Management Gaming on a Computer Mediated Conferencing System: A Case of Collaborative Learning through Computer Conferencing

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Abstract

Effective collaborative learning is essential for management education. Interpersonal skills are particularly important. A computer mediated communication system, augmented with Virtual Classroom (R) software, was used in conjunction with a micro-computer based management game. Results of the experiment, in terms of game performance, and student group learning experience, were encouraging. Further experimentation is needed to firmly establish the significance of this experiential learning method.

1. Introduction

This is a report on an on-going experiment [Hsu and Geithman, 1988], in teaching collaborative managerial skills through simulation-gaming in a Virtual Classroom(R). Previous papers [Hiltz, 1986, 1988a] described the Virtual Classroom(R) as a teaching and learning environment located within a computer mediated communication system. Accessible around the clock and around the world, it was designed to support "collaborative learning" for distance education, particularly at the college level. There are "spaces" and software support for lectures, class discussions, doing assignments (individually or collaboratively), private communication with the instructor or other students, taking tests, chatting informally in the student center or "cafe", and more.

Briefly, Virtual Classroom (R) is a set of software designed for implementation on various a family of proprietary Computer Mediated Conferencing systems called Electronic Information Exchange Systems (EIES), developed and implemented at New Jersey Institute of Technology. The EIES systems consist of these basic facilities: mail, conference, notebook, directory, and notifications. Virtual Classroom (R) software expands the capability of conference module through "read", "response", "selection" and "decision support" activities, designed to mimic the activities in a conventional class room. "Read" is a way of handing out lengthy reading assignments. "Response" is a way of asking students for their answers or opinions. "Selection" serves to give the students to pick a topic or role among those available to them. "Decision support" is used to facilitate the students to contribute their input for group decision. Virtual Classroom (R) also includes a set of instructional management tools, such as giving a quiz, maintaining a grade book, etc. The software has been used by a small number of pilot courses and shows positive results (Hiltz, 1989).

Recently, the US educational system has been widely seen as deficient at teaching job-related skills. Part of the deficiency lies in obsolete or irrelevant course material, but another part lies in the very structure of the US educational system itself. For example, the US educational system rewards individual achievement at the expense of a nearly complete neglect of collective achievement. The assignment of individual grades and the "curving" of grades discourages students from sharing hard-won insights on difficult topics with classmates, especially ones who are not already close friends. This paper addresses the deficiency in teaching collaborative skills in the education of managers. In management, interpersonal skills, informational skills and decisional skills are all of collaborative nature. Indeed, collaboration under proper leadership to achieve common goals is the very essence of good management.

Collaborative Learning has been known under many other labels in the educational literature, including "cooperative learning, group learning, collective learning, study circles, team learning..." [Bouton and Garth, 1983, p. 2]. It includes a process of group conversation and activity which is guided by a faculty member who structures tasks and activities and offers expertise. Its basic premise is that learning involves the "active construction" of knowledge by putting new ideas into words and receiving the reactions of others to these formulations. Additional structured communication provided by Computer Mediated Communication systems facilites Collaborative Learning at college level.

Management games have long been studied for teaching effectiveness [Greenlaw and Wyman, 1973; Wolfe, 1985]. The results were inconclusive. However, by re-analyzing the same data compiled by Greenlaw and

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Wyman and by Wolfe, with an eye towards the teaching of collaborative skills, Hsu [1989] demonstrated the clearly positive effects of group interaction on student performance in the playing of management games [1989]. The emphasis was on the group interaction benefits of game playing. Here we further buttress the conclusions of Hsu, by comparing the game performance of student groups using a computer mediated conferencing system to that of student groups without such a conferencing system. We show that computer conferencing increases the group interaction benefits of game playing. The student groups play better when supported by the Virtual Classroom(R) software. We also show that group cohesion and stability are enhanced, as well.

The Virtual Classroom project includes the development of software structures and pedagogical techniques to enhance the effectiveness of computer conferencing for the delivery of college level education, and the evaluation of the effectiveness of these innovations. The research methodology is based on quasi-experimental designs which use matched sections of the same courses, delivered in various modes [Hiltz, 1988a, 1988b]. Students who have used the Virtual Classroom(R), rate it, on the average, as delivering a more convenient and better quality education than the traditional classroom. Mastery of material as measured by grades was as good or better than that obtained by students in traditional classes. These outcomes established the viability of the Virtual Classroom(R) as mode of delivery of college-level courses.

2. Review of the Gaming Environment

To encourage collaboration and group identification among students, it is necessary that they associate with each other as much as possible, and that they strive towards a common goal. In addition it is desirable that the instructor be able to monitor the exchanges among students. Physical meetings of groups of students outside of class are difficult to arrange, given the diversity of students in terms of course loads, schedules and interests. This is even more problematic in urban schools, where many students work part-time and there is not a strong spirit of school identification.

The Virtual Classroom(R) is ideally suited for such a situation. Students are grouped into teams to play a management game. Meetings among team members, however, need not be physical, nor must the members schedule special times for meetings. Students may access the computer conferencing system whenever it is most convenient for them, and conduct business discussions. Additionally, the instructor can read all of the comments made.

Turoff, et al.[1989], distinguish seven default conference structures:

1. Discussion Conference: Structured to optimize general purpose discussion by active groups of up to fifty or more individuals.
2. Seminar Conference: Designed to facilitate learning oriented seminars and the "Virtual Classroom."
3. Information Exchange: Optimized for very large groups (hundreds) engaged in unpredictable information exchange.
4. Project Management: Incorporates various tracking, selection, and organizing features to maintain awareness of modifications, milestones, status, and task assignments that are taking place.
5. Composition Notebook: Allows a high degree of selective roles in different designated portions of the conference, and tracks the updates and changes being made to the generation of a collaborative document.
6. Data Collection Conference: Designed for the organization of structured data, and the tracking and validation of data changes for a group building and utilizing a collaborative data base.
7. Simulation-Game Conference: Structured to allow a group to carry out a role playing, even-oriented scenario game.

In our experiment, we used the Simulation-Game Conference option, supplemented by the Discussion Conference structure. A Simulation-Game Conference allows a group to carry out a role-playing, event-oriented scenario game. The game director can control all communication channels and the conditions and timing for events to occur. In order to simplify and standardize the scenarios, a microcomputer based management game was used to augment the role playing of the group members. In this sense, the management game served as a model to generate operating results based on a set of decision inputs and the Simulation-Game Conference provides the forum for the group members to formulate and agree on the decision inputs. The two technologies thus complement each other in a group collaboration environment.

Among the many published management games, "Business Simulator" by Reality Technologies, Inc. was selected for the following reasons:

1. The game is relatively inexpensive so that all students can afford to own it.
2. The game is playable individually. This way the students can learn business concepts at home and at their own individual paces. The students can also use the game to predict probable outcomes of various decision parameters before submitting these decisions to their group.
3. The game can be played by assigning functional roles to members of a group, thus requiring collaboration within the group.
4. The game allows for competition between groups, thereby stimulating greater student interest.
5. The game is user friendly. It does not require much computer expertise to run. It provides on line help and tutorial. Furthermore, it includes a number of color charts to show the performance results.

3. The Experiment

Four sections of OS 471 Management Practices participated in the current study. A total of fifty-three students who completed the course were organized into eighteen companies, each comprising two to four students with an average of three. "Company" is the unit of analysis of our experiment. The assigned product for all simulated companies was a household robot (Pet-Bots) that would do most domestic chores.

Three sections had access to the Virtual Classroom on EIES2 at NJIT: one larger section used the basic facilities of the Virtual Classroom on EIES2 and two smaller sections used all the advanced features on EIES2 plus readily available off-line productivity software, such spreadsheet and data base system. The fourth section, serving as the control group did not have access to EIES2 at all. Thus we have three treatments:

1. Control Category with no access to Virtual Classroom,
2. Experimental Category I with regular Virtual Classroom facilities, and
3. Experimental Category II using regular Virtual Classroom facilities,the full features of the EIES2 conferencing system plus such off-line productivity software as spreadsheet and data base management system.

Within each category, the students were randomly divided into six groups of three to four students. Each group had a name and an organizational structure, consisting of a CEO, a Financial Officer, an Operations Chief and a Marketing Executive. A Game Playing Procedure manual was distributed at the beginning of the semester, detailing the responsibilities of the various officers and the format of an end-of-semester summary report.

Three phases of the life cycle of a business were simulated: start-up, growth, and independence. The decisions to be made in each phase are shown in Figure 1.

Figure 1: Decisions in Business Simulator(R) Game

Phase I: Startup	Phase II: Growth	Phase III: Independence
Price	Price	Price
Advertising	Advertising	Advertising
Units	Units	Units
	Factory Expansion	Factory Expansion
	Long Term Debt Sold	Long Term Debt Sold
	Common Stocks Issued	Common Stocks Issued
		Sales Force Size
		Commission Paid
		% Sales on Credit
		Research & Development
		One Year Loans
		Supplier Payment Period
		Dividend

Each student company is paired with another company belonging to the same category or treatment. The pair competes against each other and against three companies played by the computer. Each week student company must submit their quantitative decisions on the items listed in Fig. 1. Members of each company must study the results of last year operation, economic trend and operational policies, and run the game program independently by guessing how their competing company might play their hand. Then company members discuss pros and cons of the quantitative decisions as put forward. Since the members play different functional roles: manufacturing, marketing and finance, they tend to focus on their respective functional area more than the other areas. However, they have a common goal of optimizing the operating results: units sold, back orders, ending inventory, market share, operating income, income tax, net income, CEO's net worth, company book value, etc. Here collaboration comes into play. Hopefully they converge toward a single set of numbers. In any case, before the weekly deadline, CEO must make final decision. In the first treatment of the experiment, CEO's submit their decisions on a piece of paper. The instructor runs the game and saves the results on a diskette available for the students to copy. In the second and third treatment, they declare these numbers in their company's private conference. The instructor, being an observer of all the conferences, picks up decisions from two competing companies and runs the game officially. The results of the game for the current year are then published in the Managers' Lounge (class conference). In the second treatment of the experiment, some key results were published. This method requires more of instructor's time in extracting the results from the game and inputting into the conference. In the third treatment, the instructor transfers a binary file containing all the results of the game through "binary file transfer" facility of the EIES2 system. Students can download this file onto their own diskette and play the next year game based on current year results. The game was played for nine weeks, representing nine fiscal years. The performances of the different companies were evaluated based on the final outcome of the ninth year.

The students also had access to the results of all other companies for comparison and reference. The key results were recorded in a data base so that the comparative results could be organized and published from time to time. This practice proved to be useful in maintaining the interest and competitive spirits of all the groups.

The companies with access to CMC were assigned a group conference for the conduct of the simulated business. Typical uses were the assignment of functional roles, discussion of the logistics and scheduling of game-playing, formulation of general strategies of the business, and review of operational results. Each student company discussed the results in its private conference to see whether the outcomes met expectations and to search for possible reasons for deviations. All students with CMC also participated in two other conferences: the Student Center for social activities and the Managers' Corner for management related discussions.

Companies without access to CMC were dependent on face-to-face meetings or telephone or mail to conduct their communication.

4. Results

The clearest indication that CMC improves student learning of managerial skills is that the companies run by students with CMC performed dramatically better than companies run by students without CMC. We defined three criteria and a composite index:

Composite Index = Profitability + ROA (Return on Assets) + ROE (Return on Equity)

as measures to rank the performance of a company. The results of the final year operation of the simulated companies are shown in the following table.

Performance Measures of Simulated Companies				
Company Name	Profitability	ROA	ROE	Index
Companies without access to Virtual Classroom on EIES2				
Hysterical Corp	8.3	9.9	10.4	28.6
Forte-Hildebrand	1.3	1.7	2.9	5.9
Robotron	11.4	19.3	25.5	56.2
KST Technologies	6.1	7.4	10.6	24.1
SWAT Engineering	13.3	19.2	30.6	63.1
RJM Partnership	4.4	4.2	8.7	17.3
Total	44.8	61.7	88.7	195.2
Average	7.5	10.28	14.8	32.5
Experimental category I with access to Virtual Classroom on EIES2				
FutureWave	11.5	20.4	39.6	71.5
RoboTech	9.4	9.8	19.3	38.5
Ma Chine	8.4	11.4	23.1	42.9
KJ&J	8.6	13.9	29.0	51.5
Robots R Us	15.4	19.0	23.1	57.5
Robbots	14.5	16.3	19.1	49.9
Total	67.8	90.8	153.2	311.8
Average	11.3	15.13	25.5	52.0
F	3.02	1.92	2.93	3.54
p	0.11	0.19	0.08	0.09

The number of students and companies was too small for results on all dependent variables to be statistically significant at the .05 level, but the results are consistently in favor of those with the Virtual Classroom. Experimental category II has just ended. Preliminary analysis of the enhanced condition shows extreme variance: the highest and lowest performances of all companies observed occurred. In depth analysis is required to identify the possible causes. Results shall be discussed in an update report.

A less tangible but perhaps more important measure of the value of CMC in teaching collaborative managerial skills is the camaraderie that developed in companies with access to CMC. As one of the questions on the final exam, the students were asked to list the names and nick names of the class members. The students who used CMC knew the names of 83% their classmates, while the students without CMC scored only 67%. The students with CMC organized ski/skating trips and small parties, while nothing of the sort took place with the students without CMC. Both the Student Center Conference and the Managers' Corner Conference played important roles in developing this camaraderie. One third of the students who used CMC asked to remain on the conference for further socializing with the instructor and the students of the next semester, some of whom selected these particular sections as a result of recommendations from the veterans. More importantly, the average student with CMC clocked an average of 5 hours per week on one or another of the conferences outside of class time, while students without CMC met less than one hour per week.

Much of the discussion in the Managers' Corner conference related to the potential problems of on-the-job managers. For example, students discussed what to do if the boss "goofs off frequently." WK responded:

> "My boss goofs off a lot since he became a partner in the design firm I work for. He also has a good sense of humor. so when he is goofing off I ask him 'How can I help You,Bob?' and he'll tell me he's not really doing anything and I'll tell him that it sounds good to me and I want to do my fair share. Something like this usually makes him self-conscious and he starts looking for something productive to do. I think most bosses got to be bosses by being responsible and capable (I said MOST O.K.?) and I think if you can find some good natured way to point out to them that their goofing off affects you, their sense of responsibility should take over without causing too much trouble."

A comparison of the American management style with the Japanese proved an inexhaustible source of discussion, while hot debate took place over the economic relationship between West and East Germany.

Discussion in the group business conferences was serious and of similarly high quality. A comment by OA, the CEO of FutureWave, represents a typical entry:

> "I agree with you about raising the price from $34 to $41. We don't have enough production to compete at a low price so we might as well make like Hewlett Packard. This will result in a lower market share but will maximize our profits until we are ready to expand. One suggestion: spend more on advertising. Instead of $500K maybe $525K. Our sales will be targeted to a higher income bracket which has not heard of us or has regarded our goods as lower quality because of the lower price range. Good hunting!"

The groups with CMC also benefitted from greater group coordination and continuity in the face of real-life disruptions. For example, OA disappeared for a time and abandoned his prerogative of finalizing business decisions. LC and GB used all three conferences to plead for OA's return by posting humorous comments:

"Hey OA, did you get stuck in traffic again . We missed you at the class today. We wanted to confer with you about the simulator but we will see you at another time. GB." "OA, First of all, I'm extremely gratified to hear that you are alive and well. I thought maybe you had been swallowed up by a garbage truck or something!!! Nice to hear from you!!!" "How come you weren't in class??? How come you don't talk to us anymore??? Do we smell??? Are we offensive??? C'mon, lets get together and talk about Year #4!!! GB and myself shared some thoughts this morning, but as our CEO we would like to get your thoughts on a plan of action. When you read this, answer me right away so we can get the ball rolling!!!"

OA returned eventually to FutureWave (not, however, as CEO). He participated actively in the game and shared the credit for the good performance of FutureWave. In fact, FutureWave was the top performer by all the objective measures.

JR, CEO of KJ&J, had a similar experience; however, he continued to maintain contact with his group through CMC. He was able to return to the game and resume his responsibilities as CEO. Both examples show that CMC provides critical support for students who have been temporarily distracted from their duties.

In contrast, the CEO's of Hysterical and RJM, both companies without CMC, also vanished from their posts. Neither returned for the duration of the semester.

Finally, CMC helped students prepare the end-of-semester summary report. The groups that used CMC for the conduct of their business had the benefit of a complete record of the individual contributions of the group members. The preparation of the report was only a matter of editing the contents of the conference, while the groups without the benefit of CMC had to convene several meetings to assign the work and assemble the results.

5. Concluding Remarks

We have shown that CMC is extremely helpful in teaching collaborative skills to management students. Simulated companies using the Virtual Classroom (R) structures within a computerized conferencing system achieved significantly higher profits, return on investment and return on equity. It also provides a lifeline to students who become temporarily distracted from their class responsibilities. An enhanced CMC system (Virtual Management Practices Laboratory or Virtual Lab for short) with special features, such as on-line "forms," binary file transfer capability, role playing sessions, incoming mail organizer functions, and "file cabinets" has made the advantages of computer mediated conferencing systems even more appealing in the education of managers, since future managers will function in a more and more automated office environment.

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