Face-to-Face Versus Computer-Mediated Communication: A Comparison of Experimental Literature

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Abstract

This paper synthesizes the findings from eleven studies completed since 1994 that focus on Face-to-Face (FTF) versus Computer-Mediated Communication (CMC) and compares the results with the earlier study by Bordia (1997). The author proposes future research directions in this area and identifies emerging trends from this research.

1. Introduction

Over the last decade the use of computers and electronic networks have become common places in all areas of working and community life. This has promoted the practices of people work widely dispersed but in close communication through computer mediated communication (CMC). As a result, there has been a proliferation of studies that focus on the comparison of face-to-face (FTF) and computer-mediated communication (CMC). Bordia (1997) collected 18 experimental studies (1985~1994) from psychological, sociological, business and communication databases and summarized them into 10 major groupings related to comparison of FTF and CMC. This paper reviews these findings and in the light of further developments in computer technology and evolution of communication related theories considers emerging trends after 1994. This paper reviews the results from and analyzes eleven studies (listed in appendix 1) that focus on the comparison of FTF and CMC and compares these results against Bordia's findings.

2. Setting Bordia's Study in Context

Bordia's 10 findings are as below:

1. CMC groups take longer to complete the allotted task.

2. In a given time period CMC groups produce fewer remarks than FTF groups

3. CMC groups perform better than FTF groups on idea generation tasks.

4. There is greater equality of participation in CMC groups.

5. When time is limited, CMC groups perform better than FTF groups on tasks involving less, and worse on tasks requiring more, social-emotional interaction. Given enough time, CMC groups perform as well as FTF groups.

6. There is reduced normative social pressure in CMC groups.

7. Perception of partner and task is poorer in CMC groups.

8. In CMC, evaluation of the communication partner is poorer under conditions of limited time. Evaluation of the medium is influenced by the type of the task.

9a. There is higher incidence of uninhibited behavior in CMC groups.

9b. CMC induces a state of deindividuation, which in turn leads to uninhibited behavior.

10. CMC groups, as compared to FTF groups, exhibit less choice shift or attitude change.

Powell et al. (2004) reviewed 43 articles (1988~2002) about virtual teams and proposed a detailed and intact framework of virtual teams. The framework includes four general constructs: "inputs", "socio-emotional processes", "task processes" and "outputs". "Inputs" focuses on the pattern and composition of virtual teams. "Socio-emotional processes" concerns the building of social relationships between team members. "Task processes" presents the processes that team members use to complete a task or reach a goal. "Outputs" consists of performance and satisfaction. Performance means outcome of teams while satisfaction relates to the well-being perceived by members.

This study categorizes Bordia's 10 findings to Powell's et al. framework as below:
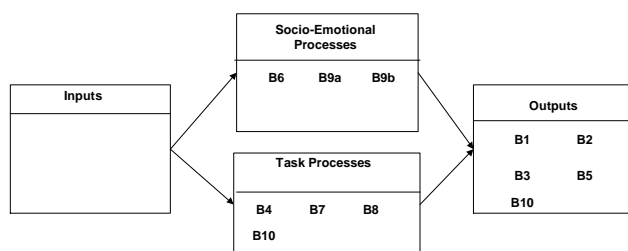
Figure 1: Categorizing Bordia's 10 Findings into Powell's et al. Framework

PS: Bx is Bordia's finding. For example, B6 is Bordia's finding 6

It can be seen that Bordia's findings are located in task and outputs dimensions. In addition, the outputs part focuses on performance instead of satisfaction. This would seem to add support to Powell's et al conclusion: social dimension needs more investigation.

3. Findings of This Study

In the following section, 10 findings of this study are introduced:

(1) The performance of CMC is worse than FTF

According to the appendix 1, most studies suggested that the performance of CMC groups is worse than FTF groups (Galegher et al., 1994; Warkentin et al., 1997; Dufner et al., 2002) while only one study stated no significant difference between both teams (Burke et al., 1996). The result is consistent with Bordia's finding 2.

The causes of CMC had worse performance vary, such as insufficient training (Dufner et al., 2002) and insufficient time to communicate (Dufner et al., 2002). It seems that time is a crucial issue for performance. If time is enough (for communicating or training), the performance of CMC groups could be the same as FTF groups. The finding is correspondent with Bordia's finding 5.

(2) The satisfaction of CMC is lower than FTF

According to the appendix 1, most studies explained that the satisfaction of CMC groups is lower than FTF groups (Galegher et al., 1994; Straus, 1996; Warkentin et al., 1997; Dufner et al., 2002; Ocker, 2002; Valacich et al., 2002) while only one study stated that CMC members enjoy the process higher (Shen et al., 2001).

These studies did not explain why the CMC groups had lower satisfaction. Only Shen et al. (2001) stated that the grading system (includes grading criteria) might affect satisfaction.

Bordia did not provide any conclusion about satisfaction. It shows that the earlier studies put more focus on the performance instead of human perception of satisfaction.

(3) CMC takes longer to complete the tasks

It is not difficult to image that CMC groups take longer time to complete the task. Stratus (1996) even stated that CMC groups took about twice as long to finish the task. It may be due to the limitations of CMC. The speed of typing message for CMC users is far slower than the speed of speaking for FTF. The CMC's property of carrying less social cue and communication content (Stratus, 1996) makes CMC groups need longer time to exchange information to complete the tasks.

However, CMC groups put more focus on the task itself. Benbunan-Fich et al. (2001) observed the task focus on the CMC:

> "They usually began their discussion by trying to solve their differences and only when the deadline was approaching, they paid attention to the worksheet questions. In asynchronous groups, most of the time was consumed in the solution of the disagreements (discrepancy reduction) or discussion of new issues that came up. During the course of the experiment, asynchronous groups had to decide how and when to proceed if they encountered missing/absent members. The rest of the team identified them when they failed to post their individual position statement by the deadline." (p. 6)

Straus (1997) studied about the relationships between tasks type and productivity and found that the task focus is positively associated with productivity in idea generation task while task focus is not associated with productivity in task requiring consensus.

The result is consistent with Bordia's finding 1.

(4) It is more difficult for CMC to coordinate the task

Some studies reported that CMC groups are difficult for coordinating (Benbunan-Fich et al., 2001; Dufner et al., 2002; Galegher et al., 1994).

Benbunan-Fich et al. (2001) observed the coordination strategy of FTF groups:

> "In order to prepare the final report, every manual group appointed a member in charge of taking notes during the discussion (concurrent). This person had the responsibility to submit the group report at the end of the session. Sometimes, the rest of the group had to wait until the note-taker could write down the important aspects of the discussion (sequential). In a few cases, the note-taker added extra ideas to the final report. This explains why some issues not mentioned in the discussion appeared in a few group solutions." (p. 6)

Otherwise, Benbunan-Fich et al. (2001) described the coordination strategy of CMC:

"Three groups appointed a representative to compile the

individual contributions and develop a group report (pooled), while two groups decided to assign each participant a different part of the final report (parallel). In the pooled collaboration mode, the compiler summarized the individual position statements based on the discussion transcripts, and posted drafts of the final reports to get approval from the rest of the team. In one online group, the compiler exercised some discretion and added extra ideas to the final report. But when the drafts were presented for approval, nobody seemed to detect or object to these extra ideas." (p. 6)

Benbunan-Fich et al. (2001) summarized that CMC groups used parallel and pooled approaches while FTF groups used combination of concurrent and sequential strategies. However, they also concluded that CMC groups adopted loosely coupled interaction modes with lower levels of interdependence when compared to FTF groups.

One interesting phenomenon is that both teams appointed one member to summarize and aggregate others' opinions and finish the reports. In addition, the representative added his/her opinions to the report without others' agreements.

The coordination strategy is absent from Bordia's findings.

(5) Communication effectiveness is still ambiguous

Communication effectiveness is crucial to group interaction and performance (Fisher et al., 1994). Many studies examined the communication effectiveness between FTF and CMC, but the results varied. Some studies stated that CMC groups had better communication effectiveness (Straus, 1997; Tidwell et al., 2002; Benbunan-Fich et al., 2001) while some studies explained that there was no difference of communication effectiveness between the two kind of teams (Burke et al.,1996; Warkentin et al., 1997). However, CMC groups follow very different patterns of communication compared to FTF group (Burke et al., 1996).

The possible factors that affect communication effectiveness are cohesion (Warkentin et al., 1997) and social relationships (Warkentin et al., 1997). It means that bonding may affect communication. If members feel close and intimate, the communication effectiveness could be higher.

The result is consistent with Bordia's finding 8, but the causes are different. The cause of affecting communication effectiveness tends to be social relationships in this study while the cause tends to be the medium's inability of conveying positive affective information in Bordia's study. The social relationships and medium's ability are possible reasons to affect the communication effectiveness. However, due to the development of technology of CMC, the medium's ability

has been advanced and it may be not a problem anymore. Thus, the recent studies just discovered the social issues without medium's ability.

(6) CMC presents higher participation

CMC groups show higher participation (Valacich et al., 2002; Straus, 1997; Straus, 1996). It may be due to the characteristics of CMC. In the FTF environment, members cannot participate simultaneously in discussion and still be heard. But in CMC environment, members can type messages and share information simultaneously (Straus, 1996). CMC reduces the obstacles and becomes an enabler that facilitates the participation (Straus, 1996).

The result is consistent with Bordia's finding 4. Bordia suggested that the participation is related to the proficiency. The more experienced subjects presented higher participation.

(7) Social relationships is not easy to be built for CMC

Many studies suggested that the cohesion is lower in CMC groups (Straus, 1997; Ocker, 2002; Warkentin et al., 1997) and it is not easy to build friendships in CMC groups (Shen et al., 2001). The result responses to Media Richness theory (Daft, 1987). The theory suggests that CMC has narrow channels and carries out less social cues, thus it is difficult for CMC members to build social relationships.

The result is consistent with Bordia's finding 6. In addition, Bordia's finding 7 explained that CMC members are poor to understand each other. Thus, the result is partly consistent with Bordia's finding 7.

(8) CMC shows higher conflict

CMC groups have higher conflict (Valacich et al., 2002; Ocker, 2002). The possible reason is that there are greater differences between the individual decisions and group decisions (Valacich et al., 2002). The members of CMC have their own ideas individually more than FTF. It is not difficult to image that more conflict occurs during the processes of opinions' convergence and reaching the consensus in CMC groups.

This result is indirectly correspondent with Bordia's findings 10. Bordia's finding 10 suggests that CMC groups exhibit less choice shift or attitude change. That means CMC members tend to hold on their own view individually than FTF members. Although Bordia just described the phenomenon, if think deeper, when every member in a team persists his own opinions firmly, the conflict will be absolutely higher in the processes of negotiation.

(9) The decision quality of CMC is worse than FTF

FTF groups reported better decision quality (Benbunan-Fich et al., 2001) and The CMC groups made

riskier decisions (Valacich et al., 2002). Thus, the decision quality of CMC groups is inferior to FTF groups. The reason may be due to lack of information (Valacich et al., 2002). This finding is correspondent with the Media Richness theory (Daft, 1987) that if there is less information, the degree of uncertainty is higher, and then the riskier decision is made.

Although the decision quality of CMC groups is worse, CMC members feel more flexibility. Shen et al. (2001) quoted CMC members' feelings about flexibility: "I don't have to go to campus. I did the exam actually from India"; "The best was you could really think about the question ahead of time and then post your version of the answer with thorough organizing and proofreading" (p. 8).

Surprisingly, Bordia's findings did not include the obvious conclusion of decision quality. But in finding 2, he quoted some studies explained that the decision report of CMC groups got fewer marks than FTF groups. While in finding 7, he explained that CMC groups made more error in their choices and decisions. Thus, this finding indirectly supports Bordia's finding 2 and 7.

(10) CMC is good at idea generation task

CMC groups have better performance at idea generation task (Benbunan-Fich et al., 2001; Straus, 1997). Possible reason is the nature of CMC. It allows members to have time to think and response deliberately. Thus, CMC groups have broader discussion and produce longer and better reports than FTF groups (Benbunan-Fich et al., 2001).

This finding is correspondent with Bordia's finding 3. Bordia suggested that due to the "reduced production blocking" and "evaluation apprehension", CMC groups could produce more idea than FTF groups. The reason is similar to the reason discussed above.

4. Summarize the Findings of This Study and The Comparison of Bordia's Study

When the findings of this study are categorized into Powell's et al. framework as well (as shown in Figure 2), it can be seen that the recent studies still focus on the task and output dimensions. The result is similar to the analysis of Bordia's study.
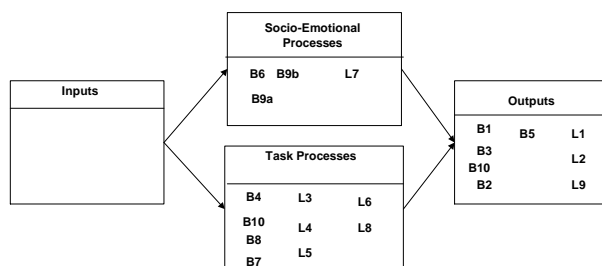
Figure 2: Categorizing The Findings of This Study and Bordia's Study into Powell's et al. Framework.

PS: Bx is Bordia's finding while Lx is this study's finding.

Next, this study compares the all findings of this study and Bordia's study and lists in the appendix 2. The finding of this study that is absent from Bordia's study is finding 4 (coordination), partly supports is finding 2. It implies that recent studies gradually noticed and extended their antenna to human's perception of satisfaction and how the group members interact and coordinate. The finding of Bordia's study that is absent from this study is finding 9 (uninhibited behavior and deindividuation). However, it does not mean that the recent studies put no attention on the individual area. It just indicates the time limitation of this study.

5. Future Direction

According to the discussion above, this study suggests the following future research directions:

(1) Social dimension still needs more attention

According to figure 2, it can be seen that the conclusions of both studies suggest that research in social dimension is inadequate. To know more about the content of FTF and CMC, it is unavoidable to understand deeply the social and psychological aspects (Warkentin et al., 1997). Warkentin et al. (1997) also suggested that add the FTF meeting to the CMC can improve the development of social relationships and performance and satisfaction of group members. Thus, the success of CMC may be dependent on the provision of social content sharing (Warkentin et al., 1997). Thus, social factors, such as friendships and the impact of outcomes (Shen et al., 2001), relationships building and cohesion (Powell et al., 2004) are worthy to be investigated deeply. In addition, the social factors' relationships and their impacts on the output (performance and satisfaction) are also crucial in the future research.

(2) Researcher should put more focus on "input" part.

From figure 2, it is obvious that seldom studies investigate the "input" part of Powell's et al. (2004) framework. The "input" part of Powell's et al. (2004) framework includes design, culture, technical and training. The following section discusses training, culture and setting (includes design and technical):

Training

Dufner et al. (2002) reported that learning to use CMC system to finish the problem solving process was more confusing than not using CMC system. The subjects reported the training time was not enough. So training may be an important issue for the experiment design. Being more familiar with tools may allow users to concentrate on the interaction with other group members instead of tools (Warkentin et al., 1997). Thus, training could be an important issue that affects the results. For

example, how long is it enough for training? What kind of tasks should match with the training courses?

Settings:

Setting includes design and technical. It relates to the subjects, environments and technology. Valacish et al. (2002) suggested that their results should be examined in other setting, for example, different population and different problem. Burke et al. (1996) suggested the future research should focus more on expertise, authority and power. In addition, grading system and instructor's role in the process are needed to be explored more (Shen et al., 2001). In addition, from appendix 1, the group size is from 3 to 6. Which size is the most appropriate for specific kind of tasks? Such topics relate to subjects' characteristics, project design, evaluation methods and leadership (Warkentin et al., 1997) deserve more attention by researchers.

Culture:

Although culture has been a popular topic in other areas, fewer studies have explored the cultural issue in FTF and CMC. A similar study by Ryssen and Godar (2000) explored the culture issue in multinational virtual teams (America and Belgium). The result indicates that language and socialization background are important for multinational virtual teams. However, culture may be an important issue in CMC and FTF when the counterparts are in different countries or cultural backgrounds.

(3) Time dimension should be taken into consideration

It is consensus that CMC groups need more time to communicate with each other and complete the task (Galegher et al., 1994). In Burke's et al. (1996) study, the result showed that there were no significant differences between CMC and FTF, the possible reason is that time is too short (4 weeks). "If we'd had the opportunity to observe more sessions, we might have seen greater differences among those patterns of change" (Burke et al., 1996, p. 99). Otherwise, the Social Information Processing (SIP) theory by Walther (1992) also suggested that if the time is enough for CMC group, the members can build social relationships as good as FTF group. Thus, the time may crucially affect the result of research. By observing appendix 1, the time of all studies varies. The range is from decades of minutes to one month. How much time do CMC members need to communicate adequately? And then, the research can avoid the bias caused by time. According to Burke et al. (1996), one month seems not enough. Therefore, the longitudinal study is needed (Burke et al., 1996; Straus, 1997).

(4) Start to investigate the real world

By observing appendix 1, most studies used lab experiment. Students were used to examine the theories ad hypotheses. There are two drawbacks: firstly, due to the limitation of lab experiment, the time is not enough

for CMC groups. So it is hard to avoid the bias caused by time (discussed above). Secondly, Because of the limitation of artificial environment of lab, the results must have deviation to reflect the real situation. Thus, the explanatory ability of the results to explain the real world is lower.

Therefore, some studies recognized the situation and urged the natural settings (Ocker, 2002). It means that researchers should start to investigate the CMC and FTF in the real world, although the natural environment that both teams exist simultaneously and suitable for research is not easy to be retrieved. Many schools that have both on-line and on-campus courses should be a good trial.

(5) New technology needs more investigation

With the fast advance of new technology, faster and more convenient tools have been introduced, such as IP phone, Instant Messenger. The advantages of new technology do not always outweigh the disadvantage (Warkentin et al., 1997). New technology may hinder the development of social relationships and lower the satisfaction with the group's interaction process (Warkentin et al., 1997). Using different system may yield different results (Straus, 1996). Therefore, it would be valuable to investigate the impact of new technology on the contents and strategies of group interaction.

6. Conclusion

Comparing Bordia's study, this study found the new trends of the recent studies:

(1) Gradually put more attention on social dimension and humanity
The researchers have put more focuses on social dimension and humanity aspect, such as satisfaction, cohesiveness, friendship, conflict and participation. Although these social and humanistic factors have been explored gradually, there is still a big room for examining the factors' relationships and their impacts on the outcome of FTF and CMC.

(2) Integrated more theories
With the development of new theories, the recent scholars incorporated more social theories into their studies, such as SIP (Tidwell, 2002), SIDE (Tidwell, 2002) and TIP (Warkentin, 1997). Otherwise, some studies still covered the previous theories such as Media Richness theory (Baker, 2002). In addition, the trend of applying social theories to the research context is getting popular.

(3) Investigated more "input part"
The recent studies did head to the "input part", such as training, environmental settings, cultural issues. Due to the complexity of environment of FTF and CMC, there is seems to be no convergence of conclusion of how the settings should be. For example, how is the group size? How long does the training take? How to design the task? Although

some studies started to explore the area, the paradox still needs more investigation.

Although these issues gradually have been explored, with the fast-advanced technology and quick evolvement of environment, not only the individual research of human, tasks and technology, but also the factors' interaction and relationships need more investigation in the future.

7. Appendices

Appendix 1. The comparison of CMC and FTF team

Year	Author	Result (CMC compares to FTF)	System	Task	Subjects	Time
1994	Galegher et al.	● Performance lower ● Satisfaction lower	ICOSY(Computer-mediated system)	Group writing(business dilemma)	117 students, 67 teams,GS=3	2 Weeks
1996	Burke et al.	● No significant differences in the patterns of change in their perception over time (Social presence, communication effectiveness and communication interface)	GroupLink, GroupWriter	Group writing	127 students, 33 teams	4 weeks
1996	Straus	● Participation associates with extraversion ● Media had few effects on information sharing or performance ● Process satisfaction is lower	Electronic Conference System	Subarctic Survival situation (Problem solving task)	54students, (VT:28; FTF: 26) GS=3	< 1hour
1997	Straus	● Less productive ● Low satisfaction ● Low cohesiveness ● Higher proportions of task communication and disagreement ● Greater equality of participation	Synchronous computer conferencing system	Three tasks: A idea generation task An intellective task A judgment task	243 undergraduate students (VT:36; FTF:36) GS=3	<1 hour

1997	Warkentin et al.	• Performance lower. • Satisfaction lower. • Communication effectiveness same	MeetingWeb (Web-based conference system)	Murder mystery	72Undergraduate(VT:39; FTF:33) GS=3	FTF:25min VT:3weeks
2001	Benbunan-Fich et al.	• More broader discussions, complete reports, focus on solving problem • Coordination is worse • No different transferring information discussion to report	Asynchronous Learning Network (ALN)(text-based)	A case(no detail)(discussion and report writing)	53undergraduate (VT:25; FTF:28) GS=4-6	FTF:2hous VT:not mention
2001	Shen et al.	• develop new friendship lower • Flexibility higher • enjoy process higher • learn from other same	Asynchronous Learning Network (ALN). Virtual Classroom and Webboard	Collaborative exam	138 graduate-level students Semester 1:63(VT:21, FTF:41) Semester 2:75(VT:15, FTF:60)	2 semester
2002	Dufner et al.	• Coordination lower • Satisfaction lower • Less efficient • More confusing • Less fair	Cybercollaboratory system	Vendor selection task Parking lot allocation problem	153 students	Train:1week Experiment: 1week
2002	Ocker	• Cohesion lower • Manage conflict lower • Satisfaction lower	FirstClass Computer conferencing systsem	Computerized Post Office (CPO) task	83 MBA students (47 in VT,GZ=4, 36 in FTF,GZ=4-6)	17 days

2002	Tidwell et al.	● Uncertainty reduction higher. ● More confidence ● Greater conversational effetiveness	CMS system	Not mention	students(158)	Not mention
2002	Valacich et al.	● Make riskier decisions ● Lower process satisfaction ● Higher and more even participation ● Higher intra-group conflict	NetMeeting	Business dilemma	274 financial accounting students(),GS=3	<1 day

Appendix 2. Comparing the findings of this study and Bordia's study

Bordia's study / This study	1	2	3	4	5	6	7	8	9	10	Comments
1		S			S						
2							P				
3	S										
4											N
5								S			
6				S							
7						S	P				
8									P		
9		P					P				
10			S								
Comments									N		

PS: S: Support   P: Partly support   N: Not mentioned

N means both studies did not find the issues. For example, in the cell (5, Comments), the "N" means there is no corresponding finding of this study to Bordia's study

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