

Learning by Doing: A Remote Communication Project

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INTRODUCTION

At a time of flattening organizational hierarchies and emerging team-based organizational structures, the ability to communicate with computer-based tools becomes increasingly important [1,2,3]. Indeed, organizational communication via computer-based tools is commonplace in business, government, and academia [2, 4, 5, 6]. Computer-based communication tools that include electronic mail, computer bulletin boards, newsgroups, computer conferencing, Tele- and video-conferencing, and the World Wide Web serve as vital mediums for discussion and managerial problem solving [4, 7, 8]. Although educators have begun to train students for general computer literacy, the use of computer-based communication as a pedagogical tool within information systems education remains, for the most part, largely unexplored (for other disciplines' usage of email, see [9, 10, 11, 12, 13]). One way to rectify this situation is to design course projects that utilize appropriate computer-based communication tools in the support of pedagogical approaches such as active and cooperative learning.

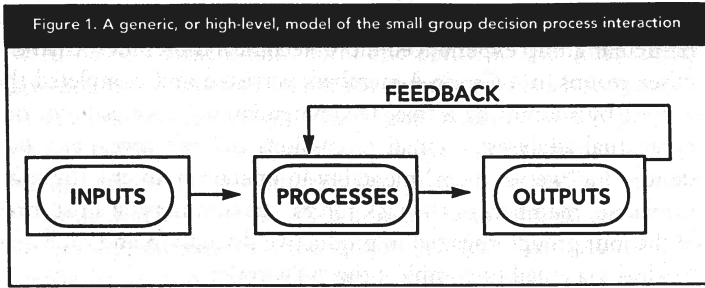
Prior educational research has demonstrated that students involved in active learning experiences tend to learn more effectively than those students engaged in passive learning experiences such as lectures [14, 15, 16]. We employ an exploratory case study design [17] to examine the outcomes, as well as the decision-making and problem-solving processes, of student groups engaged in an active learning experience in an information systems course. The remote communication project described in this

paper is an initial, descriptive step in our larger quest to understand the potential influence of computer-based communication tools in student learning experiences. Our research efforts focused on investigating the following question: What kinds of group product outcomes and group interaction processes (problem-solving, discussion, and learning) occur when groups with dispersed members adapt a computer-based communication tool to meet the demands of a complex business decision task?

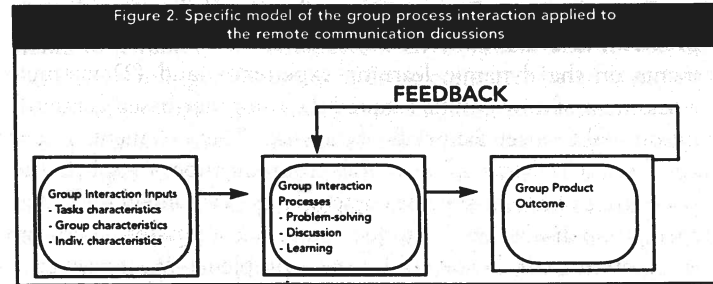
The two-fold purpose of this paper: (1) to provide a concrete example of incorporating computer-based communication into the classroom as a general instructional resource, rather than as an object of instruction itself; (2) describe the student learning experiences of actively adapting information technology to accomplish a business decision task. We first present our organizing model, a description of our methodology, and our analytic approach for this study. We then end with a discussion of study insights, recommendations, and limitations.

RESEARCH MODEL

Prior research highlights the importance of examining the group interaction among members (especially when members are geographically dispersed) to gain an understanding of how groups learn to adapt technological tools to address business tasks [2, 3, 18, 19]. Our overall model is based on a small group process model [20, 21] that highlights the communicative interaction of members during group discussions (see Figure 1).



Although the high-level model was useful for shaping our investigation, it was necessary to refine the generic model to include the specific concepts of interest in this study. We wanted to understand how usage of a remote communication project influences group problem solving, group discussion, and group learning processes as part of the group interaction process and to look for specific discussion outcomes that might result. Figure 2 shows the refined model used to guide our analysis of the remote communication discussions.



METHODOLOGY

Participants: Thirty-five upper-division undergraduate students enrolled in a core information systems class during fall quarter 1994 at two public Midwestern universities comprised our study participants. Course instructors at each university divided their participants (nine students from the Michigan campus and twenty-six students from the Minnesota campus) into four groups. Each group was instructed that it was to complete the remote communication project with its counterpart group at the other institution. Students who participated received class credit toward their final course grade. Participants at both universities had used email previously as part of their regular class assignments during the prior eight weeks of the course term.

Task : The project experience was designed to simulate: (a) typical, actual business activity in which teams, composed of members from dispersed sites, are required to work together in a decision-making situation [2, 3, 4, 22]; (b) an unstructured problem that students are likely to face in actual business settings [1, 21, 23]; and (c) a hands-on situation of managing and adapting information technology to meet the needs of group discussion and decision-making. The business decision case involved a hypothetical large Midwestern manufacturer of medical devices with two primary centers of operation, one in Michigan and one in Minnesota, with two smaller divisions in other states, each site maintaining its own human resources department. Team members were instructed to think of themselves as members of a combined task force from the two primary sites in Michigan and

Minnesota. Each combined task force was assigned to explore the issue of integrating the information systems used by each of the divisional human resources departments and prepare a recommendation as to whether these systems should be consolidated. Task force members at each university were provided with unique site information. Thus, the task design provided resource interdependence, an integral feature of cooperative learning techniques and, group active learning experiences [24].

Procedures: A packet of task materials was utilized that included: the names and email addresses of course instructors and all task force members (local and remote), the business case, a statement of expected project deliverables, and a deadline for the group decision. Participants were strongly encouraged to conduct all project communication via email discussions, including any project communication among proximate task force members. Course instructors also provided brief reminders of the importance of establishing rapport among all task force members. The complete materials packet is available from the authors.

ANALYTIC APPROACH

Our qualitative data analyses relied upon the following data sources: (1) contextual analyses and assessments of the email discussions of inter-university groups; and (2) student evaluation comments for the course. Email discussions were captured by the researchers for use in the contextual analyses and evaluations. Evaluation comments were extracted from course evaluations and reflective notes completed by the students as part of another course assignment. Each data source contributed to our overall interpretation of the group interaction processes (shown in Table 1) and are described in the following section.

Inputs	Processes	Outputs
Group Interaction Inputs	Group Interaction Processes	Group Interaction Outcome
Task characteristics (degree of structure, desired outcome)	Group Problem-solving: - problem identification - goal identification - alternative generation - selection of final recommendation	Final recommendation - form - content
Group characteristics (group size, cohesiveness)	Group Discussion - initiation of discussion - ongoing communication - concluding discussion	
Individual characteristics (computer anxiety, communication apprehension)	Group Learning Process - learning to adapt technology to needs	

Interpretive Analysis

Group Interaction Inputs: This portion of the model is concerned with task characteristics, group characteristics, and individual characteristics. Our model acknowledges the importance of these elements for understanding group interaction, but this study does not examine these variables in detail.

Group Interaction Process: In an effort to understand how use of a remote communication project affected student learning, we highlighted the group interaction processes of problem-solving, discussion, and learning. Prior research indicates that each of these specific group interaction processes plays a key role in how the group accomplishes tasks [3, 20, 21].

Group Problem-Solving Process: Our evaluation of each group's problem-solving process was based upon the following four dimensions: problem identification, goal identification, alter-

native generation, and selection of a final recommendation. These dimensions represent cognitive processes that decision makers are capable of providing in complex decision situations and have been identified in competence models of decision making under uncertainty [25, 26]. Our analysis presumes that these processes were operating while group members worked to complete the task in this study, as the task was designed to simulate a complex and uncertain business task.

None of the four groups showed a systematic problem-solving approach that included clear problem identification, goal identification, and generation of alternatives that culminated in a final recommendation. Discussion in Groups 1 and 3 began by concluding that merging the various systems was necessary, clearly evidencing a problem-solving process often seen in actual work groups [20]. There was no discussion of alternatives; groups appeared to choose quickly their recommendation. A Group 1 member wrote at the end of the project that the two sites "didn't even agree on what the project was about." Discussion among Group 2 members showed that participants at both sites recognized the need to share information about their respective sites, but this group also adopted a single alternative as a solution without much discussion. One individual in Group 4 attempted to summarize the major points, but the clearest goal articulated in this group was "to finish this project."

Evidence of a muddled problem-solving approach was not surprising in light of prior research in computer conferencing [2, 4, 13] and given the lack of specific instructions in this sub-task provided for the students. That is, a step-by-step process for identifying the problem, goals, and alternatives was not outlined for students before the project began. Our observations suggest the need for more specific problem-solving guidelines at the outset of such a project.

Group Discussion Process: When evaluating the overall quality of the discussion among the inter-university groups, we utilized three dimensions: (1) initiation of discussion, (2) ongoing communication, and (3) discussion conclusion process. Prior research indicates that how a group organizes and conducts its discussion process has significant bearing on the group's performance of its task in both computer-based and non-computer-based settings [4, 13, 20, 21].

We discovered a wide variation in discussion processes among our groups. Group 1's discussion was least successful. Half of the group (located at one site) provided its recommendation without incorporating the ideas from their counterparts at the other site. In contrast, Group 2 immediately adopted a "liaison" mode of communication when one member at each site assumed responsibility for sending and receiving messages. Group 2's discussion evidenced a fairly even exchange of ideas between sites with members actually responding to each other's ideas and its concluding discussion indicated a synthesis of all prior topics. This group also circulated rough drafts of its final report. Group 3 started its discussion early, and their exchanges indicated a convergence of ideas after starting from rather divergent views. One member of Group 3 developed the group's recommendation by synthesizing the many views/ideas discussed by the group, but there was no group discussion about completing the task in this way. The messages from Group 4 were somewhat fragmented although the closing

discussion indicated a synthesis of the participants' ideas. This particular group experienced more "technical difficulties" than the other groups, but Group 4 members persisted and completed the project by submitting a final recommendation. Interestingly, our contextual analyses of email discussions did not reveal any evidence of a "we vs. them" mentality in operation among the non-proximate members of the task forces. In summary, at least three of the four groups engaged in productive discussion and exchange of ideas via email to complete the assignment.

The wide variation in group discussion patterns may be due to students' relative inexperience in conducting online discussions with group members who are not in the same location. In particular, any discrepancies, issues, or problems encountered during email discussions could not be resolved by meeting individuals in a face-to-face setting as would be the case when all members are co-located. The lack of agreed-upon and implicit mechanisms for conflict resolution in group discussions often results in widely varying discussion patterns [21]. However, this did not prove to be a significant problem in our study.

Group Learning Process: Our evaluation of the group learning process was based on the following elements: (1) student comments on the dynamic learning experience, and (2) instructor assessment of how groups adapted the computer-based communication tool to meet the needs of the task. These elements provided a selective view of how the group members applied their knowledge of course specific content on systems integration, managed group discussion techniques, and used computer-based communication tools to solve a business problem. We reviewed all email communications over the course of the assignment to arrive at an overall impression of how each group learned to use the technology and to adapt the medium to meet the needs of the decision-making task.

The level of learning was mixed among the four groups. A participant in Group 1 wrote at the end of the project, "our remote project did not go well." Several participants in this group at one site did not successfully use the medium in that they never established regular, ongoing exchanges with their counterparts at the other institution. It is possible that Group 2 members demonstrated the best use of the technology, although it is unclear if the learning was shared by all participants because this group adopted the liaison mode of communication. Participants in Groups 3 and 4 demonstrated improved ability in adapting the technology to meet their discussion needs as the project progressed. Particularly in Group 4, one site's members continued to respond and send messages to their counterparts at the other institution in spite of numerous computer "glitches" (e.g., email system unexpectedly failed at one point during the project). In hindsight, Group 4's members may have learned best to adapt the technology to their needs. As one Group 4 participant wrote, "the remote project was frustrating but it illustrates how difficult this type of project can be." In summary, students experienced at least some frustration using the medium, but their experience appeared to have heightened their awareness of the complexity of communication necessary for resolving this type of unstructured business task. Our observations suggest that the level of frustration encountered in a group's use of a computer-based communication tool may mediate the group's and/or the individual's learning process.

Final Group Product: The quality of the final product was evaluated on two dimensions: form and content. The form dimension addressed whether or not the group provided a summary of advantages, disadvantages, costs, and benefits of the potential change. The content dimension addressed whether or not the group understood the problem and provided a feasible solution, given the facts of the case. Based on an overall evaluation of these underlying dimensions, the quality of the final product was assessed according to the following numeric scale: 1 = poor, 2 = fair, 3 = adequate, 4 = good, and 5 = very good.

The quality of the final products ranged from poor to adequate. Group 1's report was so vague that it could have been the final recommendation in a variety of business situations. It was written as an outline that closely resembled material from the course text. Group 2 provided a better final product, although it was poorly worded and lacked editing. The final reports from Groups 3 and 4 showed consolidation of participants' ideas and were evaluated as adequate.

The aim of this exercise was not to produce the quintessential recommendation. Rather, the two-fold goal was to expose the students to a remote communication environment and to use this experience to highlight issues of using computer-based communication technologies, previously only highlighted in classroom discussions and lectures. Although final products of higher quality would have been preferred, the lack of high quality was not considered a project failing. Additionally, the timing of the remote communication project coincided with other end-of-term deadlines and uncontrollable system problems at both university sites. Given these conditions, the resulting group product outcomes were not surprising.

DISCUSSION

Practical Insights & Recommendations: The practical insights of this assignment are apparent when the project's successes and failures are tallied. In the success column, we determined that this remote computer-based project heightened students' awareness of the difficulties that may be experienced in using technology to establish discussion groups at remote sites [4, 9, 13, 22]. Moreover, this assignment provided students with a tangible experience of using technology to complete an unstructured task so typical of decision situations in actual business settings [2, 4, 22, 23]. This experience could not have been replicated within the standard class format that utilizes lectures of textbook material. Almost every student participated and took part in an active learning experience that involved actual operational issues of adapting the information technology to meet the task's needs [3, 14, 15, 27]. In addition, the project promoted group work at both local and remote sites and promoted students' writing and communication skills.

In the failure category, we communicated the "what" of the assignment but not the "how." That is, we instructed students as to the nature of the task but provided little guidance for tackling such an unstructured problem. The lack of process structure may have compounded the frustration of using the technology to establish discussion at a remote site. This frustration also may have derived in part from the dramatic difference of group composition at each site. For one site, there were too few groups that resulted in the

combined group having a vastly different participation ratio by university site (e.g., 2 Michigan students and 7 Minnesota students in one group). In addition, there was little evidence that students' prior use of the technology for intra-university communication prepared them for establishing email discussion across inter-university sites. As for the case itself, it could be strengthened to include a better articulation of the company's goals. Although one of the objectives of the project was to involve students in an unstructured task that would simulate an actual business decision situation, we needed to realize that our students were, after all, students who generally lacked experience at tackling this type of problem.

We recommend this type of project for creating an active learning experience, but suggest the following changes in future endeavors: (1) establish "task forces" with equal members of students from each institution; (2) initiate the "task forces" earlier in the term to allow members to establish a working relationship among themselves; (3) provide a role play exercise prior to the start of the assignment that emphasizes typical organizational resistance to consolidation efforts; (4) demonstrate a standard problem-solving technique that requires problem identification, goal identification, alternative generation, and alternative selection in earlier assignments; and (5) add to the task's structure by clarifying the company's goals.

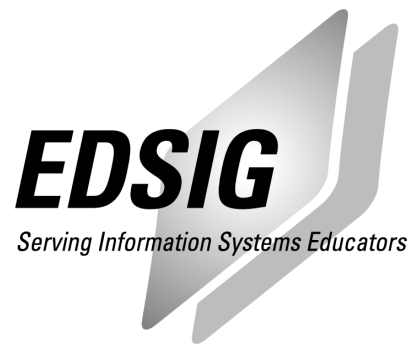
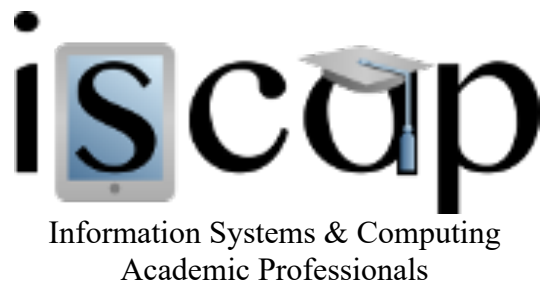
Research insights & recommendations: The remote computer-based communication assignment produces a large amount of diverse data to be collected and analyzed by the researcher(s). Although the diverse data are valuable in providing insights for understanding the phenomena, the volume and largely qualitative nature of such data require greater organization and pre-processing for subsequent analysis. We recommend this type of project for exploring student learning experiences during the use of computer-based communication technologies, but suggest the following cautions: (1) be aware of the demanding nature of data collection and data analysis; and (2) use quantitative mechanisms (e.g., instruments or coding schemes) to evaluate the group processes of discussion, learning, and problem-solving.

Limitations: There are obvious limitations to the external validity of our study due to the small sample size, the kinds of groups we were able to include in the research study (students), the size of the groups, and the composition of each group (on average, two students from the Michigan site and up to seven students from the Minnesota site). Further, our observations are largely qualitative and did not involve detailed coding or other quantitative approaches. Despite these limitations, our study did allow for a rich description of the group problem-solving, discussion, and learning processes involved in the use of remote communication projects in information systems courses. A rich, descriptive view of the process is an important initial step in building an understanding of incorporating computer-based communication tools into active learning experiences.

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