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ABSTRACT

The research on Computer-Mediated Communication (CMC) is largely inconsistent. These inconsistencies may be attributed to the different system software, tasks, subjects, and methodological designs. A study utilized a commercially developed conferencing software (Quickmail) to allow other researchers to gain easy access to the software and form a basis for future comparative study. Quickmail was used to compare the effects of Face to Face (FTF) and CMC among 144 undergraduate participants on communication variables in a two-stage (idea generation and idea evaluation) design. Results indicated that more ideas were generated within CMC than in FTF, and participants engaged in more off-task comments in FTF than in CMC. No differences were found on process satisfaction, decision outcome satisfaction, and consensus. Research limitations and practical implications are addressed. (Three figures are included and 47 references are attached.) (Author/SR)

COMPUTER-MEDIATED COMMUNICATION IN SMALL GROUP DECISIONAL STAGES

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Abstract

The research on Computer-Mediated Communication (CMC) is largely inconsistent. These inconsistencies may be attributed to the different system software, tasks, subjects, and methodological designs. This study utilized a commercially developed conferencing software (Quickmail) to allow other researchers to gain easy access to the software and form a basis for future comparative study. Quickmail was used to compare the effects of Face to Face (FTF) and Computer-mediated Communication (CMC) among 144 participants on communication variables in a two stage (idea generation and idea evaluation) design. Results indicated that more ideas were generated within CMC than in FTF, it took longer to reach a decision using CMC than FTF, and participants engaged in more off-task comments in FTF than in CMC. No differences were found on process satisfaction, decision outcome satisfaction, and consensus. Research limitations and practical implications were addressed.

Computer-mediated communication research is characterized by several inconsistencies in its findings. For instance, Dennis, George, Jessup, Nunamaker, and Vogel's (1988) present a review of experimental studies comparing Local Area Decision Nets (LADN) and Decision Rooms showed wide variations for variables like decision quality, idea quantities, consensus and satisfaction. Dennis et.al., (1988) concluded that the only generalization possible for CMC studies is that of inconsistent findings.

There is reason to believe that research on CMC in decision making has confounded CMC effects with aspects of group discussion. In CMC research, group discussion typically has been treated as a unitary process. That is, groups are presented with a decision/problem and left to devise solutions in one continuous, undifferentiated episode. Alternatively, small group research has established stages and several activities involved in the small group process (see Fisher & Ellis, 1990; Shaw, 1981). Thus, previous research reports only that CMC is alternatively helpful or detrimental to group decision-making without specifying which aspect of the decisional process is affected. Even in group decision support system (GDSS) research which has used CMC in two or more different discussion activities, comparisons have been made at the gross level of computer-mediated versus unmediated groups, and not at the level of discreet processes by mediation (e.g., Gallupe & McKeen, 1988; Hiltz, Johnson and Turoff, 1986; Jessup, Connolly, and Galegher, 1987; Kiesler, Siegal, & Maguire, 1984; Siegel, Dubrovsky, Kiesler, & McGuire, 1986; Turoff & Hiltz, 1982). If the group decision-making process were to be analyzed at the level of stages, we might be able to determine the specific strengths and weaknesses of CMC and identify where it might serve to enhance group problem solving.

Two central processes have been identified as integral to small group discussion: idea generation and idea evaluation (Price, 1985). Maier (1970) argues that problem solving may be enhanced by separation of the generation of ideas from evaluation and selection of alternatives. Price (1985) extends this framework, arguing that group productivity is directly related to the procedures used in each phase. Further, independent evaluation of both phases of problem solving is called for to determine if interaction is beneficial in one or both phases. Using this way of thinking one might be able to select a procedure that yields the least process loss at a specific phase of problem solving, idea generation or evaluation.

Idea Generation

In the idea generation literature, brainstorming has received the most attention. Brainstorming is seen to be most successful in those situations where individuals are asked to be "freewheeling" in the expression of ideas (Osborn, 1953). Harari and Graham (1975) and Maginn and Harris (1980) compared group brainstorming in face-to-face (FTF) groups with individual brainstorming (i.e., individuals working alone whose products are combined in nominal groups). The critical difference was the presence or absence of interaction during idea generation. Their findings indicate that individuals working alone (in nominal groups) generated more ideas than the same number of individuals collaborating in FTF groups. These findings are consistent with other brainstorming studies (see Lamm & Trommsdorff, 1978; Street, 1974). Street (1974) suggests that interaction tends to minimize productivity because one's ideas become public knowledge.

If CMC minimizes some of the process loss in the brainstorming process which normally occurs in FTF meetings (i.e., if CMC negates the social factors which impede productivity), then CMC should benefit the idea generation process compared to that of unaided groups. Some properties of CMC relate to this requisite. First, CMC participants need not take turns, but are free to generate ideas freely and without interruption (Siegel et al., 1986). Second, since many CMC systems mask the identity of message originators, offering alternative or competing suggestions does not personally threaten prior "speakers" (Connolly, Jessup, & Valacich, 1988).

Idea Evaluation

The second stage of problem solving is the evaluation and selection of a single alternative or set of alternatives (Price, 1985). Studies assessing the effects of interaction in the evaluation phase generally contrast the quality of a group's decision with the best individual pre-group decision. The basic consensus is that, if the group's interaction adds anything to the process, the

group's decision ought to be better than the best individual pre-group decision.

Price (1985) found that in these types of comparisons, group interaction was superior to the average group member working alone. However, comparisons using the nominal group technique (NGT) method indicate that group performance only sometimes falls above the level of the best group member (see Nemiroff, Passmore, & Ford, 1976; Rohrbaugh, 1981). According to Price (1985, p.296) "groups appeared to perform at about the level of the average individual working alone, and below the level of the best individual." Elsewhere, group dynamics research is rife with the findings that groups may produce markedly worse decisions than do individuals (e.g., Janis' [1982] "Groupthink Hypothesis").

Despite these mixed findings, prediction can be made for higher decision quality in CMC groups over that of FTF groups. Because CMC participants are able to generate ideas freely without interruptions from other participants (see Siegel et al., 1986), CMC is likely to generate more ideas than FTF. When more ideas are generated, there is likelihood that critical issues have not been overlooked and decisions may be better (see Osborn, 1953; Parnes, 1975; VanGundy, 1986).

While FTF research may be inconclusive, CMC research may be somewhat more revealing. Hiltz et al. (1986), for example, found that CMC groups reach consensus on decisions less frequently than FTF groups. These researchers analyzed participants' contributions using Bales' (1955) Interaction Process Analysis and found that CMC groups offered fewer agreement messages than did those in FTF. Hiltz et al.(1986) concluded that a reduced tendency to express agreement hindered a group's ability to reach consensus. Weisband (1989) similarly found a greater percentage of assertions relative to agreement in CMC as compared with FTF. Connolly et al. (1988) found that the quality of the groups' decisions in CMC was related to the "critical tone" of an experimental confederate: When all members were supportive, decision quality was inferior. These findings suggest a reduced likelihood that CMC groups will be as successful in idea evaluation when compared to FTF groups. Therefore, CMC groups may be at disadvantage in reaching consensus, and in amount of time spent on a task, when compared to FTF groups.

This study contends that separation of idea generation and evaluation stages will serve to make prediction more accurate, minimizing the intervening variables that confound prediction in a non-separated situation. Separation of stages may reveal different effects on satisfaction (i.e., process satisfaction and decision outcome satisfaction). For instance, the presence of off-task remarks may affect the two satisfactions differently. This separation may bring structure to an understanding of the group process (Dennis et al., 1988 p. 606). Furthermore, we may be able to determine where the most process loss occurs. Providing solutions to some of these issues allows us to determine the aspect of group process that is more likely to benefit from the use of CMC and, at the same time, those likely to benefit from FTF process. Therefore, the study described in this paper utilizes a procedure where the idea generation and evaluation phases are separated.

Hypotheses

Idea Quantity

CMC should result in more straight forward communication and expression of candid opinions than FTF communication. In FTF meetings, where participants are less likely to express their views due to interruptions, talkovers, and social presence factors that often inhibits interactions (see Coombs & Friedman, 1987; Hoare & Race, 1990; Kiesler, et al., 1984). Therefore:

H1: CMC groups will generate more ideas than FTF groups.

Consensus

Consensus is the degree of agreement with the decision reached (Fisher & Ellis, 1990). Because interpersonal interaction in a face-to-face setting persuade individuals to certain opinion. H2: Groups who use FTF communication in decision evaluation are more likely to reach consensus (or greater concordance) than CMC groups.

Decisional Quality

Decisional quality is the extent to which a decision proposal resolves the problem task (Kowitz & Knutson, 1980). The next hypothesis assumes that the the greater the number of of ideas generated, the more likely it is that information needed for decisions has not been overlooked. As Osborn (1953) indicates, "quantity breeds quality." This view is similar to that of the creative problem solving model that seeks to avoid obstruction of imagination during idea generation (see Parnes, 1975; Parnes, Noller, & Biondi, 1977; VanGundy, 1987). Therefore, groups using CMC during idea generation (who are expected to suggest more solutions) are at an advantage as they head toward task resolution. FTF interaction, on the other hand, is expected to enhance the idea evaluation phase. FTF interaction is believed to increase consensus among group members due to the social presence effect which in turn affects satisfaction; therefore, the more a group can generate a variety of ideas (CMC) and collectively agree on a specific solution (FTF), the better the decision. Thus, the following hypothesis is contingent on H1 and H2. That is,

H3: Groups using computers to generate ideas and a FTF format to evaluate those ideas (condition 4 groups) will produce better (higher quality) decisions than any other groups.

Non-Task oriented Remarks

Non-task oriented remarks are ideas, propositions, and/or arguments that are not related to the problem task (see Weisband, 1989) (e.g., " I can use a drink right now," "Oh what a jerk," "Let's hurry up, I've got an exam tomorrow"). Given the social presence factor (i.e., Visual contacts resulting in affective cues), the numbers of off-

task comments should increase in FTF settings. Therefore,

H4: Participants in FTF groups engage in more non-task activities than those in CMC groups.

Time to Reach Decision

It would seem that CMC groups, with little social presence will reach decisions faster than FTF groups. However, CMC groups not only have to think about what to say during the group process, they must also get their thoughts across to other group members by typing. Because typing takes more time than oral communication (see Hiltz, 1986),

H5: CMC groups (conditions 1 and 3) will take longer in idea evaluation than FTF groups.

Group Satisfaction and CMC

Another area where CMC research is incoherent is that of group and members' satisfaction. For instance, of four studies that looked at outcome satisfaction two found higher levels of satisfaction one found lower satisfaction, and no difference. Also, four studies that measured satisfaction with group process found that group decisional support systems (GDSS) users were no more and no less satisfied with the group process than were members of FTF groups (see Dennis et al., 1988). A report of five studies that utilized field and case study techniques showed inconsistencies when compared against experimental or laboratory simulated studies. Users in both case and field study methods were found to be more satisfied with CMC than FTF when compared to those in the experimental settings where students simulated actual users (see Adelman, 1984; Dennis et al., 1988; Nunamaker, Applegate, & Kosynski, 1987; Nunamaker, Grohowski, Heminger, Martz, & Vogel, 1989; Vogel & Nunamaker, 1988). Two types of satisfaction may be considered: Process satisfaction and outcome satisfaction.

Group process satisfaction

Group process satisfaction represents the degree of contentment (e.g., reward and willingness to perform the task again) group members enjoy as a result of participating in a group discussion (Marston & Hecht, 1988). This study assumes that process satisfaction can be found where there is greater social presence and non-task remarks which break monotony, making group participation more tolerable and interpersonally satisfying. As a result FTF groups are better able to satisfy their affective needs while working on the group task at the same time. Accordingly,

H6: There is a positive relationship between off-task comments and process satisfaction.

The next hypothesis is contingent on hypotheses 4 and 6.

H7: Participants in FTF groups are more satisfied with the group process than participants in CMC groups; that is, FTF groups are most satisfied, FTF/CMC and CMC/FTF are second most satisfied, and CMC/CMC is least satisfied.

Decision outcome satisfaction is the degree of contentment expressed by group members towards the solution/decision generated for the problem task (see Bradford & Bradford, 1981). There is a tendency that when members feel that they have been able to express their ideas without pressure or inhibition from other group members they are likely to be more satisfied with the group outcome than in those situations where they have to compromise their beliefs due to group pressure. Since CMC reduces status differences and group pressure,

H8: Satisfaction with decision outcomes is greater among participants in CMC only situations than in FTF situations.

Method

Group Conditions

This study examined four experimental group conditions to which participants were randomly assigned: Condition one involved CMC only, with subjects using a computer conference for both idea generation and evaluation. Condition two was an FTF only group, where both idea generation and evaluation took place face-to-face. Condition three was a mixed treatment group, where the idea generation occurred face-to-face and the evaluation phase was performed through CMC. Condition four was the direct opposite of condition three: this mixed treatment group used computers during the idea generation phase and the evaluation phase was handled face-to-face.

Several conceptual needs are addressed in the design of the current research. First, the present research utilized commercially available software. In that commercially available software is more widely used than site-specific software, the results of the present efforts are more generalizable to the kinds of events taking place in the business community. By using easily accessible commercial programs, consistency of findings among studies may be enhanced, as is valid generalization from experimental findings.

Second, subjects in experimental studies (e.g., students) have often been accused of not being "realistic" or representative of the work setting, and not treating the tasks assigned to them as their own problems (Dennis et al., 1988). Utilizing students as subjects in CMC studies, however, is not necessarily unwarranted. Caution must be taken, of course, in their selection and the assignment of tasks. Specifically, an effort should be made to select tasks that reflect "realistic student problems" (or school relevant problems) where the students will serve as knowledgeable experts on the group task. Additionally, there must be some realistic benefit contingent upon the quality of the participants' efforts. In this case, the amount of credit a subject received for participation was ostensibly linked to the quality of the groups' decisions. If the problem task is related to the students, and if there is something at stake for them to perform well, they constitute a real group (McGrath, 1984). For these reasons, the present study used commercial system software and student subjects who were given tasks dealing with school related problems.

Design

A 2 x 1 design was used for idea quantity, consensus, time to decision, and decision outcome satisfaction. Idea quantity was compared for CMC and

FTF groups for the idea generation stage and decision quality was compared in CMC versus FTF in the idea evaluation stage. A 4 x 1 design was used for decision quality, off-task comments, and process satisfaction. All comparison were based on twelve group replications.

Subjects (Ss) & Group Assignments

The Ss were 144 undergraduate students recruited from several undergrad communication classes. All Ss volunteered to participate for extra credit that applied towards their final course grade. The Ss were randomly assigned to conditions, then to forty-eight groups. Three member groups were used because most of the experimental studies in the CMC literature are based on three member groups (Kiesler et al., 1984; Siegal et al., 1986; Weisband, 1989).

Upon random assignment of Ss to each of the four conditions, a convenience method was used to assign Ss to groups. This was done to accommodate Ss schedule for common date and time for a two to three hour meeting (see Walther & Burgoon, 1991). The Ss were not aware of their conditions until the time of the experiment. This procedure prevented subjects from revealing the task and procedure to other potential subjects.

CMC Training

All participants underwent basic training for Macintosh computers. Additional training was provided to Ss assigned to the CMC group. This training consisted of a ten to fifteen minutes instruction on using the "mouse" to send messages to other group members with the conferencing software (Quickmail).

The Environment

The CMC conference took place in a large 20 x 14 room divided by a partition board. The room was equiped with twenty "Macintosh SE" computers. Using the room layout and partition Ss were unable to stare at others' terminals or engage in verbal interaction.

The FTF conference took place in another 22 x 15 rectangular room. The room was equiped with a round table surrounded with four chairs. To allow equal status and equal participation, the researcher felt that a round table would better facilitate a leaderless group discussion environment (see Burgoon, 1988; Shaw, 1981). When Ss were seated, a General Electric brand voice activated tape recorder was placed to record the proceedings.

The Software

Quickmail is a communication software manufactured by CE software. While it is equiped with both conferencing and e-mail features, this study used only the conferencing feature. It provides participants with remote accessing (the capacity to send and receive messages remotely) of up to five users within a network. The software can be used on most Macintosh computers. It requires a designated file server which, with the aid of Appletalk connectors (like phone cables), allows participants to relay messages to one another.

The conferencing feature of Quickmail divides the computer screen into three panels. The left top panel displays all the online users, the lower left is the entry panel that displays the users' typed messages, while the right panel is the transcript panel that gives simultaneous access to all meeting and messages. One thing that separates Quikmail from most conferencing software is the simultaneous access of messages by Ss without having to leave the screen. Ss can scroll back and forth to review previous messages and compose replies to those messages.

Task

In order to keep the task as realistic as possible for the subjects, they were asked to develop a plan to make dormitories more attractive to students.[1] The Ss were asked to use their creativity to generate a solution by expressions of divergent opinions. Ss were instructed to separate the idea generation from the evaluation phase. During the idea generation phase, the Ss were instructed to refrain from discussion and criticism of ideas until all parties were through generating ideas. For evaluation, subjects were told to combine their ideas and use them in arriving at the final decision. No further guidance regarding content or task completion was given.

Instruments

Group process satisfaction and decision outcome were assessed with a questionnaire adapted from a computer based group communication survey used with conferencing system (Walther, 1989). This measure was chosen because it specifically dealt with satisfaction in group interactions. The alpha reliability for the process satisfaction scale was .98 and .93 for the decision outcome satisfaction.[2]

Decision Quality. Decision quality was assessed by three separate coders using eight, seven-interval semantic differential scales (e.g., idea comprehensiveness, feasibility, creativity, with one as the lowest and seven as the highest). Thus, the coders were asked to rate each group's final decision proposal. The scale reliability was .89 and the inter-coder reliability was .87 using Cronbach's alpha. For off-task comments, Weisband's (1989) conception of off-task comments was used. The recorded conversations and computer transcripts were coded by three coders for task-related and nontask-related behaviors (see Weisband, 1989).

To measure consensus, a semantic differential scale using five bipolar items was developed. The scale utilized a one to seven interval (one represents the lower end and seven the highest). This measure was completed after the idea evaluation stage.

Analysis & Results

Participation in any group process creates a situation in which one is constantly influencing and being influenced by other group members rather than by the environmental or situational characteristics (see

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[1]The task is available from the first author by requst.

[2]The questinnaire is available from first author by request.

Sabatelli, Buck, & Kenny, 1986). In order to assess the degree to which this mutual influence may have affected the dependent variables several steps were taken. First, preliminary analyses of variance were conducted including a random effect variable, group nested within condition (see Walther, in press-b; Walther & Burgoon, 1991). These analysis yielded a significant effect for the nested variable only in one case, group process satisfaction, $F(44, 96) = 2.61$, $p < .001$. Group outcome satisfaction and consensus were not effected by this variable. These results suggested a reduced model analysis was more appropriate for the latter variables, and for the sake of consistency, a reduced model ANOVA was used in all hypothesis tests.

Hypothesis Tests

The group consensus and decision outcome satisfaction hypotheses were tested as follows. First, they were analyzed for main effects with a four by one design. Second, direct tests of the hypotheses were performed with focused comparison contrast analyses for hypothesized directions between conditions (see Rosenthal & Rosnow, 1985). Since these hypotheses are directional, the results of the contrast analysis were based on one-tailed t-tests.

H1: Numbers of Ideas generated (Idea Quantity)

This hypothesis specified that CMC groups would generate more ideas than FTF groups: Specifically, CMC and CMC/FTF conditions would generate more ideas than would the FTF and FTF/CMC conditions.

In order to test this hypothesis, the idea generation phase transcripts in the CMC groups were coded by four independent coders. They were asked to count the number of ideas within groups. The Cronbach alpha intercoder reliability was computed on the data after every 25 percent of the transcripts. An a priori intercoder reliability alpha of .98 was established since reliability should be higher when coders are counting units than when using judgment scales. The observed intercoder reliability alphas were 98.1, 98.27, 98.51, and 98.58 after each 25 percent of the transcripts, respectively.

A one-way analysis of variance was computed with idea quantity as the dependent variable and experimental condition as the independent variable. The ANOVA result was statistically significant, $F(3,44) = 7.39$, $p < .001$, $eta^2 = .34$. The means were in the predicted directions: CMC = 20.92, SD = 8.7; FTF = 14.1, SD = 6.1; FTF/CMC = 15.58, SD = 3.8; and CMC/FTF = 31.92, SD = 17.2. A focused one degree of freedom contrast analysis was computed and the result was significant, $F(1,44) = 44.5$, $p < .001$ level (see figure 1.1). Thus, this hypothesis is supported. Groups using CMC in idea generation produced more ideas than those using FTF communication.

H2: Consensus

The consensus hypothesis specified that the FTF groups were more likely to reach consensus than the CMC groups. A one-way ANOVA result was not significant, $F(3,140) = .38$, $p = .76$, power = .21. The means were CMC = 6.19, SD = .94; FTF = 6.28, SD = 1.2; FTF/CMC = 6.44, SD = .87; CMC/FTF = 6.33, SD = .89. The means did not fall in the predicted direction; therefore, there was no need for contrast analysis. An exploratory post hoc mean comparison multiple range test was also calculated, and the result also showed no differences between the means. Thus, H2 was not supported.

H3: Decision Quality

This hypothesis is contingent upon hypothesis one (idea quantity) and two (consensus) being true. Since hypothesis one is supported but hypothesis two was not, this hypothesis test was not tested.

H4: Off-Task Comments

This hypothesis specified that participants in the FTF groups engage in more non-task activities than those in the CMC groups. Specifically, off-task comments would be highest in the FTF, second highest in CMC/FTF and FTF/CMC, and lowest in CMC.

This hypothesis was tested by having coders tabulate each group's comments and remarks in task and non task categories, and compute a ratio of task to total comments. An intercoder reliability measure for nominal data was used: the Kuder-Richardson coefficient (KR21). The KR21 method is a measure of internal consistency reliability for dichotomous variables and is similar to the Cronbach alpha method (see Allen & Yen, 1979, for the formula and more discussion). The KR21 was calculated for a 25% sample and the average intercoder reliability was .87. The KR21 method gives the lower bound estimate of reliability.

A one-way ANOVA was computed. The result was a significant, $F(3,44) = 2.22$, $p < .05$, $eta^2 = .13$. The means (out of a possible zero to one range) were: CMC = .079, SD = .06; FTF = .162, SD = .11; FTF/CMC = .126, SD = .09; CMC/FTF = .11 SD = .05 in the direction predicted (see figure 1.2). A focused one degree of freedom contrast analysis was computed and the result was significant $F(1, 35) = 16.2$, $p < .001$. Thus, this hypothesis is supported. Groups using FTF communication engage in more off task comments than those using CMC.

H5: Time To Reach Decision

This hypothesis specified that the CMC groups would take longer to reach decisions than would FTF groups: that is, Condition one (CMC) and condition three (FTF/CMC) would take longer than any of the other conditions.

Time was measured by having the time recorded as groups perform their task. The one-way ANOVA result was significant: $F(3,44) = 2.77$, $p < .05$, $eta^2 = 16$. The means fell in the predicted direction: CMC = 55.6, SD = 15.8; FTF = 39.42, SD = 16.32; FTF/CMC = 53.92, SD = 18.6; CMC/FTF = 42.5, SD = 4.75 (the means are in minutes). In order to determine if the means were significantly different from

one condition to another, a planned comparison contrast analysis was computed. The result indicated that the means were significantly different across conditions, $F(1,35) = 6.73$, $p < .005$ (see figure 1.3). Therefore, this hypothesis was supported.

H6: Off-Task Comments and Satisfaction

This hypothesis specified a positive relationship between percentage of off-task comments and group process satisfaction. The hypothesis was tested by computing a correlation coefficient between the percentage of off-task comments and group process satisfaction. The result was not $r = .031$. Thus, this hypothesis was not supported.

H7: Group Process Satisfaction

The group process satisfaction hypothesis specified that group process satisfaction is higher in FTF groups (condition two) than in CMC groups: specifically, highest in FTF, second highest in FTF/CMC and CMC/FTF, and lowest in CMC groups.

Similar to the decisional quality hypothesis, this hypothesis is contingent upon hypothesis four (off-task remarks) and hypothesis six (positive relationship between off-task comments and satisfaction) being true. While hypothesis four was supported, hypothesis six was not. Therefore, hypothesis seven cannot be supported and its testing was discontinued.

H8: Decision Outcome Satisfaction

The decision outcome satisfaction hypothesis predicted that satisfaction with group decision outcome would be greater in he CMC only condition than in the FTF condition.

A one-way ANOVA result was not statistically significant $F(3,140) = .70$, $p = .55$, and power = .15. The means were CMC = 5.84, SD = 1.14; FTF = 6.18, SD = 1.17; FTF/CMC = 5.9, SD = 1.03; and CMC/FTF = 6.1, SD = .93 (on a one to seven point scale, with seven as the highest). These means did not follow the predicted direction. Thus, this hypothesis was not supported.

Discussion

This study found that more off-task remarks were uttered in FTF groups than in CMC groups. One implication of this finding is that that CMC groups are more task oriented than FTF groups. Another possible explanation is the fact that CMC participants may be so occupied with task oriented activities that they have less time for non-task activities (see Short, William, & Christie, 1976). However, this does not in anyway imply that CMC groups are more efficient than FTF groups. As a matter of fact, this study indicates that it took CMC groups considerably longer to arrive at decisions than it took FTF groups.

Furthermore, there were a greater numbers of ideas generated in CMC groups than in FTF groups. In the absence of status (as with this group of subjects), the argument that CMC allows participants to participate in group interaction with less interruptions and talkovers may have merit. It also appears that when there is nobody to criticize or pressure group participants to conform to a particular notion in group interaction, participants have no need for face saving. Thus, they are more likely to express their views readily and willingly. This argument also found support among studies indicating that students using CMC seem to be more uninhibited in their computer communication than in FTF interactions (see Hoare & Race, 1990; Kiesler et al., 1984). Shy students were reported to be able to participate more without fear of embarrassment (Coombs & Friedman, 1987; Hoare & Race, 1990).

There were no differences in consensus between CMC and FTF groups. Although previous CMC studies have reported that students in CMC are less likely to reach consensus due to fewer statements of agreement, disagreement, or tension release (e.g., Hiltz et al., 1986; Saunders & Heyl, 1988), the results of the present study do not support such a view. As Walther (in press-a) has argued, time may be a critical variable. In the present study time was not fixed; all groups were allowed time flexibility for task completion. That is, the participants were not given a specific time within which to complete the assigned task; rather, they were told to work on their task at their own pace until they were done. If time for task completion was limited, differences might have emerged. Since time was not fixed, it is logical to expect that CMC groups would eventually reach consensus even though it might take CMC groups longer than it took FTF groups. This argument can be further supported by looking at the "Time to decision" hypothesis (H4) which confirmed that, on the average, it took the CMC groups more time to accomplish their task than it took the FTF groups. Therefore, it might be worthwhile to repeat this experiment using a scenario where both CMC and FTF groups are assigned the same time period for task completion.

No support was found for the decision outcome satisfaction hypothesis. It was argued that the CMC group would result in higher satisfaction with the decision outcome, in that, CMC facilitates high participation because participants are under less pressure to conform to dominant view. Thus, participants should be more willing to express their feelings without the feeling they are rocking the boat. This high participation level was then expected to attract participants' support for the group decision and its implementation (see also Siegel et al., 1986). It is possible that participation may, indeed, be a necessary but not sufficient reason for high decision outcome satisfaction. Therefore, other variables like consensus, perception of decision qualities etc. may be more revealing.

Practical implications

One practical implication of this finding is that the CMC medium may be more appropriate when varieties of ideas, opinions, and diverse views are important for organizations. CMC may also help facilitate activities involving interactions between top management and lower management employees (i.e, both vertical and horizontal communication). In general, top management might benefit from encouraging the use of

CMC when seeking sincere contributions from subordinates in those situations where status may inhibit interactions. However, there is no compelling evidence from this study that satisfaction or other decision outcomes benefit from CMC.

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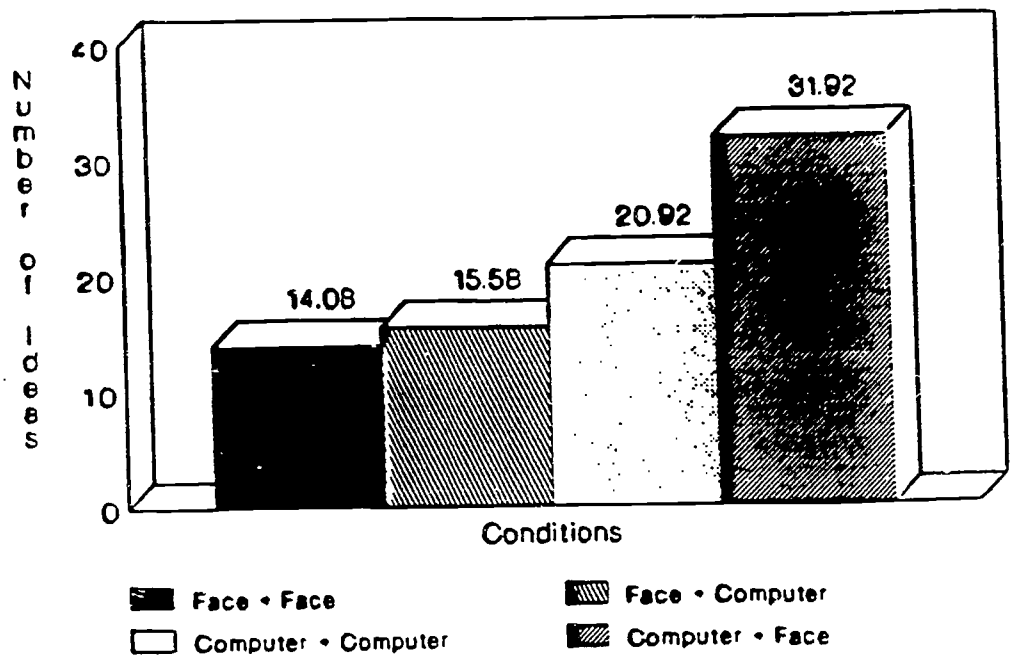

FIGURE 1.1: Idea Quantity by Conditions

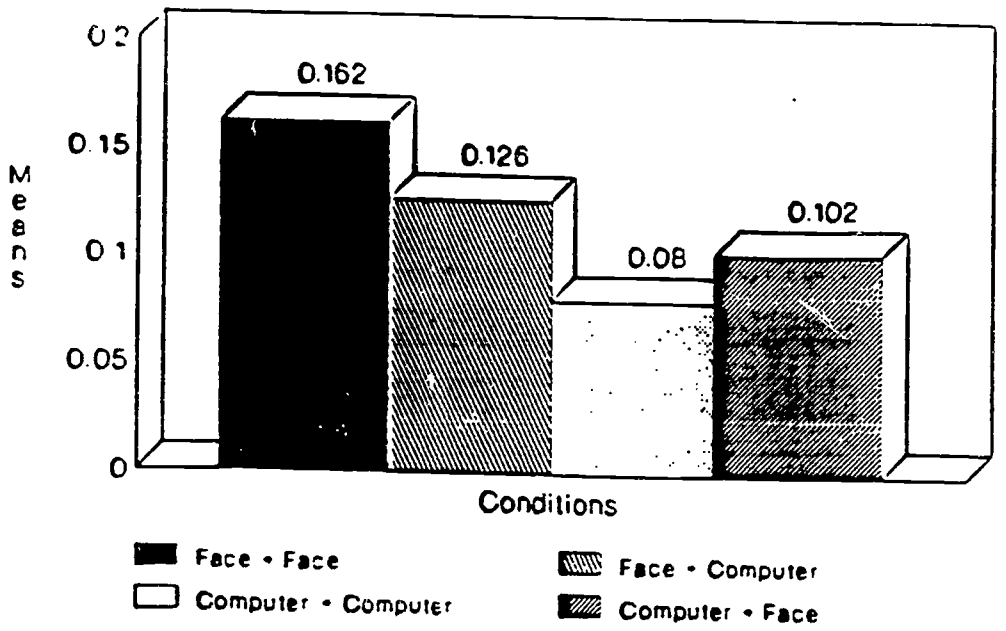

FIGURE 1.2: Off-Task Comments .

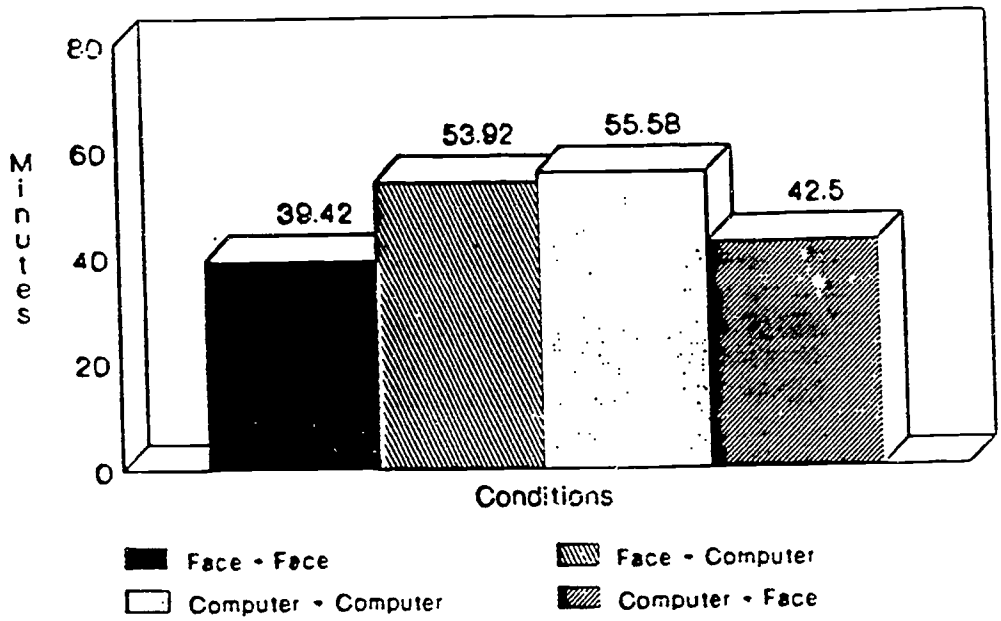

FIGURE 1.3: Time To Decision (Total Time)