SYNCHRONOUS COLLABORATIVE PROBLEM-SOLVING VIA CMC:
APPLICATION OF CONCEPT MAPPING

Ahmad Khamesan, University of Birjand, Iran
Email: a.khamesan@birjand.ac.ir

Abstract. This paper presents a concise report of three experimental studies investigated application of concept mapping (CM) as a knowledge representative tool in synchronous collaborative problem-solving via CMC. The studies compared: synchronous collaborative CM in Face-to-Face (FtF) and via CMC, different types of CMC channels in collaborative CM, and different methods of synchronous collaborative CM via CMC (distributed, shared, and moderated).

1 Introduction

One of the most promising uses of CM is its integration into co-operative learning activities. In this situation the members of a group collaboratively construct their group maps. Collaborative CM can be used in different forms. For example collaborative sessions may be FtF or of a distance. They may be synchronous (all participants working simultaneously) or asynchronous (one collaborator draws his or her concept map and then passes it to other collaborator). Collaborative CM can facilitate the exchange of information and relationship between members of a group and clarify the collaborator’s view on the topic. It can also support discussion about concepts among members of a group. There are not a lot of studies that consider collaborative CM, however most of them suggest that it could lead to effective discussions concerning concepts and thus enhance meaningful learning. For example, Baroody and Bartels (2000) showed collaborative CM promotes more questioning, discussion and debate among participants. Stoyanova and Kommers (2002) found synchronous collaborative CM provoked “a more intense collaboration” and resulted in “a more dense conceptual representation”.

On the other hand, there are some negative views on the effect of collaborative CM. There are some studies that have found collaboration has little effect on participants’ learning. For example Chung, O’Neil and Herl (1999) found the quality of concept maps was not related to teamwork process. In another study, they found construction of a collaborative concept map does not benefit from collaboration (Herl, O’Neil, Chung & Schachter, 1999). They compared a network collaborative CM with an individual CM. The results showed in individual CM students had significant improvement in mapping scores in comparison with the collaborative condition. This might be to do with the task. There is a good deal of evidence that creative tasks or ill-defined tasks are more effectively solved by individuals than by groups. A further significant development in the field of collaborative CM took place with the emergence of network technology and ICT. In this development, computers have been used to support collaborative CM since the mid-1990s. Now with some empirical studies on network technology to support collaborative CM, there have been some moves to create web-based CM with collaborative facilities. With the developments in using ICT for on-line learning environments, it seems more research is needed to investigate the methods and implications of using learning tools as an essential part of any educational environment. More specifically, some research has investigated learning by network supported CM and its related issues (e.g. Cañas et al. 2001).

Using CM in collaborative learning situations has been investigated by some researchers. For example, Chiu, Huang and Chang (2000) investigated the interaction patterns among participants to explore how participants use the communication process to accomplish a synchronous web-based CM task. They found that greater interaction with complex co-operation led to better performance in a group. They suggest any tool for communication or interaction in collaborative CM should be applicable and easy to use. Stoyanova and Kommers (2001) investigated the learning effectiveness of CM for computer-supported collaborative problem solving. They showed that a shared collaboration, when all members of a group collaboratively construct a map, is more effective than moderated or distributed collaboration. In moderated collaboration, a leader of a group constructs the map based on the members’ opinions and in distributed collaboration members of a group distribute their maps together and every member construct his/her own map. De Simone, Schmid & McEwen (2001) showed university students preferred sharing concept maps and discussing with one another in a synchronous mode, where the immediate feedback helped in constructing maps. They used collaborative CM without web-based facilities. Komis, Avouris and Fidas (2002) used CM in the shared activity space of the environment as a knowledge representative tool and a text as communication tool.
tool. They found participants managed to solve complex problem of data modeling similar to reference group that solved the problem using paper and pencil. They also found while the shared activity space played an important role in collaboration, the textual communication tool, despite its limitations, has been used effectively and is essential. Finally in one the more recent study on collaborative CM, Suthers, Hundhausen and Girardeau (2003) investigated the role of discourse and knowledge representations, here CM, in FtF and online collaborative learning. Although their main focus was on the discourse in online collaborative learning, they compare the learning outcome (an essay about the task) as well. The results supported a hypothesis that a knowledge representation like CM in the online situation could be more effective than FtF because participants must rely more on the representations to compensate for the absence of the richer attributes of FtF communication. However, the results regarding the output of the collaboration, essays, showed the inferential quality of the essays suffered in the online condition relative to FtF. They believed these results may show that online participants are not able to take full advantages of the representations as substitutes for conversation because they are not co-present. In summary, the idea of CM has been recognized for nearly two decades and several computer-based tools are now available. Some attempts are now being made to design web-based CM systems for synchronous collaborative CM. The web-based CM software can provide an opportunity for applying this technique in online and electronic learning environments. Although some research has been done into collaborative CM, most studies were used asynchronous conditions or synchronous FtF collaboration with technology. Thus, with increasing consideration being given to electronic learning, and with the development of web-based CM systems, research is needed to investigate the various aspects of synchronous collaborative CM techniques, both regarding collaborative learning and instruction. In this paper, results of three experimental studies, investigated the application of CM as a knowledge representative tool for synchronous collaborative problem solving via CMC, are reported. Two main issues for investigating synchronous collaborative CM via ICT are addressed in this paper. The first issue was: “can CM, as a knowledge representative mediated tool, be used to enhance synchronous collaborative learning via ICT and, if so, how?” The other issue explored was “which CMC channels are much appropriate for effective collaboration when CM is used as a mediated tool”.

2 The First Experiment

As a starting point, the difference between collaborative CM in FtF and ICT groups is compared (for more information on this experiment see Khamesan and Hammond, 2004a). The main research question is addressed in this study: is collaborative synchronous, web-based, CM as effective as collaborative CM using FtF?

2.1 Method

This study used 2*2 mixed design. The between-subject variable was collaborative CM with two levels, FtF and synchronous web-based via ICT. The within-subject variable was individual CM in two levels, pre-test and post-test. Twenty pairs of participants (13 males and 27 females) volunteered, in response to advertisements distributed by email and notice boards in York University, to take part in the experiment. IHMC CmapTools beta version 3.0 (dsp) was used for CM. Yahoo Messenger version 5.0 was used in ICT group as the communication medium. The written chat room was the only function of this software activated. At the first step of the experiment, participants filled out the personal detail questionnaire were led to experimental rooms. After reading instructions of the experiment, a short training session took place. In this session, the experimenter drew a sample concept map with Cmap software and answered any possible questions related to the experiment and the software. Then participants had 15 minutes to draw an individual concept map (pre-test). In collaborative session, participants’ individual concept maps in pre-test were not available. After this step, participants were divided randomly into the two conditions of the experiment. In the first condition, participants used Cmap software to create a concept map with FtF collaboration. They led to a room and worked together on the previous task about the educational system in United Kingdom. In the second collaborative condition, participants were given the same task but in separated rooms. For collaboration, they used the online collaborative part of Cmap, which was web-based CM, and the written chat room facilities of Yahoo Messenger. Participants in both conditions had a maximum of 30 minutes to draw a group CM but were allowed to finish their work as soon as they felt their map was complete. At the end of this session, participants filled out technology, leadership, and awareness questionnaires. The awareness questionnaires were based on one previously developed by Daly-Jones, Monk and Watts (1998) and had two sections, interpersonal awareness (or awareness of others) and personal awareness (or awareness of self). At the final step of the experiment, participants attended a post-test session after 14 days. They were asked to make an individual CM for the same task that they had done in the pre-test as completely as they could by using their experiences from the pre-test and collaborative CM. All
questionnaires items were answered on a 100mm analogue Likert-type scale. The task was a scenario about the introducing the educational system of UK to an overseas student.

2.2 Results

There were not any statistical differences between two groups regarding assessment of technology used in the experiment (P > .05). The result shows that there was a statistically significant difference between the time used for group CM between two conditions (p < .05). In addition, participants evaluated the role of leader when collaborating through response to two questions “who take the leading role in the constructing the maps?” and “who contribute more knowledge and idea were included in map?” The results show that there was not a statistically significant difference between the two conditions in leading role of constructing the maps and in knowledge that contributed in maps. The first research question addressed here is a comparison between synchronous web-based versus FtF collaborative CM. The data were analyzed with t-test for each measure separately. There were not any significant differences between two-experiment conditions (df =18, p > 0.05). The concept maps constructed by the FtF and synchronous web-based via ICT groups were very similar in results of the measures used. The second concern of the experiment was the extent to which the collaborative CM can affect individual learning. The pre-test and post-test had been designed to investigate this issue. The data were entered into a 2*2 mixed ANOVA. The between group factors were collaboration (FtF collaboration versus web-based via ICT collaboration). The within-subject factor was learning effectiveness (pre-test versus post-test). This analysis revealed that the main effect of learning effectiveness (pre-test versus post-test) was statistically significant for all measures, total score (F (1, 38) = 44.8, p < .001), main node (F (1, 38) = 22.9, p < .001), supplementary node (F (1, 30) = 8.5, p = .007) and proposition (F (1, 38) = 51.1, p < .001). But the group (FtF versus ICT) by individual achievement interaction was not significant for any of them, total score, main node, supplementary node and proposition (p > 0.05). In addition, there were not statistically significant differences in interaction level (between group and learning effectiveness) in any of the measures (p > .05). In summary, these analyses show learning effectiveness was significantly increased after collaborative CM. They also show there were no differences between conditions of the experiment in learning effectiveness. The second research question addressed in the experiment is a comparison between participants’ awareness during collaborative sessions, FtF communication versus communication through text as CMC channel. The data were analyzed with t-test for each measure separately. Participants reported their awareness of their partners on five scales (attention, presence, reaction, understanding and contribution). The results show there was a significant difference between the two conditions. Participants in the FtF group, with the total mean of 83 out of 100, had more interpersonal awareness of their partners than the participants in the ICT group, with the total mean of 71 out of 100. There were statistically significant differences between the two groups in attention and presence (p < .01). The participants of the FtF group had better feeling of their partner’s presence and more attention to them than the participants in the ICT group. But there were not any statistically significant differences between the two conditions in the other factors of interpersonal awareness, reaction, understanding and contribution (p > .05). In the other awareness measure, personal awareness, there were four scales, enjoyment, involvement, attention and interest. The results show there were no significant differences between two means of communication, FtF versus online with text as CMC channel, in means of personal awareness either as a whole or for each measure (p > 0.05).

2.3 A Scoring system for Analyzing Collaborative Concept Maps

After analyzing the data of the first experiment, a new scoring system for better understanding of learning effectiveness in collaborative CM was developed (Khamesan & Hammond, 2004). It was on the basis of Stonayova and Kommers’s work (2002). Three levels for measuring learning effectiveness are assumed individual learning, the group as a whole, and interaction between individual and group. Each level of learning effectiveness has a numbered sublevel. The results of the first experiment with new scoring system shows in most of measures of learning effectiveness the performance of CMC group was not significantly different from the FtF group, such as individual achievement and creativity, retention, group creativity, rejection measures and overlapping. However, there are some differences between the FtF and CMC groups in measures of transfer. Although there was not a significant difference between conditions in mean of individual to group transfer, in both individual to group and individual to individual transfer measures, FtF condition had better performance than CMC group. It shows FtF collaboration may facilitate the process of conceptual transfer at the group level.
3 The Second Experiment

The second experiment addressed issues regarding CMC channels in a synchronous collaborative CM. In the first experiment, there were significant differences between FtF and ICT with text groups in interpersonal awareness. One solution for improving interpersonal awareness is to use an audio connection as a CMC channel. In addition, a question arises from the experiment one regarding the suitable task for a collaborative problem solving activity with mediating of CM. It seems that a ceiling effect occurred in the first experiment with regard to the task (educational system in Britain). As the task is an important factor in any collaborative learning activity and can hinder the effect of collaboration, changing the task may give a clearer idea about the effect of collaboration. Thus, two main questions that addressed in this experiment were: “what is the effect of CMC channels (FtF versus ICT with text versus and ICT with audio/text) on personal and interpersonal awareness in synchronous web-based collaborative problem solving with mediating of CM via ICT?” and “does the type of CMC channel affect learning effectiveness in a synchronous web-based collaborative CM on a problem-solving task?”

3.1 Method

This study used a between-subject design. The between group manipulation was the kind of CMC channel [with three levels: online with written chat (text) versus online with audio and text connection versus FtF]. Dependent variables were “awareness” and “learning effectiveness”. Thirty pairs of participants (12 males and 48 females) volunteered, in response to advertisements distributed by email and notice boards in York University (UK), to take part in the experiment. The software, instructions and questionnaires were the same of the first experiment. The procedure of the experiment also was similar to the first experiment except to the post-test session. A pilot study was conducted for choosing appropriate task for a collaborative CM. A pilot study was conducted to choose a suitable task.

3.2 Results

The interpersonal awareness data were entered into a one-way ANOVA. The results show there were statistically significant differences among the conditions in the means of attention (F (2, 57) = 7.177, p = .002), reaction (F (2, 57) = 9.106, p = .001) and total score of interpersonal awareness (F (2, 57) = 6.268, p = .003), but there was not a statistically significant difference among the groups in presence and understanding (p > 0.05). In addition, there was no significant difference in perceived contribution (F (2, 57) = .120, p = .888). The results of a Tukey’s HSD test showed that in attention and total score of interpersonal awareness the different was statistically significant between FtF and audio/text group (p < .05). In reaction, the audio/text group was significantly different from both the FtF and the text group (P < .05). The participants in the audio/text group reported lower awareness ratings than those in the FtF and text groups for attention, reaction and total interpersonal awareness. On the other hand, the results showed there were no statistically significant differences among the conditions for any of the measures of personal awareness (p > 0.05). Each participant constructed one individual CM, at pre-test, and a group CM with his or her partner in the collaborative session. Overall, 90 concept maps were constructed in the experiment. The total number of concepts in the individual concept maps (pre-test) gives an indication of the participants’ knowledge on the task before the collaborative session. The results show there was not any significant difference among the groups in means of participants’ knowledge (base level) on the task (p > 0.05). In addition, the total number of concepts in the group concept maps shows the group achievement. The results show there was not any significant difference among the groups in mean of group achievement (p > 0.05). The total number of concepts in the group concept maps that are not in either of the individual concept maps shows the group creativity. The results showed there was not any significant difference among the groups in creativity (p > 0.05).

3.3 Follow-up Experiments

In a follow-up experiment, the effect of a high quality of audio connection was investigated. The experiment investigated an unexpected result from the second experiment regarding the lower learning effectiveness and interpersonal awareness of the audio/text group. One hypothesis for this unexpected result is the low quality of audio/text connection. In this experiment, I added a high-quality audio (a sound mixer instead of using online software) to the previous study. The experiment revealed there were significant differences in interpersonal awareness between low and high quality of audio/text groups. On all measures of the scale used, participants in high quality of audio/text had higher awareness of their partners compared to participants in low quality of audio/text
group. Furthermore, the experiment results show that with higher quality audio connection, the learning effectiveness does not rise necessarily. On the other hand, although there was not a reliable difference amongst the conditions in learning effectiveness measures, high quality audio/text group had lower group achievement and creativity not only than FtF but also than ICT groups, text and low quality audio/text. One explanation for these trends is that participants usually engage more in social collaboration when they use audio as CMC channel than other kind of communication methods. This result reveals text as CMC channel could make better learning environment in synchronous collaborative CM because it causes more focus on the collaborative task than other CMC channels.

4 The Third Experiment

With the potential of digital networks, different group interactions for collaborative problem-solving task with mediating of CM via CMC can be manipulated. I designed three different scenarios, on the basis of Stonayova and Kommers’s work (2002), investigated for interaction. Shared Interaction was used in the previous experiments where both members of a group built the group concept map simultaneously. In this condition, each member of the group can see any changes of the group concept map that are made by his or her partner, on his or her screen. They have a CMC channel for communication. In Moderated Interaction, at the beginning of the collaborative session, participants discuss the task and decide who would be editor (leader or facilitator) of the group. The editor of the group is responsible for building and editing the group concept map. The other member of the group is able to see any changes of the group concept map on his or her screen and gives his or her comments to the editor, but is not able to edit the group CM. They have a CMC channel for communication; and Distributed Interaction is a non-web-based interaction. Each member of a group is allowed to edit the group concept map intermittently. At the beginning of collaborative session, members of the group discuss the task and decide who starts building the group concept map. They also decide when shared concept map should pass to other member of the group. During the period when a member of the group is drawing the concept map, the other member of the group have access to the last concept map that he or she drew and passed to his or her partner. This may facilitate the process of thinking about the map. They have a CMC channel as well. In conclusion, this experiment gives consideration to using different modes of interactions for synchronous collaborative CM via CMC with three main questions. Firstly, does web-based collaborative CM via CMC affect learning effectiveness in comparison with non web-based collaboration? Secondly, which kind of group interaction in synchronous collaborative CM via CMC is work effective for learning? And thirdly, does web-based CM affect the participants’ personal and interpersonal awareness in comparison to non web-based interaction? The hypotheses of the experiment are “web-based collaborative CM enhances learning effectiveness and awareness in comparison with non-web based collaboration” and “shared interaction enhances learning effectiveness in comparison with other interactions”.

4.1 Method

This study used a 3*2 mixed design. Between group manipulation was the mode of interactions in synchronous collaborative problem solving CM via CMC (with three levels: shared, moderated and distributed interaction). The within-subject variable was learning effectiveness in individual concept map at two levels, pre-test versus post-test CM. Twenty participants, ten groups, served in each condition. All were the students of York University (age between 18 and 27 with mean of 19.9 years). There was no significant difference regarding the age of participants among the conditions (p > 0.05). The procedure of the experiment was essentially the same procedure of the first experiment, with the exception of different conditions. After the pre-test session, participants were divided randomly into the three conditions of the experiment, shared, moderated and distributed interactions. Participants had up to 40 minutes to draw a group concept map but were allowed to finish their work as soon as they felt their map was completed.

4.2 Results

Awareness: Although participants’ interpersonal awareness in distributed interactions was lower than other conditions in most of measures, the results show there was not a statistically significant difference among the three conditions in the means of interpersonal awareness (p > .05). Overall means of interpersonal awareness in shared, moderated and distributed interaction were respectively 84, 82 and 75 out of 100. There was not a significant difference among the conditions in contribution measures either (p > .05), although the contribution of moderated conditions is lower than other interactions. In addition, the results show there was not a statistically significant
difference among three conditions in the means of personal awareness ($P > .05$). Overall means of personal awareness in shared, moderated and distributed interaction are respectively 82, 78 and 78 out of 100.

**Learning effectiveness at individual level:** Learning achievement in collaborative CM is based on the total number of concepts. A comparison between the total number of pre-test and post-test can show individual achievement following a collaborative session. The data was analyzed with $3 \times 2$ mixed ANOVA with main effect of individual achievement in two levels, pre-test and post-test and between-subject factor of mode of interaction. The results showed there was a significant difference in main effect of group achievement (individual CM in pre-test and post-test) ($F (1, 55) = 177, p < .001$). But the group (mode of interaction) by individual achievement was not significant ($p > .05$). In addition, total number of concepts in post-test concept map consists of two parts: knowledge acquisition and retention. Knowledge acquisition is a measure of the number of new concepts in the post-test which are not in the pre-test. It includes concepts transferred from the group CM and individual creativity (new concepts that were neither in the pre-test concept map nor in group concept map). Retention indicates concepts that are transferred from a participant’s pre-test concept map to his or her post test concept map. The results show there was a statistically significant difference among the conditions in means of participants’ knowledge acquisition ($F (2, 53) = 3.61, p = .034$). The result of Tukey HSD shows the distributed interaction group has significantly higher score than both shared interaction ($p = .05$) and moderated interaction ($p = .034$). On the other hand, the analysis on individual creativity and retention measures show there was not a statistically significant difference among the conditions in means of participants’ individual creativity and retention ($p > .05$).

**Learning effectiveness at the level of the group as a whole** has three measures: group achievement, group creativity and structure and configuration. The total number of concepts in the group concept maps shows the group achievement. The data was entered to a one-way ANOVA. The results show there was not a significant difference among the conditions in mean of group achievement ($p > .05$). The total number of concepts in the shared concept maps that are not in either of the individual concept maps (in pre-test) shows the group creativity. The results show there was not a significant difference among the groups in mean of group creativity ($p > .05$).

**Learning effectiveness at the level of interaction between individual and group** has six measures: rejection at the group level, rejection at individual level, individual to group transfer, group to individual transfer, individual to individual transfer and overlapping. The results showed although there was not a significant difference among the conditions in number of transferred concepts from individual concept maps to the group concept map ($p > .05$), there was a significant difference among the group in concepts transferred from the group concept map to individual concept maps in post-test ($F (2, 53) = 5.31, p = .008$) and individual to individual ($F (2, 53) = 5.47, p = .007$). The result of Tukey HSD showed the distributed interaction group, with mean of transferred concepts from the group concept map to individual post-test of 12, has significantly higher score than both shared interaction ($p = .01$) and moderated interaction ($p = .033$). In addition, the result of Tukey HSD for individual to individual transfer shows the distributed interaction group has significantly higher score than both shared interaction ($p = .018$) and moderated interaction ($p = .014$). For rejection at the group level (concepts from the pre-test concept map that are not transferred to the group concept map) and rejection at individual level (concepts of the group concept map that are not transferred to the post-test concept maps) the data was entered to one-way ANOVA. The results show there was not a significant difference among the groups in number of rejected concepts both at group level and individual level ($p > .05$). Overlapping between partners’ concept maps in pre-test and in post-test can be considered as the effect of collaboration. The data was entered into a one-way ANOVA. The results show there was a significant difference among the conditions in means of concepts that were overlapping ($F (2, 53) = 5.81, p = .005$). The result of Tukey HSD shows the distributed interaction group has significantly higher score than both shared interaction ($p = .007$) and moderated interaction ($p = .025$).

5 Summary

5.1 *Using CM as mediated tool to enhance synchronous collaborative learning via ICT*

The first experiment of the thesis compared collaborative CM in FtF versus via ICT groups. The experiment revealed that the technology, i.e. Cmap, had an acceptable level of performance, both in individual and collaborative CM and both in FtF and ICT groups. The results also showed the collaboration results in learning, both at individual and group levels. That proves new technologies, based on ICT, can create a learning effectiveness environment as
5.2 **Appropriate CMC for effective synchronous collaborative CM**

The second issue was addressed in the thesis was the appropriate type of communicational media that is needed for a synchronous collaborative CM via ICT. Using ICT for learning and teaching cannot be imagined without using CMC channels because collaboration and exchanging knowledge and idea is an inseparable part of any collaborative learning and teaching program. Therefore, for investigating any online learning technique we need to investigate which communicational medium can create better communicative environment and, subsequently, more effective collaboration and learning outcome. For evaluating the appropriate CMC channel, I measured participants’ interpersonal and personal awareness during collaborative session. The theatrical and empirical literature shows that awareness plays an important role in an effective collaboration. The assumption for using awareness measures was: “having knowledge of group and individual activity has central role in collaborative activity”. In the first experiment, the participants’ awareness in ICT group with text as CMC channel was compared with FtF group. Although there was not a significant difference between conditions in means of measures of the personal awareness, the participants of FtF group reported significant higher level of interpersonal awareness than participants in ICT condition both in the whole interpersonal awareness scale and in factors of attention and presence. The result of interpersonal awareness in FtF condition was probably because of physical presence. The differences between the two conditions also show web-based facilities with a written chat room cannot create a collaborative environment which exactly matches the FtF environment. In addition, the results may be considered as an explanation for the lower transfer measure in ICT group in comparison with FtF and show the effect of CMC channel on the learning outcome. Although these results show a web-based collaborative CM, like Cmap, can create a suitable collaborative environment for CM because it can affect most collaborative factors that are essential for creating an acceptable group CM (e.g., understanding, contribution, and reaction), more investigation needed to show which CMC facilities could minimize the differences between FtF and ICT conditions in awareness and created a collaborative environment which could compensate for the lack of physical presence. I explored this issue in the second experiment with comparing FtF collaboration with two ICT groups, online with text and online with text/audio, with a different task (university campus) and more time for collaboration (40 minutes). Surprisingly, the results did not match with what we had expected and also was inconsistent, with the results of text condition in the first experiment. I had expected with providing richer CMC channel and more time for collaboration, the measures of interpersonal awareness in text/audio condition increased as much as FtF condition whilst the participants of the text/audio group showed lower awareness of their partners, in attention and reaction. The results do suggest that the addition of an audio channel may not always improve interpersonal awareness, and may even degrade it. I supposed these unexpected results was the effect that an artifact caused by some sort of degradation of Cmap performance when Yahoo audio was used at the same time. This possibility was explored in another study (section two, chapter four). The experiment approved our hypothesis because there were significant differences between low and high quality of audio/text groups in interpersonal awareness. In addition, although it was not reliable, participants of high quality of audio/text group had better awareness of their partners than text group and as nearly the same level as FtF group. It
shows with a shared workplace, having an audio connection channels does not lead, necessarily, to better interpersonal awareness. In the other follow-up experiment, I investigated the effect of time on interpersonal awareness when text used as a CMC to investigate the inconsistency between the results of the first and second experiments, in the text group. The results showed with increasing the time of collaboration participants reported higher interpersonal awareness. The experiment revealed the time of collaboration is an effective factor in awareness of other in synchronous collaborative CM via text as CMC channel. In conclusion, with the current task at least a forty-minute collaborative session is essential in synchronous collaborative CM for creating an interpersonal awareness between participants as well as a FtF collaboration. On the other hand, the results of the last experiment showed participants in web-based interaction had better interpersonal awareness than non web-based interaction, although the results were not statistically reliable. Thus, the results suggest that the mode of interaction may be a factor for interpersonal awareness in collaborative CM via CMC along the kind of CMC channel.

6 References


