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| Volume 5 Issue 2 | Past Issues | A-Z List |

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A Comparison of Face-to-Face and Computer-Mediated Student Project Teams

By Mark C. Russell

Many university engineering courses require students to work in small groups to complete a class project. This experience is often valuable for students going into an industrial setting where group projects are the norm. Learning to function in a group environment can be challenging itself, but the addition of technology as a medium of communication can often create as many obstacles as solutions. At Wichita State University, an Industrial/Manufacturing Engineering class (Lean Manufacturing) implemented a group project using two methods of group communication - face-to-face (F2F) and computer-mediated communication (CMC). Students were randomly assigned to complete a semester-long project in either a F2F or CMC group. Those in the F2F groups were instructed to meet in person to complete the project. Participants in CMC groups were instructed to communicate with each other only through electronic means, such as e-mail, electronic bulletin board, or virtual chat.

Aside from the comparison of performance of the F2F versus CMC groups on their class assignment, this study also examined participants' overall satisfaction with their group process. Research in this area shows that groups communicating exclusively through technological means generally experience lower levels of member satisfaction than traditional F2F groups (Walther, 1996). Scott's (1999) review of recent research on a wide range of technology-related communication issues presents studies that support this notion, but also includes results from studies showing CMC groups reporting equal or greater levels of member satisfaction than F2F groups.

A closer look at Scott's (1999) review reveals that "member satisfaction" is defined in multiple ways. Some studies focus on member satisfaction with group "outcomes," while others reported satisfaction differences with regard to "group process." The latter can be further broken down into satisfaction with the "precision of the process" and the "accuracy of the process" (see Valacich, Paranka, George and Nunamaker, 1993).

This article reports a summary of our findings. In particular, we discuss the project outcome across groups and student reported satisfaction with the group experience.

METHOD

Participants

A total of 41 students (33 male, 8 female) participated in this study. The average age of the participants was 26 years (*SD* = 5.7). Nearly all of the participants (91%) were graduate students and were enrolled in the industrial engineering and manufacturing program at Wichita State University. Twenty-two participants indicated they had worked in some type of industrial manufacturing environment, and the average number of years of such experience was 4.6 (*SD* = 7.1). There were 18 participants in the CMC groups and 23 participants in the F2F groups. Participants were assigned to groups of 3 or 4 members resulting in 5 CMC groups and 7 F2F groups.

Materials/Procedure

The Lean Manufacturing course was supplemented with Blackboard™ (www.blackboard.com), and all course materials and assignments were posted on a course Blackboard site. The group project required students to learn how to increase the efficiency of a production process through a technique called *value-stream mapping*. This technique examines the flow of a product, movement of labor, lead time, and interval levels, and determines how each can be optimized. Students studied a virtual manufacturing line and created an "as-is" value stream map and a "to-be" value stream map as a group.

At the beginning of the semester, all participants were instructed to log on to the Blackboard site and review the instructions for communicating with the members of their assigned group/condition. Members of CMC groups were instructed to meet electronically with their fellow members (via the Blackboard Discussion Board, Virtual classroom, and e-mail) and NOT to meet face-to-face to discuss the project. Participants were asked to complete satisfaction surveys throughout the semester and again at the end of the semester along with written feedback, indicating what they liked most and least about their experiences working on the group project.

RESULTS

Final project scores were assigned to each class participant based on their overall group score but modified by a peer review process. There were a total of 100 points possible, and the final scores ranged from 68 to 102 (some students were able to score > 100 points if their peer reviews were exceptional). A comparison of the final project scores between the CMC (M=92.0, SD=8.3) and F2F (M=91.3, SD = 1.8) conditions showed no significant difference ($t(39) = -.389$, $p = .70$).

Participants' overall satisfaction with the group project was determined by calculating a scaled score from 11 items in the final survey (Alpha = .945). The response format consisted of a 4-point scale, with 1 = "Very True" and 4 = "Very False." Therefore, the lower the mean satisfaction scores the higher the satisfaction.

In general, participants in the F2F condition (M = 1.3, SD=.28) were significantly more satisfied with the overall group process than the participants in the CMC condition (M=1.7, SD = .49; t (37) = -3.121, p = .007). Despite this significant difference, it should be noted that both group means were below the average point in the scale indicating an overall positive level of satisfaction across both groups.

Analysis of the bi-weekly surveys distributed throughout the semester showed that the CMC groups began meeting earlier than the F2F groups. This might be due to the ease by which CMC groups could "meet" (i.e., exchanging e-mail) in comparison to F2F groups who had to schedule a time to get together in person. However, by the end of the semester, both groups had met a similar number of total times. Interestingly, the F2F groups reported having greater success at scheduling group meetings, while the CMC groups reportedly got worse at coordinating their communication activities as the semester progressed. Presumably this difficulty was due to the fact that the teams met more often near the end of the semester (when the project was near completion) and that impromptu group meetings were more difficult to schedule via CMC.

Another interesting trend noted during the semester involved group cohesion and cooperation. Although the groups in both conditions reported similar opinions about their satisfaction with the other members of their group and with being a member of their group, the CMC participants reported having more difficulty reaching agreement than the F2F groups both at the beginning and at the end of the semester.

Written Feedback

Written feedback solicited in the final survey was structured by a set of open-ended questions. Tables 1 and 2 show a sampling of final comments divided by group. Overall, the F2F participants found their experiences useful for future group work, and enjoyed the opportunity to brainstorm and get perspectives from people of other cultures. There were traditional problems with F2F groups, such as scheduling difficulties, as well as some language barriers between the students.

The CMC participants found the experience valuable in terms of enhancing their written and communication skills, and they saw the work as challenging as they experienced new uses of technology. Like the F2F groups, CMC groups also complained about scheduling and noted that the technology was sometimes a barrier to communication, both for technical reasons and because they had to type their conversations.

Table 1. What Participants Liked Most About Both F2F and CMC Conditions

FACE-TO-FACE	CMC
What they Liked MOST— • It helped me to understand problems to be in a group. In future this will help me to attend, participate group meetings more effectively. • The group was easy to work with - everyone was engaged and intelligent in approaching the problems. • Coming together and providing each and everybody's ideas and brainstorming • Sharing of ideas and innovative thinking • New thoughts from different people from different parts of the world • The interaction with my team members and gaining knowledge from them since their background was different from mine. • Collaborative team learning	What they Liked MOST— • CMC has increased my written skills. • Learning how we can work in a CMC team! • Our group work was excellent • It was a challenge • Professionalism is heightened • I got to try new technology • Sharing responsibilities • It's very efficient and also increased my communication skills

Table 2. What Participants Liked Least About Both F2F and CMC Conditions

FACE-TO-FACE	CMC
What they Liked LEAST— • Fast learners and slow learners made the group imbalanced. • Difficulty understanding language spoken by other group members. • Face to face meetings were very difficult to arrange due to differences in work and school schedules between the full-time students and the evening-only students. • People not turning up in time. • We had some group dynamics problems.	What they Liked LEAST— • It consumed more time to bring our thoughts in writings (Chat) and I was not able to communicate all my thoughts effectively. • Team members' attitudes and poor commitment. • Technology hold-ups • Takes a while for every member to get on the same page sometimes. • Technology was a struggle. We had a hard time getting the point across. • Most of the time, is hard to schedule the meeting due to conflict of schedule

CONCLUSIONS

The purpose of the group project in the Lean Manufacturing class was to give the students experience working on team projects, a skill they will need in their future work environments. It is inevitable that they will also use technology, in one way or another, to communicate with fellow employees regarding collaborative projects. In this study, we found that students in both F2F and CMC teams performed equally well.

In terms of overall satisfaction, the F2F group members were, in general, more positive than the CMC group members. Of course, the F2F students were naturally using previous experience with interacting in other F2F groups for comparison. Judging by the written feedback from group members, one of the most salient features of this group experience was actually the cultural diversity of the group members, which resulted in both a broader range of perspectives as well as language-related difficulties. Other issues identified by the group members were quite common to F2F groups, such as problems scheduling meetings, reaching agreement, etc.

CMC group members were less positive in their survey responses than the F2F group members, but still positive overall. Most of the students in this group were new this application of technology as an exclusive means of collaboration. They were more aware of the challenges of interacting via a technological medium, such as technical problems encountered both in terms of working on the project and maintaining successful communication across e-mail, chat, and discussion boards. However, they also identified areas of potential benefit in the CMC medium, such as the chance to hone their written communication skills.

As corporations become more global, the use of computer-mediated technology will begin to supplement - and in extreme cases even replace - traditional F2F project teams. Future research involving CMC should continue to examine both performance and social aspects of group communication. It is possible that another contribution of this area of research will be the determination of what variables influence students training for professional careers to be better capable of adapting to and communicating in CMC group settings.

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