Group Collaboration in Information Systems Class Projects: Survey and Critical Success Factors

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ABSTRACT: *Group projects play an important and increasing role in students' learning in information systems courses at colleges and universities. Due to various reasons, successful completion of complex group projects depends on effective collaboration among group members. Despite the continuous improvement in teaching methods and techniques for group projects in the past decade, collaboration among members of student groups is often impaired, resulting in group or individual problems and diminished overall performance.*

This paper presents the findings of a study on group collaboration among students working in information systems projects at St. Cloud State University during the period of 1993-1994. The study includes a review of literature and a survey of student members of IS group projects. The paper concludes with discussions of success factors and suggestions for improvement.

KEYWORDS: *Group Decision Support Systems, group collaboration, process losses, electronic meeting, 4GL tools, groupware.*

INTRODUCTION

Group projects play an important and increasing role in students' learning in computer information systems courses at colleges and universities [1, 2]. Due to demanding time constraints, successful completion of complex group projects depends on effective collaboration among group members. For a variety of reasons, however, collaboration among members of student project groups is often impaired, resulting in group or individual problems and diminished overall project performance. Ultimately, in order to improve effectiveness in information systems teaching, creative solutions are needed to minimize these problems and to increase the satisfaction and the success of group collaboration efforts in class projects [1, 2, 3].

GROUP COLLABORATION PRODUCTIVITY AND PROCESS LOSSES

MIS students spend a significant portion of their time working in project groups, with varying degrees of success. For a variety of reasons, these group efforts are often not entirely satisfactory in terms of team communications, member satisfaction and task outcomes. Numerous studies have been done to study group productivity in information systems development. One of the early studies in this area was from Brooks [4] who argued that the chief programmer team model was the most efficient development team organization. However, a recent study by Phan et al. [5] noted that this model has become less popular in modern development environment due to team member's resentment to being dominated by the chief programmer. A study of group collaboration by George et al. [6] studied the decision quality, member satisfaction and degree of consensus for groups that followed a meeting agenda and groups that did not. In these experiments, groups of four and five members were studied. Groups that followed an agenda were less likely to reach consensus but produced results of greater quality. Major factors that influence group productivity and satisfaction such as group size, anonymity, tools, etc. were also studied. In general, without the use of a groupware tool, larger groups tend to generate more ideas than smaller groups but members in larger groups tend to be less satisfied [7, p. 271). With the use of the Electronic Brainstorming System (EBS), larger groups consistently generated more ideas and their members were more satisfied than those in smaller groups [8].

Other studies have also been done to identify group process losses that hinder the effectiveness of group meetings and group collaboration efforts in the workplace and classrooms [9, 10, 11]. Valacich, et al. [7] summarizes several major process losses commonly occurring in group work:

1) Production blocking: Reductions in group production that occur because only one member of the group can speak at a time.

2) Unequal air time: In larger groups, the unbalanced allocation time available for each participant to speak.

3) Evaluation comprehension: Fear of negative response to ideas that are shared with the group.

4) Free-riding: Tendency of some group members to rely on others to carry the discussion or solve the problem.

5) Cognitive inertia: Tendency of a conversation to continue along a given course.

6) Socialization: Spending of group time socializing rather than working on problems and solutions.

7) Domination: Domination of topic, opinion or discussion time by one or a few individuals.

8) Failure to remember: Tendency for members to forget comments or ideas made by other members.

9) Incomplete analysis: Failure to use data that is available.

While this set of common problems affects all project groups, classroom observations suggest that there are additional process losses affecting student group performance [1, 2, 3].

Furthermore, students have reported that class project group gatherings are often ad hoc with haphazard or no agendas. Duration of the gatherings were often unpredictable. Due to poor project management, differing time schedule, and procrastination, group members occasionally work all night to catch up with team and project deadlines.

METHODOLOGY

To study the problems and success factors in class project group collaboration, a study in student group collaboration was conducted during 1993-1994 at St. Cloud State University. In this study, students enrolled in various Management Information Systems and Systems Analysis and Design II classes were grouped into teams of two to six members to work on IS projects which covered various stages of the Systems Development Life Cycle (SDLC). The class project used in the Management Information Systems course was a case project in which teams were assigned to define problems and opportunities, design alternative IS hardware and software solutions, and make the recommendations for a local small business. The project used in the Systems Analysis and Design II course was also a case project in which teams were required to design the data model, database, I/O, and user interface for an information system. Each team then implemented the system to the university's AS/400 computer using Synon/2E, a 4GL development automation workbench. Finally, each team alpha-tested the system before delivery. For better project management and control, this project was broken down into two sequential sub-projects. After the projects had been completed and submitted, the reports were presented, discussed, and evaluated in class. Students also evaluated the contributions of other members in their team. The group collaboration study ended with a survey of students regarding the problems, success and satisfaction of team efforts (appendix).

Development of survey questionnaire

Two brainstorming sessions with students were conducted during the Spring Quarter of 1993 to produce a list of possible problems that students encountered while working in groups. The final list of these problems was used to develop the questionnaire. Items in the survey fell into three areas: (1) collaboration problems that students faced in group projects, (2) team members' satisfaction resulting from the group collaboration, and (3) the level of overall project success accomplished by collaboration. Respondents were asked about the frequency of occurrence of

Table 1: Measurement of Group Collaboration Success

Group success indicators	Number of responses	Percent
Satisfaction Frequency		
Rarely and Never	10	6.0
Sometimes	56	33.5
Usually	76	45.5
Always	25	15.0
Satisfaction Level		
Very Unhappy	4	2.3
Unhappy	10	5.8
Average	61	35.7
High	73	42.7
Highest	23	13.5
Level Of Group Success		
Poor	2	1.2
Average	20	11.7
Good	77	45.0
Excellent	72	42.1

Table 2: Frequency of Reported Problems in Group Projects

Problems	Frequency	Percent
Production Blocking		
Rarely and Never	122	71.3
Sometimes	38	22.2
Usually	10	5.8
Always	1	0.6
Self Evaluation Comprehension		
Rarely and Never	144	84.2
Sometimes	23	13.5
Usually	4	2.3
Always	0	0
Evaluation Comprehension By Others Members		
Rarely and Never	111	66.1
Sometimes	47	28.0
Usually	10	6.0
Always	0	0
Free Riders In Group		
Rarely and Never	90	52.6
Sometimes	47	27.5
Usually	24	14.0
Always	10	5.8
Cognitive Inertia		
Rarely and Never	61	35.9
Sometimes	65	38.2
Usually	40	23.5
Always	4	2.4
Socialization		
Rarely and Never	44	25.7
Sometimes	84	49.1
Usually	29	17.0
Always	14	8.2

Table 2: Frequency of Reported Problems in Group Projects (continued)

Problems	Frequency	Percent
Domination		
Rarely and Never	74	43.5
Sometimes	63	37.1
Usually	30	17.6
Always	3	1.8
Group Forgot Ideas Contributed		
Rarely and Never	107	62.6
Sometimes	53	31.0
Usually	10	5.8
Always	1	0.6
Difficult To Find Convenience Time		
Rarely and Never	32	18.7
Sometimes	59	34.5
Usually	53	31.0
Always	27	15.8
Problems w/Member Backgrounds		
Rarely and Never	110	64.3
Sometimes	42	24.6
Usually	15	8.8
Always	4	2.3
Conflict of Personalities Among Members		
Rarely and Never	129	79.5
Sometimes	23	13.5
Usually	15	8.8
Always	3	1.8
Members Were Too Defensive		
Rarely and Never	131	76.6
Sometimes	34	19.9
Usually	4	2.3
Always	2	1.2

the problems that they encountered in group collaboration efforts by selecting one of the five choices: never, rarely, sometimes, usually, and always. They were also asked to rate their satisfaction level ranging from worst (lowest) to excellent (highest). In order to measure the success level of the group collaboration efforts, students were asked to rate the success of their efforts based on various indicators such as project grade, individual's amount of knowledge gained, level of accomplishments, and level of satisfaction. Thus the project grade was not used as the sole indicator of project success in this study.

The survey

During the three quarters of Spring 1993, Fall 1993, and Winter 1994, 175 undergraduate students assigned to 36 project groups from three Management Information Systems classes and four Systems Analysis and Design II classes were surveyed. In these classes, students had been assigned various information systems group projects with duration ranging from 2 to 6 weeks. The students were told in advance that the anonymous survey responses would be confidential and the results would not be tallied until after the course final grades were posted. With a small incentive for early class dismissal upon completion, 171 surveys were completed, a 98 percent return rate. Group sizes had an average of 4.6 team members and a median of 5 members. Data collected were tabulated and analyzed using Statistical Analysis System (SAS) available on the University's VAX computer.

FINDINGS

Overall, the results showed positive feelings toward group collaboration (Table 1). Sixty one percent of respondents indicated that they were usually or always satisfied with their groups, fifty six percent of the responses indicated their level of satisfaction ranged from high to highest, and 87% of the response declared that the success of their group efforts ranged from good to excellent.

Despite this good news, problems in information systems group collaboration are evident (Tables 2 and 3). Chief among these are the difficulty in finding convenient times for group members to gather and minimizing socializing activities. Difficulty in finding convenient times for group meetings was noted in 81% of the responses and was cited as frequently or always a problem by 47% of the respondents. Furthermore, spending time socializing during group meetings exists in 74% of the responses and was cited as frequently or always a problem by 25% of the respondents. In addition, 19% of the respondents indicated the frequent problem of group domination from one or more members, 20% of respondents reported frequent occurrence of free-riders in group work, 26% of the respondents reported frequent problems of cognitive inertia, 34% indicated the frequent problem of fear of negative response to ideas shared with the group and 6% indicated the frequent problem of production blocking. Due to difference between the university and workplace environments, some of the problems reported by Valacich et. al. were not positively identified by students (Table 4).

Based on Spearman rank correlation tests of hypotheses, H_0: $\rho = 0$ (ie. there no correlations between group size, process loss factors, etc. on group's success and satisfaction levels) with $p < .05$, this study found no correlations between group size and group success nor satisfaction level. These results contrast with the productivity and satisfaction findings of previous studies by [6, 7, 8] mentioned before. However, satisfaction and success levels with group collaboration were found correlated to each of the following factors:

1) Group members possess common background for the assigned task (p_1=.0001 and p_2=.0001)[1],
2) Conflict in personalities is minimized (p_1=.0001 and p_2=.0001),
3) Individual members do not fear negative evaluation of their ideas by the group (p_1=.0001 and p_2=.0002),
4) Everyone contributes a fair share, with no free-riders (p_1=.0001 and p_2=.0002),
5) Individual group members are open minded and are not too defensive (p_1=.0001 and p_2=.0038),
6) No individual member allowed to dominate and dictate the work of the entire team (p_1=.0001 and p_2=.0200),
7) There is plenty of convenient time to get together for group work (p_1=.0001 and p_2=.0386),
8) Group utilizes all relevant data available,

no relevant ideas omitted (p_1=.0021 and p_2=.0029),

9) Group discussion does not go too long in a given course (p_1=.0881 and p_2=.0165), and

10) Socialization during group gathering is minimized (p_1=.0233 and p_2=.1897).

[[1] p_1 is the p value for correlation test between the observed factor and the satisfaction level and p_2 is the p value for correlation test between the observed factor and the success level.]

Table 4: Problems in Group Collaboration - Cited as Sometimes, Usually, or Always a Problem

Problems	Percentage of respondents
Convenient meeting time	81
Socialization *	74
Cognitive inertia *	64
Domination *	56
Free riding *	47
Failure to remember ideas *	37
Failure to use data for analysis *	36
Different backgrounds among team members	36
Evaluation comprehension *	
for others in the group	34
for self	16
Production blocking *	29
Personality conflicts	24
Personal defensiveness	23
* Noted by Valacich, et. al.	

IMPROVING GROUP COLLABORATION

Better group collaboration is needed to improve the productivity, efficiency, success and satisfaction on group projects. While principles for effective group collaboration in the work place and classrooms have been well documented, certain basic, but often overlooked, elements can and should be introduced into the student project group process. These include setting aside in-class group discussions, teaching of key project management practices such as good planning, scheduling, division of tasks, coordination, and quality assurance. Further, rules and expectations of project participation must be spelled out in advance to maintain fairness, prevent free-riders, reduce socialization, and improve individual learning and contribution. Student group members need to be taught to identify factors that can diminish group effectiveness and learn how to deal with them. Finally, instructors should be seen as supportive to the group effort and willing to intervene, if necessary, or if invited, to help the group overcome or progress beyond process losses and personnel problems. Instructors should also take actions to prevent project schedule slippage by enforcing project checkpoints and milestones.

"Better group collaboration is needed to improve the productivity, efficiency, success and satisfaction on group projects."

Since Group Decision Support tools for groups have proven beneficial, opportunities for process improvement also exist through use of computer assisted group collaboration tools. With the proliferation of client-server technology, 4GL tools (such as Knowledgeware's ADW, Texas Instruments' IEF, Excelerator, Computer Associates's Super Project, Microsoft's Visual Basic, Synon/2E, etc.), and group collaboration tools (Electronic Bulletin Board, E-mail, electronic meeting systems [6, 7, 8], Xerox' COLAB board [12], etc.), students with access can work together, on-line, to complete key parts of their project assignments. They can monitor and manage work in process, ie. reports, charts, data flow diagrams, spreadsheets, data dictionaries, and other project documentation at their own PCs, at their own convenience while still maintaining good collaboration with the rest of their group [6, 11]. At dozens of colleges and universities which have installed electronic meeting rooms, or similar tools, students can also set up electronic meeting sessions to work on problems, opportunities and solutions for their projects.

CONCLUSIONS

Overall, this survey has identified some potential process losses and noted successes in group collaboration in IS class projects. As well as previously noted process losses in group work, new factors relevant to student group collaboration emerge. For student project groups, key problems are convenience of group meeting time, uncontrolled and unnecessary socialization, individual domination, free-riders, and cognitive inertia. Guidelines for helping members to overcome group collaboration problems include better time allocation for group work, team's ability to coordinate and control of group collaboration. Clearly, opportunities exist to facilitate and enhance student group learning in information systems projects.

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REFERENCES

[1] Olman, L.; and Bostrom, R. P. "Innovative Teaching Materials and Methods for Systems Analysis and Design," *Database*, Spring 1992, pp. 7-12.

[2] Woodfield, S. W.; Collofello, J. S.; Collfello, P. M. "Some Insights and Experience in Teaching Team Project Courses," *ACM SIGCSE Bulletin*, Feb. 1983, pp. 62-65.

[3] Bullard, C. L.; Caldwel, I.; Harrell, J.; Hinkle, C.; Offutt, A. J. "Anatomy of a Software Engineering Project," *ACM SIGCSE Bulletin*, Feb., 1988, pp. 129-133.

[4] Brooks, Frederick, Jr., *The Mythical Man-Month*, Reading, MA: Addison-Wesley, 1978.

[5]Phan, Dien D; Vogel Douglas R.; and Nunamaker J. F. Jr. "Empirical Study in Software Development Projects: Field Survey and OS/400 Study," *Information & Management*, forthcoming, April 1995.

[6] George, J. F., Dennis, A. R.; Nunamaker, J. F.; and Easton, G. K. "Experiments in Group Decision Making," *Working paper*, Univ. of Arizona, 1989.

[7] Valacich, J.; Dennis, A.; Nunamaker, J. "Electronic Meeting and Group Decision Support Systems," *International Journal of Man-Machine Studies*, Vol. 34, No. 2, Feb. 1991, pp. 261-282.

[8] Dennis, A. R.; Valacich, J. S.; and Nunamaker, J. F. "An experiment investigation of group size in an electronic meeting system," *IEEE Trans on Systems, Man, and Cybernetics*, 1990,

Group Collaboration, *page 161*

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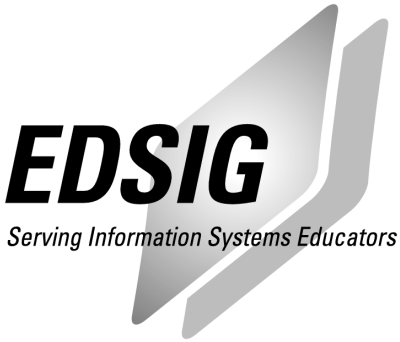

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