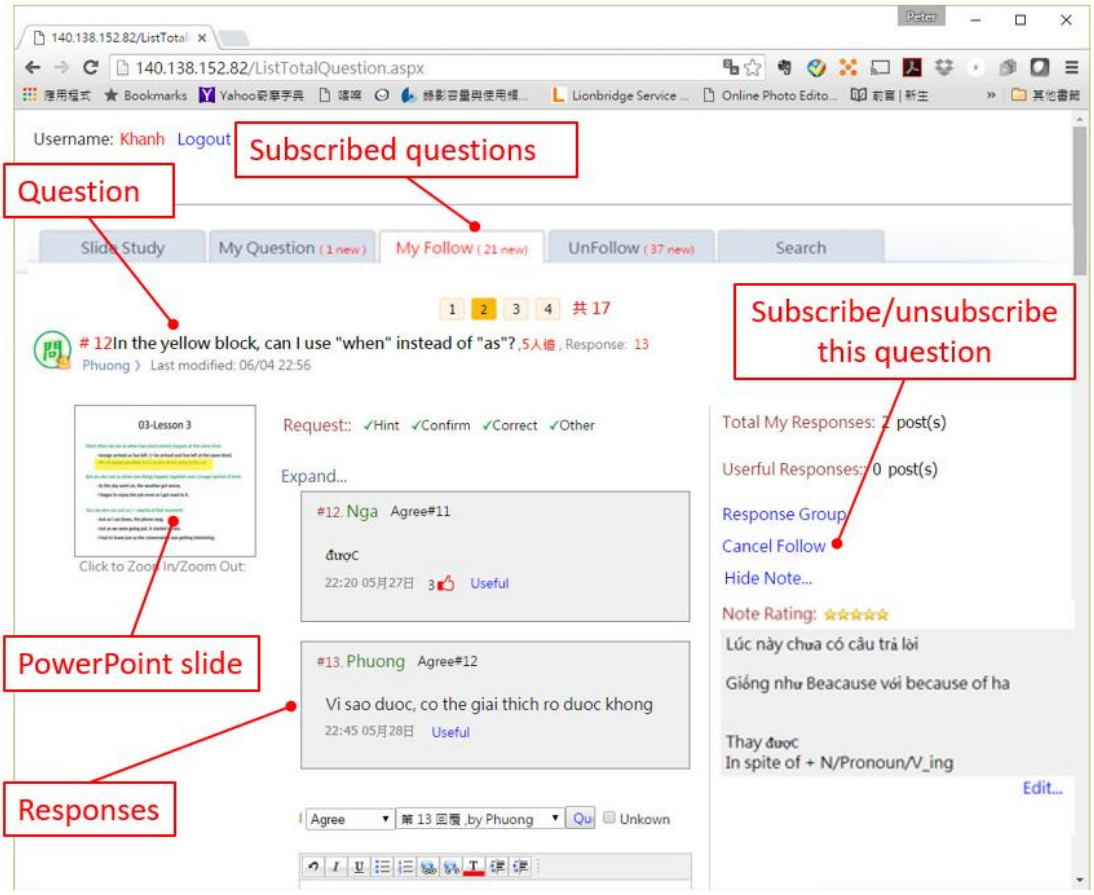

Figure 1. A proactive online discussion forum

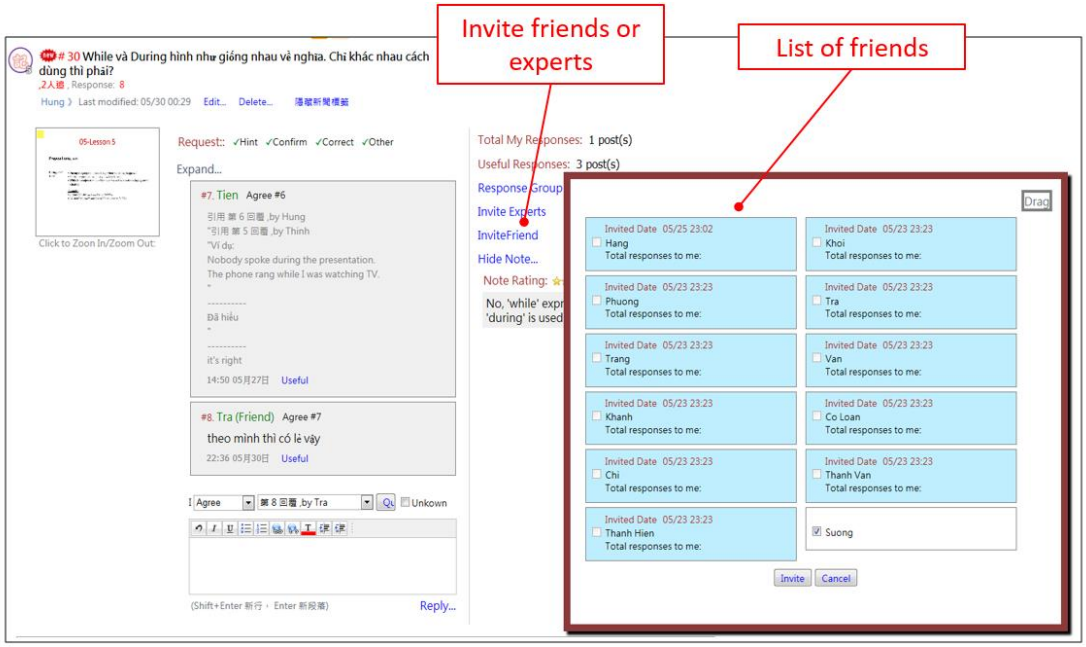

Figure 2. Inviting friends to participate in problem solving

Research design and procedure

Two versions of online discussion forums corresponding to their respective functions were employed in the experiment: a proactive online discussion forum and a conventional online discussion forum. The proactive online discussion forum designed for the experimental group students included basic online discussion forum features and invitation functions. The basic features, as shown in Figure 1, allowed the students to post questions, comment on questions, view the comments, and subscribe to interesting questions. The invitation function, as shown in Figure 2, allowed students to receive recommendations of potential experts and invite their friends or the recommended experts to the discussion of their questions. The conventional online discussion forum, which was designed for the control group students, had the exact same basic online discussion forum features as the proactive online discussion forum except for the invitation functions. This version mirrored the help-seeking features of typical online discussion forums that allowed students to request help in public and wait passively for other students' responses. The procedure for the study mainly consisted of a one-hour training session and three weeks of study sessions for all participants. In the training session, the respective versions of the online discussion forums were introduced to the participants. An instructor presented the system to the students and encouraged them to use the forums to post their questions or provide comments to the questioners. In the study session, the two groups of participants were asked to study the material related to Basic English grammar. They were free to use the functions of their respective online discussion forums to resolve their questions in a convenient location and at a convenient time during the three weeks. During this session, all participants' activities of asking questions, making comments, viewing comments, giving likes, and subscribing to questions were collected. The invitation emails sent by the experimental group were also collected for analysis. Finally, all participants were asked to complete a questionnaire that investigated their perceptions of help seeking using the respective online discussion forum.

Instruments, data collection and analyses

The instruments employed in this study included two different versions of online discussion forums and the questionnaire for investigating students' perceptions of help seeking. There are three major variables involved in this study: students' participation in problem solving, students' ego networks of problem solving, and the students' perceptions of help seeking. In both versions of the forum, the students' participation in help seeking for problem solving was explored by analyzing their problem solving activities during their study of the material. The activities were identified according to some common behaviors of participating in an online discussion forum such as posting questions, making comments on questions, viewing comments, and subscribing to questions. All the aforementioned activities were logged by the two versions of the forum, and the frequencies of the activities were computed to compare the differences between the two forums.

The ego network of problem solving was employed to analyze the degree to which a student utilized or created social connections with other students when subscribing to questions, commenting on questions, viewing comments, or giving likes to other students' comments. Among the properties of these ego networks of problem solving, their size and strength were computed to compare the differences between the two discussion forums. For example, to compute the size and strength of the ego networks of subscribing to questions, connections that link the subscribers with the authors of the subscribed questions were first identified. The size of the ego networks of subscribing to questions refers to the number of connections that link a subscriber with distinct authors of subscribed questions. The strength of the ego networks of subscribing to questions refers to the ratio of the number of total connections to the size of the ego networks of subscribing to questions.

To measure the participants' perceptions of help seeking, a revised version of the help-seeking scales questionnaire (Karabenick, 2003) was adopted. Because the original items and scales were in English, the back translation process (Brislin, 1970) was performed to ensure the construct validity of the translated items and scales in Chinese. There was no disconcerting discrepancy between any of the original and back-translated item pairs used in this study. To address the construct validity of help-seeking scales in this study, Partial Least Squares (PLS), which could model latent constructs under conditions of non-normality and small sample size, was adopted with using VisualPLS (Chin, 1998). The results (Table 1) support the convergent validity of the scales: loadings ≥ 0.7; composite reliability ≥ 0.7; average variance extracted (AVE) ≥ 0.5 (Fornell & Larcker, 1981). To ensure their discriminant validity, the results (Table 2) confirm that the intercorrelations of the construct do not exceed the square root of the AVE (Fornell & Larcker, 1981), which supports discriminant validity. The questionnaire focused on variables included in most models of help seeking (e.g., Newman, 1990). Because students' goals of and attitudes towards help seeking have been suggested as being useful for measuring help seeking, in this study, as shown in Table 3, four relevant dimensions of the students' help-seeking were

employed: instrumental help seeking, executive help seeking, help-seeking threat, and help-seeking avoidance. The questionnaire was scored on a 5-point Likert scale, from 1 (strongly disagree) to 5 (strongly agree). The coefficient of Cronbach's α was adopted to reveal that the reliability of the four scales was .72, .77, .72 and .68, respectively. The instrumental help seeking, executive help seeking, help-seeking threat, and help-seeking avoidance scales are comprised of two, two, three, and three items, respectively. The differences in the two groups of students' perspectives on help seeking for the different online discussion forums were compared. Because the major variables involved in this study were non-normally distributed, nonparametric Mann-Whitney U tests were employed to examine differences between two groups.

Table 1. Convergent validity

Dimensions/ items	Factor loadings	AVE	CR
Instrumental help seeking			
IN1	0.901	0.813	0.897
IN2	0.902		
Executive help seeking			
EX1	0.900	0.809	0.895
EX2	0.899		
Help-seeking threat			
TH1	0.725	0.644	0.844
TH2	0.814		
TH3	0.863		
Help-seeking avoidance			
AV1	0.861	0.617	0.828
AV2	0.718		
AV3	0.770		

Table 2. Discriminant validity

Dimensions	1	2	3	4
1. Instrumental help seeking	0.902			
2. Executive help seeking	0.010	0.899		
3. Help-seeking threat	-0247	0.058	0.802	
4. Help-seeking avoidance	-0.179	0.352	0.550	0.785

Note. The main diagonal shows the square root of AVE.

Table 3. Dimensions of help-seeking scale

Dimensions	Description	Examples
Instrumental help seeking	The extent that help sought would serve instrumental goals.	If I were having trouble understanding the material in this PowerPoint slide course I would ask someone who could help me understand the general ideas.
Executive help seeking	The extent that help sought would serve executive goals.	The purpose of asking somebody for help in this PowerPoint slide course would be to succeed without having to work as hard.
Help-seeking threat	How threatened seekers are to seek help.	I would feel like a failure if I needed help in this PowerPoint slide course.
Help-seeking avoidance	The extent to which seekers decide not to seek help.	I would rather do worse on an assignment I could not finish than ask for help.

Results

The difference in student academic problem solving

A series of nonparametric Mann-Whitney U tests was used to examine the difference between the experimental and control groups in terms of their participation in problem solving using the online discussion forums, as shown in Table 4. The results revealed significant differences in the participation of questioning, subscribing to, commenting on questions, and viewing comments on questions. The students in the experimental group had significantly higher frequencies than those in the control group for questioning (U = 101, p = .03) and subscribing to questions (U = 0, p < .001). These results indicate that the proactive online discussion forum could prompt the students to post questions and subscribe to questions of interest. In terms of commenting on questions and viewing the comments on questions, the experimental group made significantly more comments

on other students' questions (U = 106.5, p = .049) than the control group did. The experimental group students also had significantly higher frequencies of viewing the comments on self-asked (U = 80, p = .005) and others students' questions (U = 0, p < .001). These results suggest that the proactive online discussion forum could further facilitate students' comments on other students' questions, and could encourage the students to view the comments relevant to their own and others' questions.

Table 4. Comparison of the academic problem solving of the experimental and control groups

Activity	Experimental[b]		Control[a]		
	M	*SD*	*M*	*SD*	*U*
Questioning	5.26	1.79	4.06	1.16	101*
Subscribing	61.84	11.97	20.94	5.32	0***
Commenting on					
Self-asked	4.16	2.73	2.98	1.75	126.5
Other students'	22.89	8.49	17.44	6.47	106.5*
Viewing					
Self-asked	13.53	8.57	6.84	5.44	80**
Other students'	96.58	44.62	46.17	15.21	0***

Note. [a]n = 18, [b]n = 19; *p < .05; **p < .01; ***p < .001.

The difference in student ego networks

A series of nonparametric Mann-Whitney U tests was used to examine the difference between the experimental and control groups in terms of the size and strength of students' ego networks of problem solving. These ego networks for analysis were identified according to the students' interaction with other students including subscribing to others' questions, commenting on others' questions, viewing comments made by others, and liking comments made by others. For example, the size of the ego network of subscribing represents the number of distinct members that a student subscribed, and the strength of the ego network of subscribing represents the average number of questions that a student subscribed to each member. As shown in Table 5, the students in the experimental group had significantly smaller size (U = 79, p = .005) but higher average strength (U = 0, p < .001) ego networks of subscribing than the control group did. This result suggests that the proactive online discussion forum could facilitate student concentration on fewer members of the forum when subscribing to questions, and could also enhance students' attention to interested questioners. With regard to giving comments on questions, the experimental group students had higher average strength (U = 83, p = .007) of their ego networks of commenting than the control group did. This result suggests that the proactive online discussion forum may help students offer academic support that is more responsive to the requests made by members of the ego networks.

Table 5. Comparison of the size and average strength of the ego networks of the experimental and control groups

	Experimental[b]		Control[a]		
	M	*SD*	*M*	*SD*	*U*
Subscribing					
Size	10.16	3.02	12.94	1.55	79**
Strength	6.77	3.03	1.61	0.31	0***
Commenting					
Size	10.84	2.46	10.28	2.49	149
Strength	2.08	0.47	1.66	0.29	83**
Viewing					
Size	13.95	2.64	8.28	3.12	29***
Strength	7.11	3.48	6.12	2.36	147.5
Liking					
Size	10.74	2.85	9.56	4.40	144
Strength	3.14	1.10	2.35	0.897	98*

Note. [a]n = 18, [b]n = 19; *p < .05; **p < .01; ***p < .001.

However, in terms of the ego network of viewing, that of the students in the experimental group was significantly larger (U = 29, p < .001) than that of the control group. This result may reveal that the proactive online discussion forum could also assist students in extending their social networks, allowing them to view comments made by more diverse members of the forum. With regard to liking comments, the experimental group students had higher average strength (U = 98, p = .026) in the ego network of liking than the control group

did. This result suggests that proactive online discussion forum may lead to social networks that are more attentive to offering emotional support for the members of the ego networks.

The difference in student perceptions of help seeking

A series of nonparametric Mann-Whitney U tests was used to examine the difference between the experimental and control groups in terms of their perceptions of help seeking using different online discussion forums. As shown in Table 6, the results obtained by Mann-Whitney U tests revealed significant differences in the scale of instrumental help seeking (U = 104.5, p = .036), and the scale of help-seeking threat (U = 93, p = .014). The students in the experimental group had higher scores of instrumental help seeking in solving problems using online discussion forums than did those in the control group. These results suggest that the proactive online discussion forum could improve the students' tendencies to seek instrumental help for solving academic problems. In addition, the results reveal that the students in the experimental group had lower scores for their help-seeking threat of seeking help using the online discussion forum than did those in the control group. This result may imply that the proactive online discussion forum could reduce the threat of help seeking in solving problems.

Table 6. Comparison of the experimental and control groups' help-seeking scales

Help-seeking scales	Experimental[a]		Control[b]			
	M	*SD*	*M*	*SD*	*U*	*p*
Instrumental help seeking	4.06	0.68	3.67	0.51	104.5	0.036*
Executive help seeking	2	0.71	2.22	0.94	143.5	.388
Help-seeking threat	2.18	0.39	2.54	0.46	93	0.014*
Help-seeking avoidance	2.63	0.46	2.85	0.53	134	0.254

Note. [a]n = 19, [b]n = 18; *p < .05.

Discussion and conclusion

This study developed a proactive online discussion forum supporting help-seeking activities for students' problem solving, and further assessed its effectiveness by exploring students' participation in problem solving and their perceptions of help seeking. It was found that the students in the experimental group significantly outperformed those in the control group in terms of participation in problem solving. The overall results revealed that the proactive online discussion forum supported by online social networks could promote students' participation in help seeking for problem solving when compared with the conventional online discussion forum. These findings are consistent with the previous suggestions (Bull et al., 2001; Melrose, 2006) that providing students with social supports in an online community would be helpful for the interaction between help seekers and potential helpers.

Many technological and pedagogical issues of academic problem solving using online discussion forums were addressed in this study. In terms of the technological aspect, this study strengthened online social networks that associate students with their friends and system-recommended experts to encourage invitation to potential helpers. This feature, which strengthens the social connections among members of the online discussion forum, provided the students with reliable help sources for help seeking and problem solving. This facilitates help-seeking activities by proactively engaging potential helpers in solving problems rather than passively waiting for responses from other members. Unlike other facilitation techniques that require particular facilitators such as teachers or board managers to keep the discussion on track or to promote engagement in the discussion (Hew & Cheung, 2008), the proactive online discussion forum encourages help seekers and invited helpers to play active roles of facilitating the discussion or participating in solving problems. Such active roles in help seeking activities may assist students in fostering positive help seeking strategies. Such positive help seeking strategies include adaptive help seeking strategies, which help seekers show an awareness of the difficulties they cannot overcome on their own, and exhibit self-determination to remedy those difficulties by requesting assistance from more knowledgeable individuals for independent learning (Newman, 2002). Consequently, an online discussion forum incorporated with online social networks enabled a proactive help-seeking environment that supports the students in problem solving while considering the students' concern about seeking potential helpers. The results showed that the students who utilized the proactive online discussion forum posted and subscribed to more questions than did the students who utilized the conventional online discussion forum. The students also demonstrated more comments on questions and more viewing of comments than did the control group students. These improvements in participation of problem solving confirmed the effectiveness of the online social network

approach in terms of reducing students' difficulties in seeking or giving help in an online discussion forum. The findings of this study provide some evidence that the online social network approach to the design of online discussion forums is beneficial for students' help seeking for problem solving.

The difference in the ego network patterns of help seeking for problem solving also evidenced the influence of the online social network approach on social participation in an online discussion forum. Some novelty features provided by the proactive online discussion forum may have influenced the students' interactions with other members of the forum. For example, the forum allowed students to explicitly invite their friends to the discussion of questions. With the invitation, the inviters can anticipate feedback from their friends, and their friends may then feel responsible for responding to the questions. Therefore, the online social network approach that reinforces social connections may influence the patterns of ego networks of problem solving. Taking the ego network of subscribing to questions as an example, the results show that the explicit invitation to friends or experts may lead to smaller sized ego networks of subscribing. The invitation feature helps students concentrate on fewer members of the online discussion forum when subscribing to questions. The results also show that explicit invitations to friends or experts may assist students in demonstrating higher strength of ego networks of problem solving, which are more attentive to offering academic assistance (e.g., comments) and emotional support (e.g., likes) to the help seekers in their social networks. This suggests that the invitation feature may also facilitate in-depth participation of help givers. From a cooperative learning perspective, students' strengthened social networks may reflect a cooperative group that could improve productivity, personal responsibility, and members' willingness to complete difficult tasks (Johnson & Johnson, 1999). Therefore, the formation of such attentive social networks seems especially important in motivating help seekers and help givers to participate in problem solving in online discussion forums because the help givers in the attentive social networks are responsive to help seekers' requests. In this sense, techniques or strategies that help students form a group in which members have close relationships (e.g., friendship) with each other may play positive roles in promoting social participation of help seeking and help giving in an online discussion forum.

The increase in the students' tendencies of seeking instrumental help, and the decrease in the students' help-seeking threat also evidenced the effects of the proactive online discussion forum. Some technical features adopted by the forum may have enhanced the tendency of instrumental help-seeking and reduced the help-seeking threat in seeking help for solving academic problems. For example, familiar friends as target sources of help seeking may influence attitudes towards seeking help. According to Newman (2000), where there was greater familiarity and friendship among students, help seeking was more likely to be successful and hence more likely to be positively reinforced as a useful strategy. Students' help-seeking threat may be reduced by the familiarity of help givers, and students' value of instrumental help seeking could be enhanced during the successful help seeking process. In addition to the invitation to their friends, students also sent invitation emails to the experts recommended by the system. A Mann-Whitney U test result shows that the students sent more invitation emails to their friends than to the system-recommended experts (8.72 vs. 5.76 per question). This preference may suggest that the friend relationship had a positive impact on stimulating help seeking in the online discussion forum when compared with the recommendation of potential experts. However, the result of Pearson's correlation revealed that the frequency of inviting experts for discussion was negatively correlated with help-seeking threat in solving problems (r = -.47, p = .044). This may suggest that introducing competent experts into the help seeking process for solving academic problems tends to have a positive effect on reducing help-seeking threat. Therefore, the invitation to friends and potential experts should be employed complementarily to help students obtain friendly and credible comments as well as to assist them in developing different support groups. For example, a novice member may initially be suggested to invite system-recommended experts to their questions and gradually develop friendships with the potential experts or other members attracted by the discussion.

A series of comparative results revealed that the students exhibited more frequent and in-depth participation when they utilized the proactive online discussion forum to resolve their problems. Given that problem solving is viewed as a powerful way of promoting knowledge construction (Anderson, 1993), further application of the proactive online discussion forum could be carefully reframed as an educational tool or environment from pedagogical perspectives to promote students' learning or help-seeking strategies through problem solving. For example, the proactive online discussion forum could include assignments containing problems relevant to the curriculum to guide students to learn. Then a teacher could encourage the students to discuss the problems in the proactive online discussion. Additionally, students' behaviors of seeking help for problem solving (e.g., inviting potential helpers or giving comments) or the structures of ego networks (e.g., size or strength) could provide a conceptual framework for assessing students' help-seeking strategies or for predicting interaction patterns among students. Finally, the application of the proactive online discussion forum to learning and instruction in some specific subjects, such as computer programming, which often require students' understanding and use of

abstract concepts to solve problems, should be carefully examined. Nevertheless, the lack of a significant difference between the two groups on the executive help-seeking and the avoidance of help-seeking subscales may be the result of the small-scale sample or other personal factors such as goal orientation (Karabenick, 2003). Hence, further work needs to be undertaken with a larger sample and considering more personal factors to provide more robust evidence.

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