12-31-2006

Effectiveness of Meeting Outcomes in Virtual vs. Face-to-Face Teams: A Comparison Study in China

Zixiu Guo
The University of New South Wales- Australia

John D'Ambra
The University of New South Wales- Australia

Tim Turner
The University of New South Wales

Huiying Zhang
Tianjin University- China

Tong Zhang
Tianjin University- China

Follow this and additional works at: http://aisel.aisnet.org/amcis2006

Effectiveness of Meeting Outcomes in Virtual vs. Face-to-Face Teams: A Comparison Study in China

Zixiu Guo
School of Information Systems, Technology and Management
The University of New South Wales, Australia
z.guo@unsw.edu.au

John D'Ambra
School of Information Systems, Technology and Management
The University of New South Wales, Australia
j.dambra@unsw.edu.au

Tim Turner
School of Information Technology and Electrical Engineering,
Australian Defence Force Academy,
The University of New South Wales, Australia
Tim.turner@adfa.edu.au

Huiying Zhang
School of Management, Tianjin University, China
zhanghuiying@tju.edu.cn

Tong Zhang
School of Management, Tianjin University, China
zhangtong@tju.edu.cn

ABSTRACT

As virtual teams become more and more important in organizations, understanding how to improve virtual team outcomes is vital to project success. This study examines how virtual teams interacting via videoconferencing systems may enhance their team outcomes in a Chinese cultural context. The results reveal that traditional face-to-face interaction outperformed videoconferencing teams when both teams had same team-building experience. However, a dialogue-based framework can be employed to help virtual teams to perform as effectively as traditional face-to-face teams that had no such shared basis of effective communication. Implications of these findings are discussed.

Keywords

Virtual teams, videoconferencing, face-to-face interaction, team outcomes.

INTRODUCTION

The increased globalization of organizations and recent advances in Internet and telecommunications have spawned a new type of team structure—virtual team. Virtual teams are groups of geographically and/or organizationally dispersed coworkers that are assembled using a combination of telecommunications and information technologies to accomplish an organizational task (Townsend, DeMarie and Hendrickson 1998).

For virtual team to be successful, effective communications and knowledge sharing among members is a necessity (Townsend et al. 1998). This importance increases when the exchange of knowledge and information purely relies on computer-mediated communication (CMC) systems. Compared to traditional face-to-face interaction, decision making under CMC environment is characterized by a number of deficiencies due to the lack of visual feedback and inhumanness of technology (Sniezek and Crede 2002). In the virtual work environment, traditional social mechanisms that facilitate communication and decision-making are effectively lost and participants must find new ways to communicate and interact effectively within the new technical context (Townsend et al. 1998).

Huang, Wei, Bostrom, Lim, and Watson (1998a) proposed a dialogue-based framework aiming to support virtual teams in building clear goals of effective communication. Previous findings suggest that this framework is useful to help virtual teams develop a shared understanding about effective communication for enhancing team outcomes (Huang and Lai 2001; Tan,

Wei, Huang and Ng 2000). However, these studies are limited to examining the framework with one asynchronous computer-mediated technology. That is, there is no visual contact or audio communication between team members. Thus, future research would benefit by employing synchronous technologies, such as videoconferencing systems. In addition, examining the framework with only one medium fails to justify whether the framework can help virtual teams to outperform face-to-face teams (Tan et al. 2000). Without comparison between computer-mediated and face-to-face team interaction, the question of whether computer-mediated technologies can be effectively substituted for the traditional face-to-face medium for virtual team interaction remains unanswered.

This paper describes a laboratory experiment examining the impact of the dialogue technique on virtual team outcomes by comparing team interactions in traditional face-to-face teams and teams interacting via videoconferencing systems in The People's Republic of China. It provides an opportunity to examine whether this framework is valid in a different cultural context. The rest of paper is organized as follows. Firstly prior research on virtual team meeting outcomes is briefly outlines. Then the dialogue technique is introduced to facilitate team members to build shared common understanding of effective communication. Next, the research model and hypotheses are presented. This is followed by a brief description of the research methods and the experimental procedures. Next, the data analysis results are reported. Finally, the paper concludes with a discussion that focuses on interpreting the results and on examining the theoretical and practical implications of the study.

THEORETICAL FOUNDATION

### Virtual Team Meeting Outcomes in CMC Environments

As CMC technologies have the ability to overcome constraints of time and place, to retrieve and search for associated materials, to reprocess and merge different contents, and to support many-to-many communication flows (Rice 1987), they have been fully utilized to support and enhance virtual team interaction effectiveness. Among various CMC technologies used to facilitate virtual teams interactions, videoconference systems are the core system around which the rest of virtual team technologies are built (Townsend et al. 1998). Synchronous videoconferencing systems allow team members separated by geographical distances to interact in an approximation of face-to-face interaction by providing audio as well as video communication capabilities. The advantages of same-time and different locations of videoconferencing system allow virtual teams to "meet" without the time, effort, and financial costs of a face-to-face meeting. Videoconferencing systems have changed the way people keep in touch and the way business is done. They provide an infrastructure across which the virtual team will interact and provide technological empowerment to the virtual teams' operation (Osterlund 1997).

However, the mediation of a team's interaction by CMC technologies creates both opportunities and challenges. Due to reduced social context cues (Sproull and Kiesler 1986) and the utilization of "leaner" communication media (Daft and Lengel 1984), the communication efficiency and team outcomes will be decreased if CMC technologies are used to facilitate virtual teams to perform their team functions that require collaborative problem-solving and decision-making (Daft, Lengel and Trevino 1987; Short, Williams and Christie 1976). According to medium-task fit perspective, rich media or media with a higher degree of social presence, such as face-to-face, are better suited to complex social interaction and interpersonal communication that requires rich information to facilitate shared meaning and consensual understanding. Prior research suggests that although teams that rely on CMC are superior to face-to-face groups in brainstorming (Dennis and Valacich 1993) and decision making tasks (Sambamurthy, Poole and Kelly 1993), they are less adept at performing other tasks such as negotiation and intellective tasks (Hollingshead, McGrath and O'Connor 1993). In a study examining the interaction between task type and communication medium, Straus and McGrath (Straus and McGrath 1994) found that the overall effectiveness of CMC groups was lower than that of face-to-face groups, especially for tasks that required higher levels of coordination. Prior research also found time may mitigate the effects of communication modality. That is, if given enough time, virtual teams might be able to gain enough knowledge with the media, the task, the context and each other. Then the differences between face-to-face and CMC may be diminished by enriching the "lean" electronic media (Carlson and Zmud 1999). However, it is being argued that virtual teams need to be effective quickly as teams may only interact for a short period of time or may be working on a task that is of great importance and urgency (Alge, Wiethoff and Klein 2003; Tan et al. 2000). Recent research has suggested that the effectiveness of computer-mediated virtual teams can be enhanced upon formation where: the teams had a shared history (Alge et al. 2003); when training in developing media use and communication-related issues took place (Lurey and Raisinghani 2001); teams had the ability to build personal relationships in the mediated environment (Pauleen and Yoong 2001); the media allowed the team to adapt their behavior to match the nature of the task and other constraints; team had shared understanding of effective communication (Tan et al. 2000). This study focuses on enhancing team satisfaction with communication and outcomes by building an adequate level of shared common understanding, a critical attribute of successful virtual teams (Townsend et al. 1998).

Dialogue Technique---Building Shared Common Understanding of Effective Communication

Based on the mental model discipline (Senge 1992) and dialogue theory (Bohm 1990), Huang et al (1998a) proposed a dialogue technique framework to help teams build up such a shared basis for effective communication. The main premise of this framework is that through dialogue, team members could build a common mental model that facilitates shared understanding (Huang et al. 1998a). This model serves as team norms to guide future interaction and activities of the team. Prior research suggested that these "team mental models" lead to higher quality communication, particularly in situation where teams must come together to make sense of complex or equivocal tasks (Marks, Zaccaro and Mathieu 2000). Researchers have suggested that shared team mental models are more important than media differences in explaining communication processed. For instance, in Zack's (1994) study of editorial teams highlights, face-to-face interaction is found to be more facilitative of building shared knowledge, but once a shared interpretive context has been built, objectively leaner media such as electronic mail can be used to communicate effectively. Prior research suggested that under conditions in which communication is difficult, shared mental models become crucial to team functioning as members are able to act on the basis of their understanding of the information and coordination of activities (Cannon-Bowers and Salas 1997; Stout, Salas and Kraiger 1996). It is this ability to adapt quickly that enables teams in dynamic environment to be successful.

The dialogue framework is illustrated in Figure 1 (for detailed discussion of the framework please refer to Huang et al 1998a).
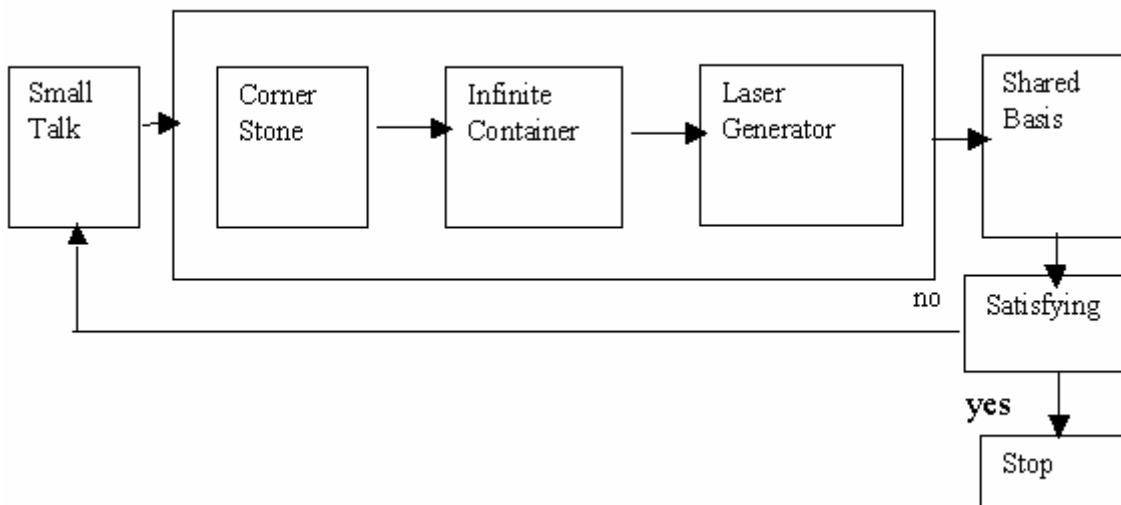
Figure 1: Dialogue Framework (Adopted from Huang et al 1998a)

The dialogue technique process includes:

1. Communicators take part in a small-talk session to introduce themselves and get to know the other communication partners (Jarvenpaa and Knoll 1996).
2. CornerStone: Communicators engage in a dialogue defining and generating shared goals for communication.
3. InfiniteContainer: The core of the framework is a dialogue session adopted from the MIT's dialogue procedure (Schein 1993). Firstly, communicators reflect on their past experience of cooperation in terms of good communications. Secondly, communicators, in concert, disclose and share their past cooperative working experiences, identifying characteristics of their past experience related to experiences of good communication

protocols. Thirdly, given the shared goals, communicators exchange feedback to the derived characteristics of good communication. Fourthly, communicators are not allowed to criticize other's input. A dialogue facilitator would intervene, when necessary, to clarify or elucidate on any issue. Fifthly, the dialogue will be closed when no further exchange and clarification from communicators are possible.

4. LaserGenerator At this stage, group members develop their group communication mental model by ranking the characteristics of effective communication practices, discussed earlier in the infinite container stage, that are most important to the attainment of shared goals.

5. Verification of an outcome that will support effective communication in a mediated environment.

RESEARCH MODEL AND HYPOTHESES

The purpose of this study is to test the impact of the dialogue technique on enhancing virtual team meeting outcomes by comparing videoconferencing groups with face-to-face groups in a Chinese cultural context. Figure 2 outlines the proposed research model. The research model explicitly incorporates a dialogue technique into the team's interaction process to examine how such a technique could help virtual teams, which collaborate via a computer-mediated technology, improve their meeting outcomes, compared with traditional face-to-face teams. The research model suggests that, when team members interact with each other, they will develop their common understanding about the media they are using and teams they are working with. Examination of this research model will reveal whether, after teams build up their shared basis for effective communication, a videoconferencing system can be used as effectively as face-to-face interaction. The end result of this process is the virtual team's meeting outcomes, i.e., satisfaction of participants in the team decision making process, and satisfaction of participants in team decision making, team decision quality. These dependent variables have been believed to be critical for understanding and predicting the use and usefulness of CMC in organizational settings (Baltes, Dickson, Sherman, Bauer and LaGanke 2002).

Figure 2: Research Model

Media richness has been found to positively impact team effectiveness and efficiency (Daft et al. 1987). Tasks requiring teams to negotiate and resolve conflicts (such as the one used in this study) may require transmission of maximally rich information. Face-to-face interaction will be better suited for enhancing team meeting outcomes since Face-to-face interaction provides opportunities for team members to meet each other, share information about themselves and interact in an environment rich in social cues. Accordingly,

H1. Perceptions of team meeting outcomes will be higher for face-to-face teams than teams interacting via videoconferencing system.

This hypothesis will be considered across the three dependent variables.

In line with dialogue-based framework, dialogue among team members allows them to specifically discuss issues influencing team communication effectiveness. This leads to the generation of shared group communication norms and ground-rules, which establish guidelines for future group interaction (Huang et al. 1998a). As a result, team members feel closer to each other and may be more willing to communicate freely and help each other (Tan et al. 2000). The ability to solve problems or

make effective team decisions may increase. Prior research has demonstrated that when communicators possess shared experience or social constructions, a lean medium, such as CMC, can be used as effectively as face-to-face meetings for rich information, which could enhance work performance for solving a complicated equivocal problem (e.g. Dennis and Kinney 1998; Huang, Watson and Wei 1998b). Therefore, the following hypotheses are developed to test the ability of this adopted technique in enhancing videoconferencing team meeting outcomes. Accordingly,

H2. Teams that use the dialogue technique will have higher perceived team meeting outcomes than teams that do not use the dialogue technique.

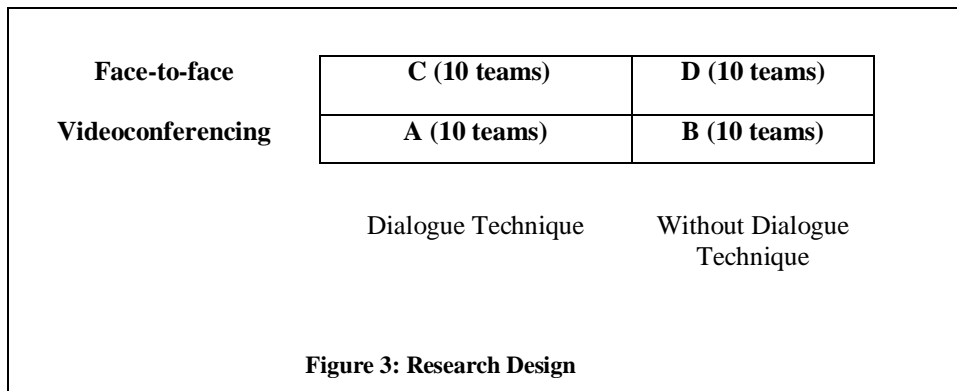Hypothesis 2 will be considered across the three dependant variables for the two media.

H3: Perceptions of team meeting outcomes will not differ between videoconferencing teams that use the dialogue technique and traditional face-to-face teams that do not use the dialogue technique.

Hypothesis 3 will be considered across the three dependant variables.

METHOD

Teams

A total of 120 undergraduate students from a large university in China voluntarily participated in this study. Subjects were administratively and randomly assigned into 40 three-person groups in such a way that none of them is known to each other (Figure 3). The random assignment of subjects to teams controlled for differences due to subject characteristics. The average age of participants was 22, and 56% of the participants were male. T-tests show that subjects under each treatment did not differ significantly in terms of age, experience of using media, and experience working in project teams. A Mann-Whitney test revealed that there was no significant gender difference across treatments. Twenty teams (both box A and C in Figure 3) were assigned dialogue technique framework. Twenty teams (both A and B in Figure 3) were using videoconferencing medium for interaction. This left one section (box D in Figure 3) that represented the control groups without technology and framework.

Face-to-face	**C (10 teams)**	**D (10 teams)**
Videoconferencing	**A (10 teams)**	**B (10 teams)**
	Dialogue Technique	Without Dialogue Technique

Figure 3: Research Design

Technology Conditions

The two technology conditions were traditional face-to-face and videoconferencing system. The physical environments for both the face-to-face and videoconferencing teams were the same. They were a tutorial room and computer lab respectively for all the teams. The equipment for the videoconferencing experiment consisted of a PC, video camera, and microphone/headset. The software used in the experiment was an installation of EPH, a free Chinese videoconferencing system. Both the dialogue technique and the team decision making steps were all conducted via the technology. The advantage of this software, compared with others, such as Lotus Notes SameTime®, is that all participants are visible to each other throughout the meeting. All participants in the videoconferencing teams were trained on how to use the software. The duration of training was about 5 minutes.

Dialogue Technique Treatment

For teams that were assigned to the dialogue technique framework, detailed instructions were given to each team member (see Figure 1 for procedure). Teams were asked to develop a mental model on good communication practices. At the end of the meeting, all team members agreed to accept the ground-rules and used them as the guideline for further interaction. Based on the pilot study, maximum time required for this discussion was 60 minutes.

Task

Past research has shown mixed results in terms of the role of "rich" media for equivocal tasks. Therefore, a task that has no clear decision-making criteria and no demonstrably correct answer was chosen – the task chosen was the "van management" task (Mennecke and Wheeler 1993). The subjects' role here was to assume the role of a group of executives to make a decision about how to best manage vehicles of their sales staff in their region. Each subject was provided the same information and each group had to reach an agreement at the end of the group meeting. This task has been adopted in a number of CMC studies (e.g., Yoo and Alavi 2001). Because the task had no demonstrably correct answer, it was classified as a preference task (McGrath 1984). All teams took a maximum of 40 minutes to complete this task.

Measurement and Data Collection

A survey was administrated after all teams completed their task discussion section. This questionnaire was designed to capture participants' personal information and their perceptions about team meeting outcomes. Decision process satisfaction, the extent to which team members are happy with their decision making process, and decision satisfaction, the extent to which members are happy with their team decision, were measured using Green and Taber's (1980) questions. Team decision quality, the degree to which team members think that their teams decision is good, was measured using Gouran, Brown and Henry's (1978) scale. After a principal component factor analysis followed by varimax rotation, single factors were generated for decision process satisfaction, decision satisfaction and decision quality and a satisfactory reliability of .88, .73, and .80 was obtained respectively.

RESULTS

A two-way ANOVA was used to investigate the influence of media mode and dialogue framework on the team meeting outcomes. Table 1 summarizes the descriptive statistics for all dependent variables. Table 2 reports the results of two-way ANOVA tests for all dependent variables.

Framework	Medium	Decision Process Satisfaction (DPS)		Decision Satisfaction (DS)		Decision Quality (DQ)		Sample Size
		Mean	S.D.	Mean	S.D.	Mean	S.D.	
With Framework	**F-t-F**	6.4	.13	6.13	.13	6.25	.12	10
	V-C	6.16	.33	5.95	.23	5.89	.37	10
Without Framework	**F-t-F**	6.12	.40	5.90	.30	5.95	.24	10
	V-C	5.63	.40	5.73	.42	5.62	.28	10

F-t-F: face-to-face; V-C: Videoconferencing

Table 1: Descriptive Statistics for the Dependent Variables

	DPS F-value	DS F-value	DQ F-value
Framework (DT)	**14.77***	**6.20***	**10.93***
Communication Mode (CM)	**11.63***	**3.74**	**16.01***
DT x CM	**1.48**	**.013**	**.018**

*** p<0.001, ** p<0.01, * p<0.05

Table 2: Results of Two-Way ANOVA Tests for the Dependent Variables

While there were no significant interaction effects identified for all dependent variables, results did reveal significant main effects due to the dialogue framework and communication media. With these significant results, separate t-tests were conducted for testing all hypotheses.

Medium	Framework	DPS t-value	DS t-value	DQ t-value
F-t-F	**With Framework** **Without Framework**	**2.07***	**2.27***	**3.46***
V-C	**With Framework** **Without Framework**	**3.27***	**1.45**	**1.83**

*** p<0.001, ** p<0.01, * p<0.05

Table 3: T-tests of Dependent Variables along Media

H1 predicted that if there was no common understanding among team members, face-to-face interaction was expected to be better than videoconferencing for team meeting outcomes. This was examined by comparing perceptions of team meeting outcomes between face-to-face teams and videoconferencing teams that did not use the dialogue technique. The significant differences were found for decision process satisfaction (t=2.71, p<.05) and decision quality (t=2.8, p<.05). In other words, teams interacting via face-to-face may have higher perceptions of decision process satisfaction and decision quality than virtual teams that interact via videoconferencing system. Therefore, H1 was partially supported.

H2 predicted the effect of the framework. Teams that used the dialogue technique were expected to have higher perceptions of team meeting outcomes than teams that did not use the dialogue technique. Table 3 shows that this prediction was supported for face-to-face teams, and the significant framework effect was found for videoconferencing teams for decision process satisfaction. Thus, H2 was partially supported.

H3 predicted that after team members built up common understanding for effective media use, videoconferencing could be used as effectively as traditional face-to-face interaction. This was examined by comparing videoconferencing teams that employed the framework and face-to-face teams that did not employ the framework. No significant differences were found between these two types of teams across all dependent variables, leading to the support of H3. These results were depicted in Figure 4 where point 1 and point 4 represented these two different treatments.

This study also revealed some significant effects that were not hypothesized. The adopted dialogue technique was found to be useful for both face-to-face and videoconferencing teams. After building shared common understanding of effective

communication, both face-to-face and videoconferencing teams improved their perceptions of meeting outcomes, resulting in better perceptions of face-to-face team than videoconferencing teams (t=.2.11, p<.05; t=2.25, p<.05; and t=2.86 p<.05 for DPS, DS, DQ respectively).

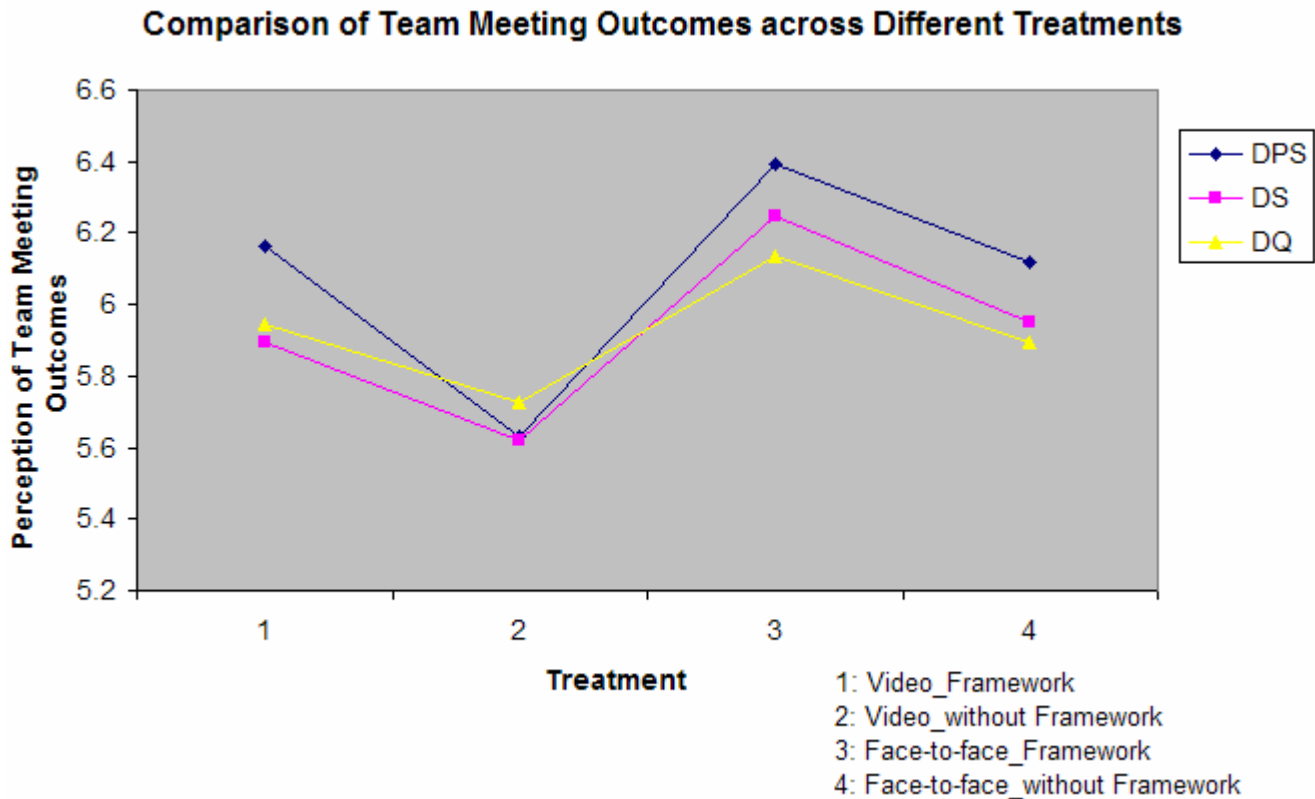## Comparison of Team Meeting Outcomes across Different Treatments

Figure 4: Comparison of Team Meeting Outcomes Across Different Treatments

DISCUSSION AND IMPLICATIONS

This study has investigated the impact of a dialogue technique on enhancing virtual team meeting outcomes by comparing videoconferencing and traditional face-to-face team interaction in a Chinese cultural context. Past research has not examined the role of this technique in shaping the attitudes and views of videoconferencing participants. This study results yielded three useful findings. First, this study reaffirmed medium-task fit perspective with better perceptions of team meeting outcomes of traditional face-to-face team (except decision satisfaction). Second, videoconferencing teams that employed the framework were found to be as well as traditional face-to-face teams. Third, this study confirmed the effect of the adopted framework, especially in face-to-face teams. Even though the employed framework assisted videoconferencing teams to improve their perceptions, it was not a significant change.

Face-to-face interaction has always being considered as the most effective medium for teams to resolve equivocal problems. Compared to other CMC media, face-to-face is able to support the highest level of interactive activities by providing continuous feedback during the interaction, using various social cues and body languages, and enabling unpredictable and spontaneous remarks. This study has demonstrated that this impact was continuing to exist even though teams built up a common understanding before they worked on their tasks. So, if both face-to-face and videoconferencing teams all have a chance to build shared common understanding before they work together as a team, face-to-face interaction may still outperform videoconferencing teams. However, if it is not feasible for teams to meet face-to-face to conduct projects, they can still be as effective as face-to-face teams as long as they can share their values of effective communication and their

frame of reference, and reach a consensus of team interaction ground-rules. Just like the brainstorming tool that has been considered an inherent part of a computer-mediated technology, the adopted framework in this study can be considered as an integral part of a virtual team. There has been some argument about whether videoconferencing offers an effective alternative or supplement for face-to-face communication with the increase use of videoconferencing and its distinctive advantages over other computer-mediated technologies and face-to-face communication (Sniezek et al. 2002; Straus 1997; Vinsonhaler, Braunstein, Boman, Johnson, Henderson and Gilliland 1998). In this respect, this study has demonstrated that after employing the dialogue technique into a virtual team, virtual team members may be able to improve their team meeting outcomes, in this regard, approaching face-to-face interaction.

This study found that the adopted dialogue technique had a stronger impact on face-to-face teams than videoconferencing teams. This may be explained by the Chinese cultural values participants have. The Chinese culture, characterized by high collectivism, high-context and interdependent communication orientation, promotes an implicit and ambiguous communication style. Chinese messages are comparatively terse in words, but rich in meaning (Martinsons and Westwood 1997). A large portion of the message is left unspecified. Thus, any subtle cues, such as tone, dynamics and any hesitation in response, between-the-lines interpretation of what is actually said, together with facial expressions and body language are important for fully understanding of the words being communicated. Hall (1976) has demonstrated that high-context cultures perceive the external environment, the situation and non-verbal behavior to be highly significant for the creation and interpretation of communication. Computer-mediated communication systems cannot convey the necessary richness of meaning in a high context communication environment. Even though videoconferencing interaction has allowed real-time interaction with audio and video communication among team members, it still differs from face-to-face interaction in important ways. Due to the physical separation of team members, the social presence of videoconferencing has been lessened, compared with face-to-face interaction. There is a general consensus within the literature that as bandwidth narrows, the communications channel becomes less suitable for complex social interaction and interpersonal communication (Rice and Williams 1984). Face-to-face meetings have made Chinese participants feel more comfortable by providing opportunities for social interaction.

Several limitations and opportunities for future research are noteworthy. First, the data for this research are cross-sectional rather than longitudinal. McGrath has noted, "Groups develop and exist in a temporal context" (McGrath 1990, p.23). Chidambaram (1996) found that virtual teams mediated through computer technologies can improve their relational development and meeting outcomes over time. Previous studies examining the impact of the dialogue technique on virtual teams under asynchronous environment have found that the impact due to time and the impact due to the dialogue technique are additive (Huang et al. 2001; Tan et al. 2000). Even though the results of this study have indicated that the dialogue technique appears to give teams a head start, a longitudinal research design examining the impact of the dialogue technique and time on team relational development and meeting outcomes when teams interact through different technologies would further our knowledge toward understanding how the amount of time that teams have spent working together moderates the role of the dialogue technique in team development process and meeting outcomes in face-to-face and videoconferencing communication environments. Second, data were collected in a Chinese cultural context. As discussed earlier, this collectivistic culture characterized with strong preference of face-to-face might undermine the potential impact of the dialogue technique on enhancing computer-mediated technology communication. But the improvement found in videoconferencing teams shows that the employment of the shared experience does help increase the information carrying capacity of videoconferencing medium, moving it closer to face-to-face in this regard. The use of the shared experience for virtual teams may move the group satisfaction with videoconferencing closer to the expectations of face-to-face medium. The third limitation is the use of students as subjects. Students have less experience in working with teams and solving complex organizational problems than virtual teams in real organizations. Nevertheless, this study does demonstrate that the dialogue technique may be a useful tool for virtual teams to quickly become effective upon the formation of the team. In addition, the task used in this study is a preference task. Task type has been consistently found to moderate the effects of the technology on team outcomes. However, previous studies have found that for preference tasks, face-to-face interactions have been found to perform significantly better than that of CMC teams. Nevertheless, future study can employ different types of tasks to examine how the impact of the dialogue technique differs across the tasks.

Limitations discussed above notwithstanding, the findings from the present study firmly establish the need to incorporate the shared mental models into theories of virtual teams. Computer-mediated virtual teams can improve their team relational process and meeting outcomes if they can build team mental models of effective communication. In particular, this study found that the shared mental models might bring virtual teams interacting via synchronous technology closer to the traditional face-to-face teams. Travel is costly. The adopted dialogue technique in this study may help virtual teams communicating via videoconferencing function as effectively as traditional face-to-face teams, leading to both reduction in transportation costs and a commensurate improvement in the time taken for team deliberations.

This study was conducted in the Chinese cultural context, a collectivistic culture that values consensus. However, as distances are spanned, cultural differences emerge. Many organizational virtual teams probably consist of members from different countries, forming a global virtual team. Since mental models are shaped by cultural background to a great extent (Hofstede 2001; Tan et al. 2000), global virtual teams with different cultural values make mental models development difficult (Furst, Blackburn and Rosen 1999). It is unknown how the adopted dialogue technique can assist global virtual teams to establish shared understanding among team members. Thus, further research is needed to test how the adopted dialogue technique might help teams working in the virtual environment best manage these cultural differences as they develop and reinforce their team mental models (Furst et al. 1999; Tan et al. 2000).

With the rapidly uptake of videoconferencing usage within organizations, a better understanding of how to use videoconferencing for virtual teams' effective communication is crucial. The dialogue technique adopted in this study may be a useful framework for helping virtual teams achieve improved team meeting outcomes. Furthermore, due to the better meeting outcomes of face-to-face over videoconferencing, a mixed mode of interaction that temporally sequences face-to-face and computer-mediated communication may be a better solution for virtual teams' communication since team relational development is an important factor for a team's success and face-to-face communication may facilitate relational development (Chidambaram and Bostrom 1996).

CONCLUSION

This study examined the impact of the dialogue technique to enhance computer-mediated communication by comparing teams working face-to-face and teams interacting via videoconferencing system. Results from the study show that the adopted dialogue technique can indeed help teams develop their relationship and achieve improved team meeting outcomes. Furthermore, this technique can be useful for both traditional face-to-face teams and virtual teams that communicate via videoconferencing systems. Results also show that virtual teams with a shared understanding can obtain improved team meeting outcomes, approaching the expectation of traditional face-to-face teams.

With the rapid development of communication technologies, combined with flatter organizational structures and geographically dispersed organizational sites, virtual teams are increasingly used to accomplish complex organizational work. Organizational managers must not only be cognizant of the inherent difficulties associated with geographically distributed teams, but must be informed about how to reduce these drawbacks. Computer-mediated videoconferencing system can be a supplement for face-to-face interaction by providing shared knowledge among team members. The dialogue technique adopted in this study may be used to increase productivity of virtual teams who need to work together but may be separated geographically.

ACKNOWLEDGEMENTS

REFERENCES

1. Alge, B., Wiethoff, C., and Klein, H. (2003) "When does the medium matter? Knowledge-building experiences and opportunities in decision-making teams," *Organizational Behavior and Human Decision Processes,* (91:1), pp 26-37.

2. Baltes, B.B., Dickson, M.W., Sherman, M.P., Bauer, C.C., and LaGanke, J.S. (2002) "Computer-mediated communication and group decision making: A meta-analysis," *Organizational Behavior and Human Decision Processes,* (87:1), pp 156-179.

3. Bohm, D. (1990) *On Dialogue* Davis Bohm Seminars, Box 1452, Ojao,CA.

4. Cannon-Bowers, J.A., and Salas, E. (1997) "A framework for developing team performance measures in training," in: *Team performance Assessment and Measurement,* M.T. Brannick, E.Salas and C.Prince (eds.), Erlbaum, Mahwah, NJ, pp. 45-62.

5. Carlson, J.R., and Zmud, R.W. (1999) "Channel expansion theory and the experiential nature of media richness perceptions," *Academy of Management Journal,* (42:2), pp 153-170.

6. Chidambaram, L. (1996) "Relational development in computer-supported groups," *MIS Quarterly,* (20:2), pp 143-165.

7. Chidambaram, L., and Bostrom, R.P. (1996) "Group development (I): A review and synthesis of development models," *Group Decision and Negotiation,* (6), pp 159-187.

8. Daft, R.L., and Lengel, R.H. (1984) "Information richness: A new approach to managerial behavior and organization design," in: *Research in Organizational Behavior,* L.L. Cummings and B.M. Staw (eds.), JAI Press, Greenwich, Connecticut, pp. 191-233.

9. Daft, R.L., Lengel, R.H., and Trevino, L.K. (1987) "Message equivocality, media selection, and manager performance: Implications for information systems," *MIS Quarterly,* (11:3), pp 355-366.

10. Dennis, A.R., and Kinney, S.T. (1998) "Testing media richness theory in the new media: The effects of cues, feedback, and task equivocality," *Information Systems Research,* (9:3), pp 256-274.

11. Dennis, A.R., and Valacich, J.S. (1993) "Computer brainstorms: More heads are better than one," *Journal of Applied Psychology,* (78), pp 531-537.

12. Furst, S., Blackburn, R., and Rosen, B. (1999) "Virtual team effectiveness: A proposed research agenda," *Information Systems Journal,* (9), pp 249-269.

13. Gouran, D.S., Brown, C., and Henry, D.R. (1978) "Behavioral correlates of perceptions of quality in decision-making discussions," *Communication Monographs,* (45:1), pp 51-63.

14. Green, S.G., and Taber, T.D. (1980) "The effects of three social decision schemes on decision group processes," *Organizational Behavior and Human Performance,* (25:1), pp 97-106.

15. Hall, E.T. (1976) *Beyond Culture* Doubleday, New York.

16. Hofstede, G. (2001) *Culture's Consequences: Comparing Values, Behaviors, Institutions, and Organizations Across Nations*, (2nd ed.) Sage, Thousand Oaks, CA.

17. Hollingshead, A.B., McGrath, J.E., and O'Connor, K.M. (1993) "Group task performance and communication technology : A longitudinal study of computer-mediated versus face-to-face work groups," *Small Group Research,* (24), pp 307-333.

18. Huang, W.W., and Lai, V.S. (2001) "Can GSS groups make better decisions and feel good at the same time? A longitudinal study of asynchronous GSS groups," Proceedings of the 34th Hawaii International Conference on System Sciences, Hawaii,2001.

19. Huang, W.W., Watson, R.T., and Wei, K.K. (1998b) "Can a lean email medium be used for rich communication: A psychological perspective," *European Journal of Information Systems,* (7), pp 269-274.

20. Huang, W.W., Wei, K.K., Bostrom, B., Lim, L.H., and Watson, R.T. (1998a) "Support distributed team-building using GSS: A dialogue theory-based framework," Hawaii International Conference on System Sciences, Hawaii.

21. Jarvenpaa, S.L., and Knoll, K. (1996) "Global virtual collaboration," http://uts.cc.utexas.edu/~bgac313/,.

22. Lurey, J., and Raisinghani, M. (2001) "An empirical study of best practices in virtual teams," *Information & Management,* (38:8), pp 523-544.

23. Marks, M.A., Zaccaro, S.J., and Mathieu, J.E. (2000) "Performance implications of leader briefings and team-interaction training for team adaptation to novel environment," *Journal of Applied Psychology,* (85:6), pp 971-986.

24. Martinsons, M.G., and Westwood, R.I. (1997) "Management information systems in the Chinese business culture: An explanatory theory," *Information & Management,* (32:5), pp 215-228.

25. McGrath, J.E. (1984) *Groups: Interaction and Performance* Prentice-Hall, Englewood Cliffs, NJ.

26. McGrath, J.E. (1990) "Time matters in groups," in: *Intellectual Teamwork: Social and Technical Bases of Collaborative Work,* J. Galegher, K. R.E. and C.Egido (eds.), Erlbaum, Hillsdale, NJ, pp. 23-61.

27. Mennecke, B.E., and Wheeler, B.C. (1993) "Tasks matter: Modeling group task processes in experimental CSCW research," Proceedings of the 26th Annual Hawaii International Conference on Systems Sciences, Maui, HL,1993, pp. 71-81.

28. Osterlund, J. (1997) "Competence management by informatics in R&D: The corporate level," *IEEE Transactions on Engineering Management,* (44:2), pp 135-145.

29. Pauleen, D., and Yoong, P. (2001) "Facilitating virtual team relationship via Internet and conventional communication channels," *Internet Research-Electronic Networking Application and Policy,* (11:3), pp 190-202.

30. Rice, R.E. (1987) "Computer-mediated communication and organizational innovation," *Journal of Communication,* (37:4), pp 65-94.

31. Rice, R.E., and Williams, F. (1984) "Theories old and new: The study of new media," in: *The New Media: Communication, Research and Technology,* R.E. Rice (ed.), Sage Publications, Beverly Hills, CA, pp. 55-80.

32. Sambamurthy, V., Poole, M.S., and Kelly, J. (1993) "The effects of variations in GDSS capabilities on decision-making processes in groups," *Small Group Research,* (24), pp 523-546.

33. Schein, E.H. (1993) "On dialogue, culture, and organizational learning," *Organizational Dynamics*), pp 40-51.

34. Senge, P.M. (1992) "Mental models," *Planning Review,* (March), pp 5-10.

35. Short, J., Williams, E., and Christie, B. (1976) *The Social Psychology of Telecommunications* Wiley, New York.

36. Sniezek, J.A., and Crede, M. (2002) "Group judgment processes and outcomes in video-conferencing vs. face-to-face groups," The 35th Hawaii International Conference on System Sciences, Hawaii,2002.

37. Sproull, L., and Kiesler, S. (1986) "Reducing social context cues: Electronic mail in organizational communication," *Management Science,* (32:11), pp 1492-1521.

38. Stout, R.J., Salas, E., and Kraiger, K. (1996) "The role of trainer knowledge structures in aviation team environment," *International Journal of Aviation Psychology,* (7), pp 235-250.

39. Straus, S.G. (1997) "Technology, group, process, and group outcomes: Testing the connections in computer-mediated and face-to-face groups," *Human-Computer Interaction,* (12:3), pp 227-266.

40. Straus, S.G., and McGrath, J.E. (1994) "Does the medium matter: The interaction of task type and technology on group performance and member reactions," *Journal of Applied Psychology,* (79), pp 87-97.

41. Tan, B.C.Y., Wei, K.K., Huang, W.W., and Ng, G.N. (2000) "A dialogue technique to enhance electronic communication in virtual teams," *IEEE Transactions on Professional Communication,* (43:2), pp 153-165.

42. Townsend, A.M., DeMarie, S.M., and Hendrickson, A.R. (1998) "Virtual teams: Technology and the workplace of the future," *The Academy of Management Executive,* (12:3), pp 17-29.

43. Vinsonhaler, J.F., Braunstein, L., Boman, R., Johnson, J.J., Henderson, D., and Gilliland, R. (1998) "A comparison of collaborative problem solving using face to face versus desktop video conferencing," The 31st Hawaii International Conference on System Sciences, Hawaii,1998.

44. Yoo, Y., and Alavi, M. (2001) "Media and group cohesion: Relative influences on social presence, task participation, and group consensus," *MIS Quarterly,* (25:3), pp 371-390.

45. Zack, M.H. (1994) "Electronic messaging and communication effectiveness in an ongoing work group," *Information & Management,* (26), pp 231-241.