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THE POTENTIAL OF SYNCHRONOUS COMMUNICATION TO ENHANCE PARTICIPATION IN ONLINE DISCUSSIONS

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Abstract

Computer-mediated communication (CMC) has commonly been adopted in educational settings. However, few researchers have studied the effects of different CMC in such settings. This study examines how the use of synchronous chat, as a complement to asynchronous discussion board, affects student participation in online discussions. Two online classes of different sizes (n=8, 19) that participated in two asynchronous and two synchronous online discussions were examined. Both actual and perceived measures of participation indicated that the use of synchronous chat affected participation positively, which was especially evident in the smaller class. In the synchronous discussions, the students felt that they worked together, because they were confident that someone would respond to their ideas, and they did not feel restricted to discussing course content, which seem to be key factors in what is labeled personal participation.

Keywords: Online discussions, online participation, computer-mediated communication, e-learning.

Introduction

Before the widespread use of computer-mediated communication (CMC), Keegan (1980) argued that one of the key elements of distance education is that learners are taught as individuals rather than in groups. The adoption of CMC has resulted in refinements of previous definitions of distance education (Gunawardena and McIsaac, 2004). For example, leading scholars in the field of distance education consider CMC to be one of its defining characteristics (Garrison and Shale, 1987; Moore and Kearsley, 1996). This has led to the introduction of new terms, such as online education and learning, to describe new forms of distance education (Harasim, 1989). It is often argued that CMC has transformed learning environments from being teacher-centered to learner-centered (Fåhræus, 2003; Kang, 1998) since learning with others within a social context has been enabled (Lindberg and Olofsson, 2005). In line with social theories on learning (e.g., Wenger, 1998; Vygotsky, 1978), the main advantage of using CMC is that it enables students to communicate with and learn from each other (Harasim, 1989): "More capable peers or adult guides on a computer network might lead students into cognitive processes of writing and communication that they might not independently consider" (Sugar and Bonk, 1998, p. 132).

CMC media are commonly classified as asynchronous or synchronous. Throughout the years, there has been an ongoing debate on the usefulness of these two types of media. Asynchronous media have been studied for over 20 years (Hewitt, 2003) and have received more attention in research (Hrastinski and Keller, 2007; Orvis, et al., 2002; Romiszowski and Mason, 2004). Hitherto, most studies on CMC in education have analyzed asynchronous media in isolation or in comparison with traditional face-to-face classrooms (Rice, et al., 2005). A review of four journals during 2000-2004 on CMC in education found that a majority of research papers discussed or evaluated

asynchronous media while research on synchronous media and mixed media approaches have been less common (Hrastinski and Keller, 2007). Thus, the debate on the usefulness of asynchronous and synchronous media seems to be primarily based on studies of asynchronous media and personal preferences, rather than on studies of mixed media approaches. However, there are some exceptions, which are reviewed in the next section.

Researchers generally agree on the usefulness of asynchronous media (Palloff and Pratt, 1999; Romiszowski and Mason, 2004). The dominance of research on asynchronous media can, at least, partly be explained by their "anytime, anywhere" feature. Since more time may be spent on refining contributions, asynchronous discussions are generally considered as "deeper" when comparing with synchronous discussions (Hiltz and Goldman, 2005). However, some educators experiment with using CMC to address the commonly mentioned problem of isolation among distance students (Carr, 2000) but asynchronous methods have not been sufficient in many cases, which has led to that some advocate the use of synchronous media as an enhancement to asynchronous online courses (Schullo, et al., 2005). Currently, opinions about synchronous media in the literature are inconclusive. For example, Palloff and Pratt (1999) have argued that synchronous discussions "rarely provides for productive discussion or participation" (p. 47) while Leidner and Jarvenpaa (1995) found that such discussions resulted in increased and more equal communication when comparing with the traditional classroom.

An emerging topic is how synchronous media should be integrated into asynchronous online education (Murphy and Ciszewska-Carr, 2006). Many teachers are already using asynchronous media, such as e-mail and discussion boards, but these methods are often not sufficient (Schullo, et al., 2005). Researchers can contribute towards a deeper understanding of this topic by investigating how variables, such as learning outcomes, are affected as a consequence of supporting synchronous communication. In this study, the variable of choice is student participation, which has been shown to affect learning outcomes positively (e.g., Fredericksen, et al., 2000; Hiltz, et al., 2000). In these studies, learning has been measured as perceived learning, grades and quality assessment of assignments. Furthermore, it has been argued that participation positively influences retention rates (e.g., Rovai, 2002), student satisfaction (e.g., Alavi and Dufner, 2005) and increases sense of community (e.g., Schullo, et al., 2005).

More specifically, this study examines how the use of synchronous chat, as a complement to asynchronous discussion board, may affect student participation in online discussions. Various measures of participation for the two types of media will be compared in order to distinguish characteristics of synchronous communication that might complement asynchronous communication. Many practitioners are interested in using and supporting synchronous communication in online courses but simply do not know what the benefits and limitations of this type of communication are in comparison with already commonly used asynchronous media. Thus, this study contributes towards a deeper understanding on a topic where guidance is urgently needed.

The plan of the paper is as follows. Previous research is reviewed, and a theoretical background on student participation and how it may be analyzed is discussed in the next two sections. Then, the underlying method of the study is outlined. This is followed by a presentation and discussion of the results. Finally, limitations, suggestions for further research, and conclusions are put forward.

Comparative studies of asynchronous and synchronous media

As noted above, most studies on CMC in education have analyzed asynchronous media in isolation or in comparison with traditional face-to-face classrooms. Examples of comparative studies of asynchronous and synchronous media are summarized in Table 1. Most of these studies have compared text-based asynchronous discussion board and synchronous chat in higher education settings. They have mainly relied on social, collaborative and constructivist learning theories. The main analysis methods have been content analysis of electronic logs, surveys and interviews. The large-scale studies have identified few significant differences between asynchronous and synchronous communication. The differences seem to be subtle and have mainly been identified by conducting qualitative content analyses in smaller groups.

The reviewed studies indicate that asynchronous media are more suitable for reflection and discussion of complex ideas. However, students have been reported to enjoy synchronous discussions because they are experienced as more social although several of the reviewed studies have found that participation may be more concise and less "deep". The reviewed studies seem to suggest that, when the purpose is to discuss complex ideas, asynchronous media are preferable. However, the findings are inconclusive on what the benefits and limitations of synchronous communication might be, even though it can be noted that several studies have found that using synchronous media might induce increased communication and social exchanges among students.

Table 1. Comparative studies of asynchronous and synchronous media					
Source	Type of CMC	Theory base	Data collection	Respondents	Findings
Bonk, Hansen, Grabner-Hagen & Mirabelli (1998)	Text-based discussion board and chat	Sociocultural learning theory	Content analysis	Two courses, 65 preservice teachers	In asynchronous discussions, students responded more to the ideas of peers, and these responses "reflected more complex ideas and depth of thought". Students interacted more frequently in the synchronous discussions but their participation was "more concise and egocentric" (p. 308).
Chou (2002)	Text-based discussion board and chat	Models of interaction	Content analysis	Undergraduate course, number of students was not reported	A higher percentage of socioemotional interactions but consequently lower percentage of task interaction was identified in the synchronous discussions. In the synchronous and asynchronous discussions, 33% and 8% of the sentences respectively were classified as socioemotional sentences.
Davidson-Shivers, Muilenburg & Tanner (2001)	Text-based discussion board and chat	Not specified	Content analysis, survey	Graduate course, 14 students	There was a greater amount of both substantive and non-substantive remarks in the synchronous discussions. However, these statements were shorter. Discussions by asynchronous media contained more complex and reflective statements. The students liked both modes of communication.
Haythornthwaite (2000)	Text-based discussion board, chat, e-mail and "PowerPoint-lectures" with audio	Social network analysis, computer-supported collaborative learning	Survey, interviews	Graduate courses, 52 students	Students who communicated frequently maintained more socially supportive relations and used more media to communicate. They reported a stronger belonging to the class. Strongly tied students used synchronous chat and e-mail to create proximity despite not being able to meet face-to-face.
Haythornthwaite (2001)	Text-based discussion board, chat, e-mail and "PowerPoint-lectures" with audio	Social network analysis, computer-supported collaborative learning	Survey, interviews	Graduate course, 14 students	Students primarily communicated with peers in their project team. Discussion board was used for class-wide communication, chat more to named others but also for class-wide communication, and e-mail for intra-team communication.
Hrastinski (2007)	Text-based discussion board and chat	Sociocultural learning theory, cultural differences	Content analysis, surveys, interviews	Graduate course, 8 students	The students felt that they worked together in the synchronous seminars. Also, there seemed to be too few students to get discussions started in the asynchronous setting. Some students dominated the asynchronous discussions while others dominated the synchronous discussions, which imply that combining asynchronous and synchronous media may enhance participation.

Source	Type of CMC	Theory base	Data collection	Respondents	Findings
Mabrito (2006)	Text-based discussion board and chat	Not specified	Content analysis, survey	Undergraduate course, 16 students	Even though students knew that they spent less time focusing on course tasks in their synchronous sessions, they still preferred this environment if given a choice. The asynchronous sessions "provided an effective space for collaborative writing" but "fewer opportunities for informal team building" (p. 105). Teachers may "need to consider structuring collaborative time in both synchronous and asynchronous environments" (p. 105).
Malmberg (2006)	Text-based discussion board and chat	Sociocultural learning theory	Content analysis	Undergraduate course, 17 students	When self-organized student groups used a discussion board the communication was on task while the chat was used as a space for private and social talk. Intensive use of the chat had a positive effect on asynchronous discussions, which suggests that "social interaction is a key feature of constructive collaboration in net based courses" (p. 262).
Ng & Detenber (2005)	Text-based discussion board and chat	Review of research on online political communication	Survey	Undergraduate course, 153 students	Synchronous discussions were perceived as more informative and persuasive. However, synchronicity did not have significant impacts on students' intention to participate. The results contrast to previous content analyses, which suggest the importance of studying perceptions.
Schullo et al. (2005)	ElluminateLive!™ (synchronous) and WebCT™ (mainly asynchronous)	Review of research on distance education	Surveys, content analysis, interviews, observations	Six graduate courses, 7 instructors and 85 students	The synchronous tool allowed educators to "build connections with and among students more efficiently and increase the potential for interaction in the online classroom" (p. 30).
Spencer (2002)	Text-based discussion board and chat	Learning (e.g., constructivism) and media theories (e.g., information richness theory)	Content analysis, interviews, survey	29 higher education courses, 133 students	Various hypotheses on possible benefits when complementing asynchronous courses with synchronous media such as completion rates, student satisfaction and student learning were examined. The only partially supported hypothesis was perceived learning of students (by teachers), especially when learning was measured as critical thinking. Students found synchronous sessions rewarding.
Schwier & Balbar (2002)	Text-based discussion board and chat	Not specified	Not specified	Graduate course, 7 students	Synchronous communication contributed to continuity and sense of community but was less effective for dealing deeply with content and issues. In conclusion, a combination of the media was suggested as appropriate since "synchronous and asynchronous strategies were suitable for different types of learning".

Researching online student participation

Learning as participation in the social world is at the core of several influential learning theories (Jonassen and Land, 2000; Wenger, 1998; Vygotsky, 1978). Wenger's (1998) definition of participation consists of two parts; "a process of taking part" and "the relations with others that reflect this process" (p. 55). Previous research emphasizes that interaction with peers and teachers is a central aspect of online participation (e.g., Bober and Dennen, 2001; Hung, 2001). Haythornthwaite (2002) argues that in particular three types of exchanges are important for building and sustaining learning communities: information exchange, social support and task support (see Table 2). These three types of exchanges are commonly addressed in the social networks, management, social psychology and online learning literature (Haythornthwaite, 2002; Münzer, 2003).

Table 2. Three types of exchanges (adapted from Haythornthwaite, 2002)	
Type of exchange	Examples
Information exchange	Ask or answer a task-related question Share information Express an idea or thought
Task support	Plan work, allocate tasks, coordinate joint efforts, or review drafts Negotiate and resolve conflicts
Social support	Express companionship, emotional aid, or advice Emoticons (e.g., ☺, ☹) Support during an upset (e.g., support when having technical difficulties) Talk about things other than class work

Firstly, the importance of sharing information among students is widely acknowledged. When doing this, students need to be encouraged to feel comfortable enough to ask questions and share information with as many others as possible. The result of such conversations may be new knowledge, reorganized knowledge or an awareness of a need for additional understanding (Edelson, et al., 1996). There is an insufficiently challenged assumption in research, that those who do not contribute are passive recipients even though they may be actively engaged in reading (Romiszowski and Mason, 2004). Sutton (2001) argued that students not only benefit by contributing themselves but also by actively processing the interactions of others. In fact, students access many times more messages than they reply to (Goldman, et al., 2005). Learning may still occur since participants observe actions of others and the results of these actions (Sutton, 2001). These arguments support an assumption of this paper: It is important to also include measures of perceived participation when studying online student participation.

Secondly, task support relations are essential, especially when students produce some kind of product, such as an assignment, in collaboration with peers. Therefore, it is important that online students gain support to accomplish such exchanges (Haythornthwaite, 2002). In some comparative studies of asynchronous and synchronous media, information exchange and task support have been analyzed as a single entity (e.g., Chou, 2002; Davidson-Shivers, et al., 2001). Unfortunately, these studies do not acknowledge that task-related interaction may either be related with content or management of a task (Haythornthwaite, 2002).

Finally, social support relations are desirable when maintaining relationships to foster knowledge work and collaborative learning (Cho, et al., 2005; Kreijns, et al., 2003). Such relations are important to create an atmosphere where communication is encouraged. Jokes may help students feel welcome, anecdotes and personal experiences encourage trust, which in turn foster receptive and creative learning environments (Hillman, 1999; Malmberg, 2006). The degree of social bonding that occurs in online education varies and is probably dependent on many factors. For example, in a study of a ten-week online course students rarely exchanged social and emotional support (Hrastinski, 2006) while another study of a two-year library program identified many examples of such exchanges (Haythornthwaite and Kazmer, 2002).

Method

Two central questions in case study research are whether to include one or several cases, and whether to use several data collection methods. The obvious advantage of the single-case design is that the chosen case can be analyzed more thoroughly. However, multiple-case designs may be preferred since there are analytical benefits of having several cases (Yin, 2003). By focusing on two case settings, the cases can still be studied thoroughly but it is also possible to elucidate more general results.

A major strength of the case study method is the possibility of using several sources of evidence (Yin, 2003). Benefits of combining data collection methods include conclusions that become more convincing and findings that can be cross-validated through triangulation (Cavaye, 1996; Yin, 2003). When departing from Wenger's (1998) definition of participation more than "simple" measures, such as the number of messages in discussion boards, are needed. An assumption of this paper is that participation is a complex phenomenon, which motivates using several data collection methods in order to gain a richer and deeper understanding (Cavaye, 1996). Consequently, electronic logs, questionnaires and interviews were used to collect both actual and perceived measures on student participation in two case settings.

Research setting

The first case setting is a series of online discussions with students from two courses in Knowledge Management. One of the courses was delivered by a university in Argentina and the other at a university in Sweden. Students from the two universities participated in two asynchronous and two synchronous text-based online discussions over a two-week period. The online discussions followed introductory on-campus sessions. Although the Argentineans and Swedes never met, introductory sessions were arranged in Argentina and Sweden respectively.

The second case setting is an online course in Change and Knowledge Management. It is the first course in a Swedish part-time master program and it is equivalent to ten weeks of full-time studies. The students of the course participated in two asynchronous and two synchronous text-based online discussions over four weeks. The online discussions followed introductory on-campus sessions. Descriptive data for the students of the two case settings are presented in Table 3 and were collected via the questionnaires discussed below.

Table 3. Age and gender of the students				
	Mean age	Age range	Males	Females
Case 1 (n=8)	38	23-52	5	3
Case 2 (n=19)	43	28-56	5	14

In the discussions of both case settings, the teacher suggested questions for the group to discuss and also asked students to submit questions. The synchronous discussions were scheduled for three hours and students worked in small groups while the asynchronous discussions were scheduled over a week. The internal validity of the study may be questioned since the students were divided into smaller groups in the synchronous discussions but not in the asynchronous ones. However, the decision to configure the two types of discussions differently was informed by research. Asynchronous discussions have been recommended to be conducted in larger groups since this creates a greater potential for interaction (Caspi, et al., 2003), while chat discussions are recommended to be conducted in smaller groups since students otherwise find it difficult to maintain a logical sequence of speakers' contributions (Mazur, 2004) and to keep message load manageable (Haythornthwaite, 2006).

Data collection

It is commonly debated whether interpersonal relations should be studied by seeking to measure existing relations or "relations as perceived by actors involved in them" (Marsden, 1990, p. 437). Marsden argues that respondents are capable of reporting on their relations in general terms but cannot be expected to "give useful data on detailed discussion topics or the exact timing of interactions" (p. 456). There is evidence from research on online education

that supports this claim. Picciano (2002) found that students who posted few messages in a discussion board perceived themselves to have made a higher number of postings than they actually did while those that posted many messages perceived themselves to have made fewer postings than they actually did. Similarly, Hrastinski (2006) reported that some students did not feel that they communicated with peers even though they submitted a high number of messages. Since actual and perceived participation may differ (Ng and Detenber, 2005; Picciano, 2002) it was decided to triangulate measures of actual and perceived participation, in order to gain a deeper understanding.

Actual participation

Electronic logs were used to study the interpersonal relations that were maintained among students, i.e. one of the two parts of Wenger's (1998) definition of participation. Quantitative measures such as the number of postings are commonly used when evaluating student participation. Such numbers provide too little information about the nature of the interactions (Hillman, 1999). For that reason it is also necessary to study the actual interactions to understand what is being discussed (Goldman, et al., 2005; Hillman, 1999). For example, frequency counts of messages or words do not reveal whether students are exchanging information, planning work or supporting each other socially.

As recommended by Hillman (1999), complete sentences were used as unit of analysis. Fixed units, such as sentences, are more objectively recognizable (Rourke, et al., 2000) as compared with more dynamic thematic units such as "units of meaning" (Henri, 1991). Sentences as unit of analysis have been proved to be easy to use and reliable, even though it has also been acknowledged that dividing text into sentences may be inconsistent, especially when communication is informal (Hillman, 1999; Rourke, et al., 2000). Synchronous discussions typically contain short and incomplete sentences. Incomplete sentences, which were most commonly found in the synchronous transcripts, were combined to complete ones. For example, the following chat lines were combined to one sentence: "for example... / when you already told your boss you want to leave / and they say 'I [will] give you extra money' or things like that" (Transcript, Synchronous discussion). The sentences of the discussions were classified according to the three types of exchanges described in the previous section. Table 4 contains examples of classified sentences from the electronic logs. Some sentences included more than one type of exchange and were counted in each category.

Table 4. Examples of sentences classified as information exchange, task support and social support		
Type of exchange	Synchronous discussion	Asynchronous discussion
Information exchange	"A lack of competence among the employees might explain why the customers are not satisfied."	"A person who is by himself and do not share knowledge is not as attractive in the eyes of the company."
Task support	"OK, I'm not with you now - which question are we discussing?"	"I have created a thread where we can discuss assignment 2."
Social support	"Well done!"	"That's great to hear!"

Perceived participation

Questionnaires and interviews were used to study perceived participation, i.e. whether the students felt that they took part and whether they felt they maintained interpersonal relations with peers. The students were asked to submit a questionnaire after each discussion. A measure on perceived participation was developed by combining items adapted from several sources: Gunawardena and Zittle's (1997) social presence scale, Haythornthwaite's (2000) items on sense of belonging, Rovai et al.'s (2004) classroom and school community inventory, and Webster and Hackley's (1997) measure on involvement and participation. There were eight items that were measured on a seven-point ordinal scale.

Perceived interpersonal relations were studied by using a social network approach, where the most common unit of analysis is the interactions between actors, i.e. relational data (Scott, 1991). The approach provides a set of techniques for understanding patterns of relations between and among people (Garton, et al., 1999) and has been argued to be a viable tool for evaluating the character of online group dynamics in learning settings (Daugherty and

Turner, 2003). In this study, two of the most commonly used techniques are relied on, network density and sociograms. Network density indicates the number of reported ties relative to the maximum possible number of ties (Wasserman and Faust, 1994). Sociograms have been of great illustrative importance ever since the 1930s and is a technique for drawing comprehensible diagrams for smaller sets of actors (Moreno, 1934; Scott, 1991).

When collecting data for the first case, every student was asked to what extent information, task support and social support were exchanged with each other student on a seven-point ordinal scale after each discussion. The scale ranged from strongly disagree (1) to strongly agree (7). An exchange was noted for students that agreed or strongly agreed (6-7) that any of the three types of exchanges had occurred. However, for the second case, it became too complex for students to assess the strength of ties with 18 other students. Therefore, a nominal scale had to be used, i.e., each student was asked whether or not information, task support or social support was exchanged with each other student after each discussion. Adjustments were made for missing questionnaire data by taking the responses others gave for interaction with the student during the time period (Haythornthwaite, 2001).

The number of participants in each discussion, and the number of them that also submitted a questionnaire, is summarized in Table 5. For example, six out of the eight enrolled students (75%) of the first case participated in the first asynchronous discussion. All of them (100%) completed the questionnaire. The most common reason for not participating in a discussion was work commitments. For the second case, some participants did not complete the questionnaire despite being reminded.

Table 5. Number of participants and response rate for each discussion							
	Case 1				Case 2			
	Participants		Respondents		Participants		Respondents	
	n	%	n	%	n	%	n	%
Asynchronous 1	6	75	6	100	19	100	16	84
Synchronous 1	7	88	7	100	18	95	17	94
Asynchronous 2	5	63	5	100	19	100	16	84
Synchronous 2	6	75	6	100	16	84	14	88
Total	24	75	24	100	72	95	63	88

Twelve half-hour telephone interviews were recorded and transcribed. For the first case, two Argentinean and two Swedish students were interviewed. They are referred to as Female #1 and Male #1-3 in the paper. For the second case, eight interviewees were randomly selected. They are referred to as Female #2-6 and Male #4-6 in the paper. All interviews were conducted within one month after the discussions were finished and aimed to get a richer view of participation in the asynchronous and synchronous online discussions. The interviews were conducted in a "conversational manner" even though an interview guide was used (Yin, 2003). The following is an example of a question from the interview guide: "Did you feel that you had a closer relation with the other students in the asynchronous (discussion board) or synchronous (chat) online discussions? Why?" The data from the interviews was categorized according to the research questions.

In the next section, students' sense of participation in the asynchronous and synchronous settings is revealed. Then, communication patterns, perceived social networks and student opinions are presented, which may help to explain why students' sense of participation differed when using different media. It is assumed that relying only on one of these measures does not address the complexity of online participation. However, the combination of these measures can give a deeper understanding of online participation by different media.

Results

The questionnaire contained a measure of perceived participation that consisted of eight items, which were measured on a seven-point ordinal scale. The measure was reliable in both the smaller class (Cronbach's $\alpha = .90$) and the larger class (Cronbach's $\alpha = .93$). Table 6 displays descriptive statistics for each item in the measure. It

shows that the means for all items were higher when the synchronous medium was used. When comparing the total means of Table 6, the difference in students' sense of participation between the two types of media was smaller in the larger group. Differences in means of items for both cases indicate that the students especially felt that the synchronous discussions included social interaction (item 2). However, the high standard deviations of this item show that the students disagreed about this to a quite a large extent. The students of the smaller class felt more connected to others (item 8) when using the synchronous medium as compared with when using the asynchronous one.

Table 6. Students' sense of participation in synchronous and asynchronous online discussions								
	Case 1				Case 2			
	Synchronous (n=13)		Asynchronous (n=11)		Synchronous (n=31)		Asynchronous (n=32)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
1. I felt like the participants in the discussion worked together.	5.7	1.2	5.1	1.8	5.9	1.3	5.2	1.1
2. I felt that the discussion included social interaction.	5.4	1.7	4.1	2.0	5.7	1.4	4.9	1.4
3. As a student, I felt part of the discussion.	6.2	0.7	5.5	1.3	6.0	1.0	5.6	1.3
4. I felt comfortable interacting with participant(s).	6.1	1.0	5.4	1.8	5.7	1.4	5.6	0.8
5. As a student, I felt personally involved in the discussion.	6.2	0.7	6.1	0.7	5.9	0.9	5.6	1.2
6. I felt that my point of view was acknowledged by others in the discussion.	6.2	0.6	5.5	1.8	5.8	1.0	5.3	1.0
7. I felt that students in the discussion cared about each others' opinions.	6.0	0.7	5.3	1.6	5.9	1.3	5.6	0.9
8. I felt connected to the others in the discussion.	5.8	1.0	4.8	1.8	5.9	1.1	5.5	1.0
Total	6.0	1.0	5.2	1.7	5.7	1.2	5.4	1.1

The eight items were also combined into the categories strong (6-7), intermediate (3-5) and weak (1-2) sense of participation to simplify interpretation. As displayed in Table 7, 24 and 63 questionnaires were completed in the first and second case respectively. All items were answered by the respondents of the first case (24x8=192), while one item was left unanswered in the second case (63x8=504). Drawing on the data, the percentage of items indicating strong sense of participation was higher when using synchronous chat. The percentage of items indicating strong sense of participation was 72-75% in the synchronous setting but 55-57% in the asynchronous setting (see Table 7). These findings are corroborated by the interviews where it was found that seven interviewees felt they participated more actively in the synchronous setting. Three interviewees did not feel there was a difference between the two media while the remaining two felt they participated more actively in the asynchronous setting. Next, results that may contribute towards understanding why students felt they participated more actively in the synchronous setting is presented.

Table 7. Students' sense of participation by case and media							
	Case 1 (n=24)[1]				Case 2 (n=63)[2]		
	Strong n (%)	Intermed. n (%)	Weak n (%)	Total n (%)	Strong n (%)	Intermed. n (%)	Weak N (%)	Total n (%)
Synch.	78 (75)	25 (24)	1 (1)	104 (100)	178 (72)	64 (26)	6 (2)	248 (100)
Asynch.	50 (57)	29 (33)	9 (10)	88 (100)	140 (55)	107 (42)	8 (3)	255 (100)
Total	128 (67)	54 (28)	10 (5)	192 (100)	318 (63)	171 (34)	14 (3)	503 (100)

[1] Chi-square (d.f. = 2) = 11.6, p < .005

[2] Chi-square (d.f. = 2) = 15.5, p < .001

Communication patterns

In Table 8, the number and percentage of sentences for the three types of exchanges are presented. The asynchronous discussions were more focused on exchanging information, especially in the smaller class. In the synchronous discussions, less than 60% of the sentences were classified as information exchange. Instead, task support and social support exchanges were more common. Note that higher total frequencies of sentences were produced in the synchronous discussions. This was especially evident in the smaller class. However, in the larger class, the students wrote a higher number of sentences classified as information exchange in the asynchronous discussions.
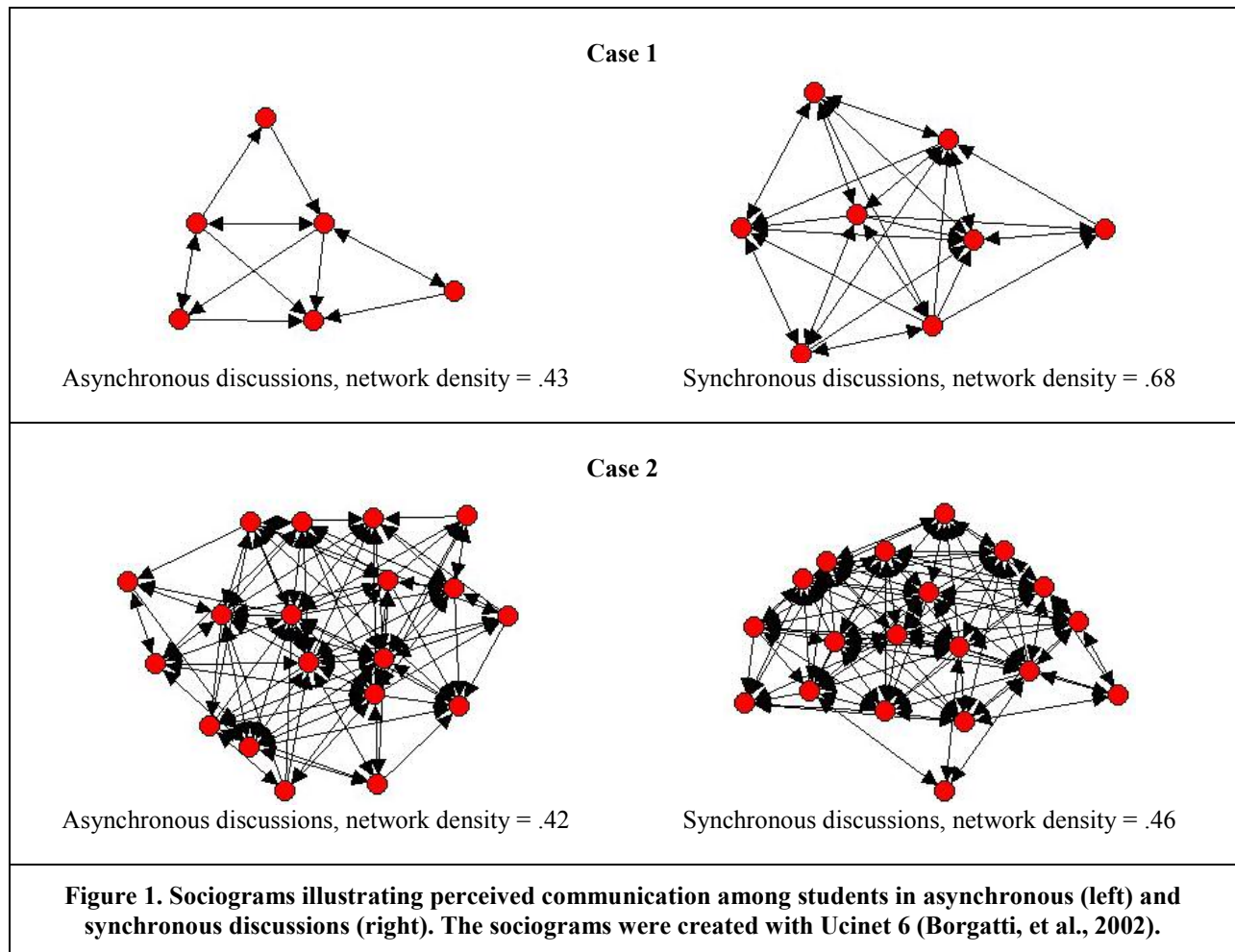
Table 8. Number of sentences by type of exchange and in total							
	Case 1 (n=24)				Case 2 (n=72)			
	Synchronous		Asynchronous		Synchronous		Asynchronous	
	n	%	n	%	n	%	n	%
Information exchange	876	58	369	99	1816	57	2438	93
Task support	507	34	5	1	935	29	131	5
Social support	198	13	2	1	572	18	124	2
All exchanges	1507	100	375	100	3173	100	2608	100

Several interviewees explained that participation in the asynchronous setting was limited by time: "It takes time to write and to read every post and maybe you try to find time to do that … and you start to say: I'll do it tomorrow and I'll do it tomorrow and the days keep on going until you really do" (Male #2). However, in the synchronous discussions, participation could not be postponed. Moreover, some students felt that "much was already said … the first or second day" (Female #3) in the asynchronous discussions and they did not want to repeat what had already been written, while this was not mentioned in relation with the synchronous discussions, probably since the students discussed questions in smaller groups. Another factor revealed in the interviews was that the interviewees felt they "kept to the subject" (Male #3) in the asynchronous discussions while the synchronous discussions enabled them to maintain more personal relations. For example, most students exchanged social support in between the group discussions, which several students acknowledged as important for getting to know other students better, especially because the classes seldom or never met face-to-face.

Table 9 displays the mean number of sentences that was submitted by each student and standard deviations. The high standard deviations for information exchanges in the asynchronous environment and social support exchanges in the synchronous environment show that the number of sentences contributed differed to a large extent between

students. For example, one student said that she is not "the kind of person that can write long texts" and also did not feel like exchanging social support with others: "I try to stick with the tasks. I think it is a bit hard [to exchange social support] since we only met once … I want to meet people several times before I can [do that]" (Female #3).

Table 9. Mean number of sentences per student and standard deviations								
	Case 1 (n=24)				Case 2 (n=72)			
	Synchronous		Asynchronous		Synchronous		Asynchronous	
	n/stud.	SD	n/stud.	SD	n/stud.	SD	n/stud.	SD
Information exchange	54	17	20	15	51	18	59	35
Task support	18	6	0	0	23	7	2	2
Social support	13	9	0	0	15	10	3	3
All exchanges	86	30	20	15	84	26	62	36

Case 1

Asynchronous discussions, network density = .43   Synchronous discussions, network density = .68

Case 2

Asynchronous discussions, network density = .42   Synchronous discussions, network density = .46

Figure 1. Sociograms illustrating perceived communication among students in asynchronous (left) and synchronous discussions (right). The sociograms were created with Ucinet 6 (Borgatti, et al., 2002).

Perceived social networks

Figure 1 display sociograms and network densities by medium and case, as perceived by the students. A tie was included if a student agreed that an exchange occurred in at least one of the two synchronous or asynchronous discussions. The students of both classes reported stronger overall network densities in the synchronous setting, especially in the smaller class. This finding underlines the fact that students not only produced more text in the synchronous discussions, but that they also felt they maintained more ties with peers. This was also evident in the interviews where eight students said they maintained ties with more students in the synchronous settings. Three interviewees did not feel that was a difference between the two media while one felt that he maintained ties with more students in the asynchronous setting. The synchronous discussions were experienced as more interactive, because discussions were conducted in real-time and in smaller groups. This configuration made the students feel confident that there would be a reply when asking a question.

Most students acknowledged that the two types of media promote different kinds of participation. Thus, even though the two sociograms of the second case look similar, they illustrate different kinds of ties. The interviews revealed that the focus of the synchronous discussions was on quantity, i.e. trying to write something fast before "someone else will say what I was going to say" (Female #3). This led to "more of a discussion … rather than a monolog" (Female #4), which might have contributed to that a slightly higher number of ties being maintained among students. However, in the asynchronous discussions, the focus was on quality, which also explains why students produced fewer sentences in this setting. This was especially appreciated in the larger class.

Discussion

In this study it was investigated how using synchronous chat, as a complement to asynchronous discussion board, affects student participation in online discussions. The results from both cases indicate that the use of synchronous chat has the potential to enhance student participation when conducting online discussions. This conclusion was based on the following indications:

(1) The students wrote a higher number of sentences classified as task support and social support in the synchronous discussions of both classes, and a higher number of sentences classified as information exchange in the synchronous discussions of the smaller class. Notably, the students of the smaller class wrote four times as many sentences in the synchronous discussions.
(2) The standard deviations of sentence counts per student were lower for information exchanges when using the synchronous medium. This indicates that the synchronous medium enabled more equal participation.
(3) The perceived social networks were denser in both settings when using a synchronous medium, especially in the smaller class.
(4) The measure on students' sense of participation was higher in both settings, especially in the smaller class, when using a synchronous medium.

There is some evidence from previous research that confirm these findings. Previous studies have found that students communicate more in synchronous environments (Bonk, et al., 1998; Davidson-Shivers, et al., 2001; Mabrito, 2006; Schwier and Balbar, 2002). Moreover, Leidner and Jarvenpaa (1995) argued that synchronous chat facilitates increased and gave rise to more equal student participation, as compared with the traditional classroom, when reviewing research. Notably, differences in participation were especially evident in the smaller class, which may be explained by the "critical mass" (Markus, 1987) to get discussions going in synchronous settings seem to be lower (Caspi, et al., 2003; Palloff and Pratt, 1999). It should be noted that, even though students seem to communicate more in synchronous environments, it has been found that conversations are more concise and egocentric (Bonk, et al., 1998; Mabrito, 2006).

The findings from both cases indicated that the use of synchronous chat, as compared to asynchronous discussion board, induced a higher relative degree of social support exchanges. The synchronous discussions included quite a number of social support exchanges (13-18%) while the asynchronous ones included very few such exchanges (1-2%). Similarly, Hillman (1999) reported that 2% of the sentences in asynchronous discussions were classified as social support. Moreover, the second item in the measure of perceived participation revealed higher means for the statement "I felt that the discussion included social interaction" when using synchronous chat. It should, however, be noted that both sentence counts per student and the second item were related with high standard deviations, i.e., some students exchanged social support frequently, while others chose not to engage in such exchanges. One reason for the higher levels of social support exchanges in the synchronous setting seem to be that students feel that it is a

more natural medium for communicating and maintaining social support relations (Kock, 2005; Malmberg, 2006). In line with the results of Orvis and colleagues (2002), exchanges of social support in the synchronous setting followed temporal patterns. Social interaction usually occurred in the beginning and end of class and in between group discussions. The classes under investigation in this paper followed a tight schedule, which may be one reason for a lower level of social support compared with some previous studies. For example, Chou (2002) classified 33% of sentences examined as socio-emotional in a CMC systems course, Mabrito (2006) classified 33% of communication units as general conversation in a business writing course and Orvis and colleagues (2002) classified 30% of chat lines as social in online military training.

The content analyses of both cases also indicated that the use of synchronous chat, as compared to asynchronous discussion board, induced a higher relative degree of task support exchanges. In the synchronous discussions, the students had to decide what to discuss, and how to sum up and present the results of their discussion within a specific time period. This explains the high percentages of sentences classified as task support exchanges (29-34%). Interestingly, Malmberg (2006) found that self-organizing groups of students who had access to both discussion board and chat chose the latter to support task support relations.

The fact that students spent more time on task and social support in the synchronous discussions may be interpreted differently depending on the aim of the learning activity. On the one hand, less time is spent discussing content and thus being engaged in what some label substantive communication (Davidson-Shivers, et al., 2001). On the other hand, students gain experience in collaborating online and functioning in a group (Haythornthwaite, 2006). Also, discussing things other than course literature, for example, supporting each other socially seems to have led to an enhancement of students' sense of participation and community (Mabrito, 2006). This conclusion is supported by Ng and Detenber (2005) who argue that asynchronous discussions may be experienced as more static and less interactive as compared with synchronous conversations.

To better understand why the use of chat positively affected student participation, one can turn to the cognitive model of media choice (Robert and Dennis, 2005). It proposes that synchronous communication makes it possible to monitor the receiver's reaction to a message so that the receiver will be more committed and motivated to read it. However, when communicating asynchronously, the receiver has more time to comprehend the message since the sender does not expect an immediate answer. Thus, the cognitive model of media choice predicts that synchronous communication increases student motivation but decreases their ability to process information. By combining the insights from their model with the findings of this study, the concepts of *personal participation* and *cognitive participation* are introduced. Personal participation describes the more intense type of participation supported by synchronous communication while cognitive participation describes the more reflective type of participation supported by asynchronous communication. The first type seems to better support less complex information exchanges, including task support and social support exchanges, while the second type seems to better support reflection and discussion of complex ideas.

Limitations and further research

This paper was based on two cases, which were studied sequentially. The first case was completed and reported (Hrastinski, 2007) but later yet another case setting was decided to be included with the aim of creating more general results. As mentioned in the method section, different scales (nominal and ordinal) were used when collecting social network data in each case. An implication is that some of the richness of the data on ties between students from the first case may have been lost when simplifying the data set (Wasserman and Faust, 1994). Another issue related with the first case is that both Argentineans and Swedes were included. The results might have been different if the students were of the same nationality. For example, the students might have participated more actively if the online discussions had been conducted using the native language of the students.

This study and most of the reviewed ones, focused on text-based media. However, as more advanced synchronous software become available, audio and video media will become more widely used. For example, in a study of an advanced synchronous system (ElluminateLive!™) it was reported that the most widely used feature was audio conversations followed by chat (Schullo, et al., 2005). Researchers are encouraged to build on the conclusions proposed here when studying other media and settings.

Conclusions

This study has showed that using synchronous chat, as a complement to asynchronous discussion board, has the potential to affect student participation positively in online discussions. This was confirmed by measures on actual as well as perceived participation, which showed that the students felt they were "taking part" and that they maintained "relations with others" (Wenger, 1998, p. 55). The synchronous discussions enabled higher sentence counts, more dense perceived social networks and stronger sense of participation. These discussions were more focused on task and social support when compared with the asynchronous discussions. The differences in levels of student participation, when comparing participation for the two media, were especially evident in the smaller class. This may be explained by the fact that the "critical mass" (Markus, 1987) to get discussions going in synchronous settings seem to be lower (Caspi, et al., 2003; Palloff and Pratt, 1999). Since these conclusions are drawn from two case settings, they need to be interpreted cautiously. The results are nevertheless promising, since student participation has been argued to underlie other important variables such as learning outcomes (e.g., Hiltz, et al., 2000), retention rates (e.g., Rovai, 2002) and student satisfaction (e.g., Alavi and Dufner, 2005).

In the synchronous discussions, the students felt that they worked together, because they were confident that someone would respond to their ideas, and they did not feel restricted to only discussing course content. These seem to be key factors in enabling *personal participation*, which should be regarded as a complement to *cognitive participation*, which is better conveyed in asynchronous discussions. The following quote summarizes well the lessons that can be learnt from this study: "I think that [chat] was needed too because when you post something [in the discussion forum] you are not feeling that the other people are there … You don't feel like you're talking to someone, it's more like talking to a system. [In the chat] you are feeling that you are talking directly with the people and … the people on the other side are hearing you and answering you. I like that." (Male #2).

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