The Relationship between Using an Informal Synchronous Medium and Participation in Online Group Work: An Explorative Study


Achieving student participation has been argued as one of the most important challenges in distance education. This explorative study examines whether a synchronous communication medium, instant messaging (IM), may enable students to participate more actively in online group work. When comparing two groups that adopted IM with two groups that did not, it was found that the adopters were related with a higher sense of participation, and spent more time working with content and communicating with peers. Moreover, the social networks of the adopters were slightly denser. Thus, the study indicates that the groups that adopted IM operated with a higher level of participation even though it should be noted that these results are based on a small group of students. All groups used e-mail for group interactions but the adopters also used IM as a complement to e-mail. The paper is concluded by calling for more research that tests the results of this study in other contexts.

Keywords: Computer-mediated communication; Participation; Synchronous communication; Instant messaging; Online education

Introduction

A lack of informal and social communication has been reported in distance education (Contreras-Castillo, Favela, Perez-Fragoso & Santamaria-del-Angel, 2004), which is unfortunate since it is important when creating bonds of community and a prerequisite for participating in learning communities (Haythornthwaite, 2001). On a traditional campus, there are common spaces such as hallways and cafés which better support informal and social communication in comparison with a classroom or lecture hall (Nicholson, 2002). Many students on a traditional campus choose to participate in such spaces. However, equivalents hardly exist for distance students. In a major evaluation of the most common virtual learning environments, Britain and Liber (2004) found that possibilities for students to engage in self-organizing activities are rare, which implies that “personal exploration of ideas is not valued nor encouraged” (p. 17). Consequently, the widely acknowledged fact that students learn and support each other both inside and outside the classroom (Brown & Duguid, 1996; Ramsden, 1992; Rovai, Wighting & Lucking, 2004) is overlooked in research on distance education (Britan & Liber, 2004).

There are probably many ways to improve the current situation. For example, Nicholson (2002) has argued that instant messaging (IM) systems may enable informal and social communication in online education “by providing the ‘virtual hallways’ for students and instructors to meet” (p. 363). IM is a synchronous communication medium that can be used to maintain a list of “friends”. These friends
can be contacted, when being online and running the software, by text messages or initiating a chat, audio or video conferencing session. It has been argued that IM is more informal as compared with common synchronous media, such as chat and videoconferencing, since meetings do not need to be scheduled (Contreras-Castillo et al., 2004). Instead, students can spontaneously communicate with peers when they are online.

It has been reported that adolescents use IM to interact socially (Boneva et al., 2006) while employees use it to communicate with co-workers (Shiu & Lenhart, 2004). Moreover, there seems to be a “mass adoption” of IM systems by students at European and American universities (Beuschel, Gaiser & Draheim, 2003). Because many students seem to like and already know how to use IM systems, they may also have the potential to become commonly used in educational settings. Nicholson (2002) presented promising results on the use of IM in an online course but his findings may be specific to the context of the study, a master class in library science. Moreover, a weakness of the study is that it does not draw from a theoretical base. Even though IM has already been used for a couple of years in online education (e.g., Eisenstadt, Komzak & Dzbor, 2003), few have conducted evaluative studies.

The primary aim of this study is to evaluate whether the use of an IM system, as a complement to established asynchronous media such as e-mail and discussion board, may support students in participating more actively in group work. This may be likely since an IM system may enhance support for interaction between students. Thus, the following research question underlies this study: *How will the possibility to communicate synchronously via an IM system affect student participation in online group work?* Participation, which is discussed more thoroughly in the next section, is defined as “a process of taking part and … the relations with others that reflect this process” (Wenger, 1998, p. 55). A detailed description of student participation will be given by comparing four groups that were engaged in an assignment to be finished within a two-week period. When addressing the research question it is also needed to understand how the IM system, as compared with other means of communication, was used.

The paper is organized as follows. Next, the theories that guided the analysis of student participation are briefly outlined. Then, the underlying method of the study is discussed. This is followed by a presentation of the results. Finally, the results are analyzed, limitations and suggestions for further research are put forward, and the main conclusions are presented.

### Analyzing Online Participation

#### Virtual Communities as Social Networks

Howard Rheingold (1993) popularized the term “virtual community” by writing what is surely the most read book on the subject. He defined a virtual community as “social aggregations that emerge from the Net when enough people carry on those public discussions long enough, with sufficient human feeling, to form webs of personal relationships in cyberspace” (p. 5). When he wrote his definition, webs of relationships had already been researched by social network analysts for decades offline but also more recently online. Rheingold (2000) acknowledged this in the revised edition of his book: “If I had … learned about social network analysis when I first wrote about cyberspace cultures, I could have saved us all a decade of debate by calling them ‘online social networks’ instead of ‘virtual communities’” (p. 360).
Social network analysis provides a set of techniques for understanding patterns of relations between and among people, groups and organizations (Garton, Haythornthwaite & Wellman, 1999). One of the most intriguing challenges in research on distance education during the 1990s and ever since has been to understand the relations between students (Moore, 1989). Social network analysis seems particularly suitable for examining those relations because the most common unit of analysis is the interactions between actors, i.e. relational data (Scott, 1991). The approach has been argued to be a viable tool for evaluating the character of online group dynamics (Daugherty & Turner, 2003).

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 1). 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 members of the network as possible. Secondly, social support has been acknowledged as complementing information exchange (Wellman & Gulia, 1999). Social support may be “interpreted as a means of maintaining and improving relationships to foster knowledge work” (Cho, Trier & Kim, 2005). Finally, task support relations are “needed to bring projects to conclusions” and therefore students “need means to accomplish these exchanges” (Haythornthwaite, 2002, p. 174). These three types of exchanges are also commonly addressed in the social networks, management and social psychology literature, and may be regarded as standard categories when classifying communication in learning communities (Haythornthwaite, 2002; Münzer, 2003).

Table 1 about here

**Online Participation**

Active participation is necessary in order for students to learn (Brown & Duguid, 1996). Most research focused on learning processes in both face-to-face and computer-mediated settings agree upon that active participation improves learning. In empirical studies, learning has been measured in various ways such as final test grades, perceived skill development, self-reported learning, interest in learning, and deep level thinking (e.g., Alavi, 1994; Alavi & Leidner, 2001; Leidner & Jarvenpaa, 1995). Many studies have also reported other benefits when students become active participants. For example, distance students that interact interpersonally may be less likely to drop out (Rovai, 2002; Wegerif, 1998).

Presenting content does not equal teaching (Moore & Kearsley, 1996). It has been argued important that distance educators find ways to support students in becoming active participants (Bento & Schuster, 2003; Moore & Kearsley, 1996). Wenger (1998) refers to participation as “a process of taking part and also to the relations with others that reflect this process” (p. 55). Moreover, he argues that it is a complex process that combines doing, talking, thinking, feeling and belonging. When participation is being analyzed in online settings it is often measured as the number of posted messages (e.g., Arbaugh, 2000; Mazzolini & Maddison, 2003). However, some argue that the process of participation is more complex (Bento & Schuster, 2003; Wenger, 1998).

One step towards a better measure of participation may be achieved by combining two dimensions, interpersonal interaction and interacting with content (Bento & Schuster, 2003). When transferring Wenger’s (1998) reasoning to an online learning
context, it becomes clear that just counting the number of messages is not sufficient
evidence to label some students as more active participants than others.

Participating in and feeling attached to a group are dual processes. People who
have a strong attachment to a group are more likely to participate and help others.
Conversely, participating and helping others drive group attachment (Wellman &
Gulia, 1999). Thus, when assessing participation in groups the importance of group
attachment should not be forgotten.

In the next section it is described how, based on the theory discussed above, data
on student participation were collected. It is suggested that combining qualitative and
quantitative data collection methods may better address the complexity of the
participation process.

Method

Research Setting
A course entitled Business English Online, delivered without any face-to-face
meetings, has been investigated. “The course is aimed at those who need to improve
their business communication skills but cannot attend a daytime course. The emphasis
is on using English for business and aims at developing reading and writing skills in
particular, as well as increasing vocabulary” (Soames, 2004). The course involves
group discussions, and continuous assessment of individual and group work.

Ever since the course was first offered in 2001, it has been delivered
asynchronously and participants have communicated mainly via e-mail and discussion
boards. However, there have been exceptions since some students themselves chose to
communicate synchronously (face-to-face, telephone, IM) with fellow students and
the teacher. One recurring problem has been to get students to work in groups. A
common feeling of annoyance has been caused by waiting for answers from their
group members. Many have preferred to work individually and have only engaged in
a one-to-one relationship with the tutor (Lindh, Hrastinski & Soames, 2005). To try to
make it simpler for students to communicate with each other, without having to wait
too long for answers, an IM system (MSN Messenger) was introduced. Previously,
students have suggested that IM may be useful in group work (Nicholson, 2002). The
IM system was associated with an introductory activity that was mandatory. After
that, using IM was voluntary.

The course was delivered over ten weeks with a course load of twenty hours per
week. This study focuses on the fourth and fifth week of the course. During these two
weeks students were expected to complete a group project. The task was to devise
three gap-fill exercises. These were then used to test another group on how tenses
work in English. The students worked in four groups (A-D). Data, collected via a
questionnaire (see below), that describe the students are displayed in Table 2.

Table 2 about here

Data Collection
A major strength of the case study method is the possibility to use many sources of
evidence, which makes data triangulation possible (Yin, 2003). The data were
primarily triangulated in two ways. Firstly, both diaries and questionnaires collected
data on how student participation may have been affected in the groups that adopted
IM. Secondly, both diaries and interviews collected data on student use and opinions of IM when being engaged in online group work.

**Diary.** The diary approach was used to examine who was connected whom, about what and by which media. When using the diary as a research tool it may range from being totally unstructured to containing specific questions (Robson, 2002). The main disadvantage of unstructured diaries is that the interpretation of the task is left to the respondent (Mintzberg, 1973; Robson, 2002). More specific questions help respondents to record their activities quickly – otherwise they might lack time to record certain events (e.g., a brief contact). However, using specific questions may be disadvantageous since the task is simplified and structured which may result in data that are prone to bias. In this study it was intended to collect specific data and therefore specific questions were developed.

For each conversation, students were asked to specify which type(s) of exchanges that described it: information exchange, social support and task support (see Table 1 which was distributed to the students). Some may argue that these categories are too broad. However, more specific coding of exchanges between students may become less reliable (Bonk & King, 1998), especially since students themselves categorize the exchanges. The respondents were also asked which mean(s) of communication that was used in each conversation. Finally, they were asked to give a short description of the conversation. The diary also included a separate section where students were to record experienced advantages and disadvantages with using IM to support group work throughout the two-week period. All students were contacted in the beginning of the time period in order to better ensure that they recorded their conversations consistently and continuously (Mintzberg, 1973). A complete diary was completed by all but one student.

**Questionnaire.** Drawing on the previous theoretical discussion of what constitutes student participation, a questionnaire was developed to collect descriptive statistics at the end of the two-week period. A measure on students’ sense of 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 and colleagues’ (2004) classroom and school community inventory; and Webster and Hackley’s (1997) measure on involvement and participation. By using this measure, it was possible to compare whether students’ sense of participation were higher in groups that adopted IM than in groups that did not. There were twelve items that were measured on a seven-point ordinal scale ranging from “strongly disagree” to “strongly agree”. For example, one item stated: “As a student, I felt personally involved in the group”. Moreover, two questions asked students to estimate how many hours they had spent engaged in interpersonal communication and working with course content (e.g., read literature, do exercises) during the two-week period when working with the assignment. All students completed the questionnaire.

**Interview.** Six half-hour telephone interviews with students from the class were recorded and transcribed. Out of these, three students were characterized as IM adopters and three as non-adopters (see below). All interviews were conducted within one month after the course was finished. The aim with the interviews was to get a richer view of how the IM system was used by the groups and also students’ opinions on using the system to support online group work. When each interview had been transcribed it was sent to the respondent for verification.
As reflected by the choice of data collection methods, students’ perceptions of exchanges and media use were of primary interest in this study. Electronic media is one of many ways the same people may interact (Wellman & Gulia, 1999). Individuals tend to, for example, meet face-to-face and communicate via the telephone, even when new media are introduced (Chen, Yen & Huang, 2004). One of the aims of this study was to compare IM with other means of communication including non-electronic communication media. The diary approach may therefore be useful since it is impossible to directly observe all interpersonal communication between students via all available means of communication.

**Results**

This section first compares the overall communication patterns for the groups that adopted IM and the groups that did not. This is followed by a description of how IM was used. Finally, data on student participation collected from IM adopters and non-adopters are compared.

**Overall Communication Patterns**

Examining the overall pattern of IM use reveals that especially group C, but also group B, adopted the IM system (see Table 3 and Figure 1). These groups had the longest prior experience of IM (see Table 2). Group A and D seldom used the IM system for conversations within the group; only two members in group D were weakly tied.

Table 3 about here

Figure 1 about here

The most commonly used communication media were e-mail and IM. Since students hardly communicated in other ways it was decided to focus on e-mail and IM use. The exceptions were one face-to-face meeting, two telephone conversations and two postings in a discussion board.

In Table 4, network densities for e-mail and IM are displayed. Network density indicates the number of pairs connected relative to the maximum possible number of pairs (see Table 3). The densities for IM adopters are calculated as the mean of densities for group B and C, and for non-adopters as the mean for group A and D. The IM adopters communicated via both e-mail and IM. Thus, IM seemed to complement e-mail rather than replace it.

Table 4 about here

In total, network densities for both task support and information exchange were as high for weak ties and slightly higher for strong ties for IM adopters as compared with non-adopters. Also, the adopters were the only ones that exchanged social support at all even though such interactions only occurred in group B. The adopters preferred IM but also used e-mail to support social support exchanges. The reason for not exchanging more social support seemed simply to be that many students did not feel a need for such exchanges. When taking this course, they were already engaged in full-
time study programs or work and many also had family obligations. As a consequence, they did not feel motivated to get to know other students enrolled in the course:

“Since I [study full-time] I already have class mates so this [course] was kind of extra. ... Maybe I was not motivated to socialize via the Net.” (Interview A2)

**IM Use**

The use of IM by the two groups classified as adopters (B and C) was quite different. Initially, group B used IM to support scheduled group meetings. However, since they found it difficult to communicate in groups of four they decided to try to be online during the afternoon or evening on a particular day. During these and other times, they used IM to support one-to-one informal communication within the group:

“Directly when you see that someone comes online you may remember: ‘Oh, I’ve to talk to him about something’ ... When you send an e-mail you do not know [when you get an answer] ... If something just pops up spontaneously ... it is easier to talk about it right away.” (Interview B4)

Group C preferred to use the IM system to support scheduled group meetings which involved all or a majority of the group members.

In total, group B engaged in ten IM conversations within the group. This and the following measures on the number of IM conversations were obtained after making adjustments for missing diary data by taking others’ responses. The most common type of exchange was task support (100%) followed by information exchange (60%) and social support (20%). This group communicated most frequently via the IM system and was the only one that reported exchanging social support. Even though information exchange was most common, one conversation could include all three types of exchanges:

“We ‘talked’ about [C3’s] business trip to Amsterdam [social support]. Then we discussed the gap-fills the other group sent us [information exchange] and that we were going to send our exercises to the teacher [task support].” (Diary B4)

As illustrated in Figure 2, in group B one woman (B4) occupied a central position in the network and used the IM system to disseminate information from and to all members of the network: “I sent [B1] some info about the thing that [B2] and I “talked” about yesterday” (Diary B4). Another woman (B3) chose a peripheral position despite having the longest experience of IM use in the class (4.5 years): “Usually, when I use it, it is only [for] social [communication] and maybe that is why I hesitated a bit – I haven’t that relation to any of these people whom I never have met” (Interview B3).

Group C engaged in three IM conversations within the group where task support and information exchange were equally common (50%). There were no occurrences of social support. As illustrated in Figure 2, no one occupied a central position in the network since all members met regularly in scheduled group meetings.

Figure 2 about here
According to the students there were some disadvantages with using IM to support group work, which may also be reasons for why some groups did not adopt the system. Several students felt that they engaged in few conversations since other students, which they would have liked to communicate with, seldom were online. Moreover, sometimes when other students were online, they were busy doing other things. At least three students experienced technical difficulties, which made it difficult or impossible to use the system. Initial technical difficulties seemed to be the reason why group D did not adopt the IM system: “If we hadn’t failed the first time we would surely have used it more. Now we [decided], let’s communicate via e-mail instead, and then it just kept on that way” (Interview D3).

**IM Use and its Relationship with Participation**

The questionnaire contained a measure on students’ sense of participation. It consisted of twelve items that initially were measured on a seven-point ordinal scale (Cronbach’s alpha = .89). Descriptive statistics for each item are displayed in Table 5. The items were later combined into the categories strong (6-7), intermediate (3-5) and weak (1-2) sense of participation to aid interpretation. Drawing on the data, the percentage of items indicating strong sense of participation for the IM adopters was 54% as compared with 28% for the non-adopters (see Table 6). Complementing this result, as has been stated above, the adopters were related with slightly higher overall network densities for strong ties.

**Table 5 about here**

**Table 6 about here**

Differences in means of items indicate that the adopters especially felt that they could rely more on others in their group and felt more personally involved in their group (item 6). Drawing on previous research, it was expected that the adopters would report a higher level of social support. However, the adopters and non-adopters did not feel that they talked regularly about personal matters (item 12) or interacted socially (item 2).

Complementing the measures on network density and sense of participation, students were also asked to estimate the number of hours spent communicating interpersonally and working with content associated with the assignment. The IM adopters perceived themselves to spend slightly more hours communicating interpersonally (M=2.9, 1.8; SD=1.3, 1.2) and working with content (M=13.6, 5.1; SD=12.2, 3.2) even though this issue needs to be examined more thoroughly.

**Analysis**

The main research question of this study was to investigate whether the groups that adopted the IM system operated with a higher degree of participation. In sum, the measures suggest that the groups that engaged in conversations via the IM system were related with a higher level of participation. Similar findings have been reported in other studies. In an online course, students who used an IM system felt a stronger sense of community (Nicholson, 2002). In a blended education setting, students collaborated more with peers and felt less isolated (Contreras-Castillo et al., 2004).
Moreover, a lack of feedback has been reported as one of the main disadvantages of asynchronous media, which makes students feel more isolated (Wegerif, 1998).

The study suggests that IM complemented rather than replaced e-mail. This is consistent with previous research stating that an increased use of one medium does not necessarily lead to the declined use of other media (Haythornthwaite & Wellman, 1998). This is also partly supported by Cameron and Webster (2005), who state that "employees use IM not only as a replacement for other communication media but as an additional method for reaching others" (p. 98). The fact that both IM adopters and non-adopters used e-mail is not surprising since e-mail has previously been reported to be commonly used for team support in specific, close knit groups in a class even when there are many other available media (Haythornthwaite, 2001; Haythornthwaite & Kazmer, 2002).

The two groups that adopted IM used it differently. At first group B used IM to support group meetings but later started to use it to support informal communication instead. Group C, however, used IM to support scheduled meetings throughout the two-week period. They were, thus, not utilizing the presence awareness function, which may be one of the main advantages of IM systems. When using the IM system for scheduled meetings the students could as easily have met in a traditional chat environment. IM may be more beneficial if the students are aware of its potential benefits such as spontaneously initiating conversations with peers.

It was found that IM was used for task support and information exchange rather than social support. However, it should be noted that the IM adopters were the only ones that exchanged social support at all. This underlines that IM systems will not, by default, be used for social exchanges – what types of exchanges that an IM system will support probably will depend on many so far unknown factors. Moreover, this finding questions the generalization of previous research on IM in an online course, which reported that such a system was mainly used for social communication (Nicholson, 2002). One difference between the course examined in this study and the one previously examined by Nicholson is that the latter group met face-to-face at the beginning of the course. A majority of social bonding in online courses has been reported to occur during on-campus sessions and then maintained via e-mail and synchronous media (Haythornthwaite & Kazmer, 2002). Consequently, a higher level of social support might have occurred by IM if students had previously met face-to-face.

It seems particularly important to support a wide range of media since different media complement each other (Haythornthwaite & Kazmer, 2002; Ligorio, 2001). Supporting this argument, Haythornthwaite and Wellman (1998) found that the more frequent the contact, the more media were used and a greater variety of exchanges occurred. So far, research on computer-mediated communication in education has mostly been focused on asynchronous media (Hrastinski, 2005). This may be problematic since only providing asynchronous media prevent “more rapid exchange of ideas and greater social presence perceived with synchronous distance interaction” (Haythornthwaite, 2002, p. 171). There is no doubt that the advantageous “anytime, anywhere” feature of asynchronous media make them unavoidable in online education. However, as reported in this and reviewed studies, there are also many advantages of synchronous media, which cannot be neglected.
Limitations and Further Research

The advantage of examining a small population is that IM use could be examined more in-depth by adopting several data collection methods. However, a disadvantage is that the results are based on a rather small population of adults engaged in a first-year business English course. Since the study is exploratory the results are preliminary and need to be tested in other contexts.

Because the students themselves decided if they wished to use IM or not, it could be studied whether and how students would adopt the medium in a natural setting. However, it cannot be concluded if certain types of students, who were already more interested in social participation, were more likely to be the ones to adopt IM. Thus, an investigation of the social preferences of the students prior to the study would have been in order.

The measurements aimed to grasp the complexity of online student participation. In doing this, it was aimed to move beyond labeling some students as more active participants than others solely based on how many messages they sent. This evaluation was based on students’ sense of participation, the social networks they belonged to, time spent interacting with others, and time spent working with content. This initial attempt can surely be further developed by, for example, refining existing measurements and adding new ones.

Conclusion

Based on a rather small and homogenous population it was shown that some groups adopted IM even though it was voluntarily to do so. Data indicated that these groups were related with a higher degree of participation in comparison with the non-adopters. The results of this study are promising since active participation by students has, among other things, been reported to improve learning outcomes and retention rates. The adopters used IM as a complement to rather than replacement of e-mail. Moreover, the students seldom used IM for social exchanges, which contradicts previous research. IM seems to be a fairly straightforward way for distance educators and developers of virtual learning environments to enable synchronous and informal interaction. In conclusion, since this is an exploratory study, more research is called for that further test the results put forward in other contexts.

Acknowledgements

An earlier version of this article was presented at the World Conference on Educational Multimedia, Hypermedia and Telecommunications in 2005. It has been submitted with permission from the Association for the Advancement of Computing in Education. This research was partly supported by The Swedish Research School of Management and IT. The work has benefited by comments on earlier drafts from, among others, Carol-Ann Soames, Jörgen Lindh, Christina Keller, Sven Carlsson, and the anonymous reviewers.
References


Rovai, A. (2002). Building sense of community at a distance. *International Review of Research in Open and Distance Learning, 3*(1), 1-16.


Figure 1. IM network - communication at least once (thin arrow) and at least weekly (thick arrow)

Figure 2. Number of conversations by IM between the adopters
<table>
<thead>
<tr>
<th>Type of exchange</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information exchange</td>
<td>Ask or answer a question</td>
</tr>
<tr>
<td></td>
<td>Share information</td>
</tr>
<tr>
<td></td>
<td>Express an idea or thought</td>
</tr>
<tr>
<td>Social support</td>
<td>Talk about other things than class work</td>
</tr>
<tr>
<td></td>
<td>Express companionship, emotional aid, or advice</td>
</tr>
<tr>
<td></td>
<td>Support during a minor or major upset (e.g., support when having</td>
</tr>
<tr>
<td></td>
<td>difficulties with an assignment)</td>
</tr>
<tr>
<td>Task support</td>
<td>Planning work, allocating tasks, coordinating joint efforts, or</td>
</tr>
<tr>
<td></td>
<td>reviewing drafts</td>
</tr>
<tr>
<td></td>
<td>Negotiating and resolving conflicts</td>
</tr>
</tbody>
</table>
Table 2. Age, gender and years of IM use for the respondents (n=14)

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean age</th>
<th>Age range</th>
<th>Males</th>
<th>Females</th>
<th>Years of IM use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A</td>
<td>28</td>
<td>20-36</td>
<td>1</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>Group B</td>
<td>25</td>
<td>24-38</td>
<td>2</td>
<td>2</td>
<td>1.9</td>
</tr>
<tr>
<td>Group C</td>
<td>34</td>
<td>25-42</td>
<td>2</td>
<td>2</td>
<td>2.7</td>
</tr>
<tr>
<td>Group D</td>
<td>27</td>
<td>24-32</td>
<td>-</td>
<td>4</td>
<td>0.5</td>
</tr>
<tr>
<td>Total</td>
<td>31</td>
<td>24-42</td>
<td>5</td>
<td>9</td>
<td>1.4</td>
</tr>
</tbody>
</table>
Table 3. Number of possible pairs and IM network density (adapted from Haythornthwaite, 2000)

<table>
<thead>
<tr>
<th>Group</th>
<th>Number of possible pairs</th>
<th>IM network density</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of respondents in group x (Number in group – 1)</td>
<td>Number of pairs / Number of possible pairs (communication at least weekly)</td>
</tr>
<tr>
<td>A</td>
<td>2 x (2 – 1) = 2</td>
<td>0</td>
</tr>
<tr>
<td>B</td>
<td>4 x (4 – 1) = 12</td>
<td>6 / 12 = 0.50</td>
</tr>
<tr>
<td>C</td>
<td>4 x (4 – 1) = 12</td>
<td>11 / 12 = 0.92</td>
</tr>
<tr>
<td>D</td>
<td>4 x (4 – 1) = 12</td>
<td>0</td>
</tr>
<tr>
<td>Frequency of communication</td>
<td>Media</td>
<td>IM adopters (n=8)</td>
</tr>
<tr>
<td>----------------------------</td>
<td>-------</td>
<td>-------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Task support</td>
</tr>
<tr>
<td>Weak ties (at least once)</td>
<td>IM</td>
<td>0.83</td>
</tr>
<tr>
<td></td>
<td>E-mail</td>
<td>0.58</td>
</tr>
<tr>
<td></td>
<td>All</td>
<td>0.88</td>
</tr>
<tr>
<td>Strong ties (more than weekly)</td>
<td>IM</td>
<td>0.33</td>
</tr>
<tr>
<td></td>
<td>E-mail</td>
<td>0.46</td>
</tr>
<tr>
<td></td>
<td>All</td>
<td>0.46</td>
</tr>
<tr>
<td></td>
<td>IM adopters</td>
<td>IM non-adopters</td>
</tr>
<tr>
<td>---</td>
<td>-------------</td>
<td>-----------------</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>1.</td>
<td>I felt like the group worked together.</td>
<td>5.9</td>
</tr>
<tr>
<td>2.</td>
<td>I felt that the group included social interaction.</td>
<td>3.9</td>
</tr>
<tr>
<td>3.</td>
<td>As a student, I felt part of the group.</td>
<td>6.0</td>
</tr>
<tr>
<td>4.</td>
<td>I felt comfortable interacting with participant(s).</td>
<td>5.6</td>
</tr>
<tr>
<td>5.</td>
<td>Computers do not depersonalize communications and social relationships.</td>
<td>3.1</td>
</tr>
<tr>
<td>6.</td>
<td>As a student, I felt personally involved in the group.</td>
<td>6.1</td>
</tr>
<tr>
<td>7.</td>
<td>I felt that my point of view was acknowledged by other group members.</td>
<td>6.1</td>
</tr>
<tr>
<td>8.</td>
<td>I felt that students in the group cared about each other.</td>
<td>4.7</td>
</tr>
<tr>
<td>9.</td>
<td>I felt connected to the others in the group.</td>
<td>4.1</td>
</tr>
<tr>
<td>10.</td>
<td>I felt that I could rely on others in the group.</td>
<td>5.7</td>
</tr>
<tr>
<td>11.</td>
<td>I felt confident that others in the group would support me.</td>
<td>5.1</td>
</tr>
<tr>
<td>12.</td>
<td>I regularly talked to others in the group about personal matters.</td>
<td>1.6</td>
</tr>
<tr>
<td>Total</td>
<td>4.8</td>
<td>1.8</td>
</tr>
<tr>
<td></td>
<td>Strong N (%)</td>
<td>Intermediate N (%)</td>
</tr>
<tr>
<td>----------------------</td>
<td>--------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>IM adopters (n=8)</td>
<td>45 (54)</td>
<td>24 (29)</td>
</tr>
<tr>
<td>IM non-adopters (n=6)</td>
<td>20 (28)</td>
<td>32 (44)</td>
</tr>
</tbody>
</table>

Pearson Chi-square (d.f. = 2) = 14.5, p < .01