

# Connecting Geographically Dispersed Classrooms for Computer Supported Collaborative Work

**KEYWORDS:** *Inter-university project, Electronic communication, Internet, Computer Supported Collaborative Work (CSCW), Teamwork, Globalization*

**ABSTRACT:** *Today's increasingly global economy is changing the way businesses communicate. Technology to facilitate business communications and operations continues to advance and set the pace for these changing needs. Educational institutions that are building tomorrow's workforce should create opportunities for students where they can apply this technology to future business needs. This paper presents an inter-university project that provided practical experience to two groups of students at two different universities. Through information technology, both groups experienced first-hand the value of computer technology and inherent problems with using computer technology to solve problems over great distances.*

## BACKGROUND

Computer Supported Collaborative Work (CSCW) examines how communication and groupware technologies can support dynamic collaboration in work groups over space and time constraints. [1, 2, 3, 4] Previous research in CSCW has focused on the technical issues of developing software applications and interfaces that facilitate group work [5], involving users in the development of the end product [6], the importance of the product interface [7, 8], and the social and psychological aspects of collaborative computing [9]. When correctly implemented, CSCW can significantly improve the quality of group work, whether between business partners, between faculty colleagues, or between students. Unfortunately, while much of the existing literature has focused on the role of CSCW in business organizations, there are few reports on the practical application of CSCW in higher education. Considering the fact that today's baccalaureate programs are preparing future business leaders, much more CSCW knowledge needs to be disseminated to academicians. This paper presents the details of a second, improved implementation of a CSCW project designed to provide students with practical experience using computing technologies for group tasks.

In 1992, an inter-university project was designed to show two groups of students the value of electronic communication across international boundaries through hands-on practice. The groups consisted of manufacturing technology students at Purdue University

(PU) studying information technology and computer science students at King Saud University (KSU) studying automata theory. [10] Three to five students from PU were grouped with one student from KSU. Both classes were assigned different case studies applicable to their specific fields of study. However, in order to solve the business problem presented in the case study, students had to communicate with their remote partner(s) via electronic mail.

The communication was forced not only by the project requirement, but also by the design of the case study itself. Much of the knowledge needed to solve the case study existed at the partner school, and the only way to retrieve it was to communicate with the student(s) at the other school. This situation is analogous to a business situation where critical, large-scale expertise exists at a distant site. If the organization cannot afford to wait the time required to transport the expertise to where it is needed, and cannot afford the cost of (or does not have access to) phone calls or sending faxes, communicating electronically may be a viable option. In the classroom situation, long-distance travel, long-distance phone calls, and long-distance faxes were too costly to be practical for students; however, all students could get Email accounts for free. Furthermore, Email allowed for the timely exchange of information and provided built-in logging of exchanged messages.

## Original Project Objectives

The primary objective of the project for the PU students was to show by personal experience the following benefits of electronic communication to a global manufacturing business: [11]

- 1) Messages sent by postal mail to/from Saudi Arabia may take two to four weeks (or longer), whereas messages sent by Email reach their destination in seconds.
- 2) Electronic communication is much less expensive (for the student) if the university is a subscriber to Bitnet or Internet ("free" Email compared to several dollars to send electronic files via air mail).
- 3) As businesses internationalize their operations, college graduates may be working with people from different cultural backgrounds more frequently. Email as an impersonal medium emphasizes the messages rather than the messenger, providing an opportunity for students to focus on the communication itself, regardless of cultural similarities or differences.
- 4) As businesses downsize their operations, key people may be in high demand, and the need to communicate with these peo-

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ple will increase. Access to Email will provide a communication mechanism to reach these important people and leave detailed messages for their review.

5) In many business situations, one person cannot solve a problem singularly, but must work with other people with different backgrounds and areas of expertise. Email can provide a Computer Supported Collaborative Work (CSCW) environment for students to share and exchange ideas on a group project. [12]

### Original Project Findings

Both the students and instructors discovered inherent problems applying this technology on a global scale. During the early weeks of the project, both groups were able to send messages and receive replies with fairly good turnaround. However, the PU students had classes Monday through Friday, while the KSU students had classes Saturday through Wednesday. In addition, KSU students' time zone was eight hours ahead of the US group. Thus, if a PU student sent an Email message on Wednesday afternoon, the KSU partner may not have read it until Saturday, and the immediate reply would not be received by the PU group until Monday -- five days after the original message was sent.

To further complicate the schedule problems, the KSU students had a three-week religious holiday immediately after the one-week spring break for the PU students. The written report by the PU students was due two weeks after the holiday period ended. The timing was such that if the PU students did not get their questions to the KSU partners in the early weeks of the project, they may not have had information to work with to complete their case study on time.

Finally, the language forced by the medium was English, which was the KSU students' second language. For this reason, some messages were unclear and had to be further clarified and re-sent. The schedule problems described above emphasized rather than minimized the language differences creating another barrier for the PU students.

### Original Project Benefits

Educators should recognize that learning can occur even when uncontrolled or unforeseen problems arise. In the case of the US-Saudi inter-university project, while the intended project objectives were not completely realized, other important lessons were learned. In fact, the project experience was used as an example to illustrate these lessons to the students:

1. Having technology in place will not guarantee success.

2. Tolerance of conflicting cultures and language barriers can affect success.

3. Better planning of (or anticipating ideal) communication opportunities (accounting for time and holiday differences) can affect success.

4. Identifying problem causes can affect future successes (through knowledge, there is power).

From this experience, students would be better prepared to anticipate problems in any similar business situation in the future, resulting in a higher chance for success on the job.

### REVISED PROJECT COMPONENTS

Before using the inter-university concept again, the project was redesigned to minimize the problems and realize the intended objectives. When the project was implemented again in 1994, PU and Virginia Commonwealth University (VCU), two US universities separated by several states, were selected. Both groups had similar work weeks (Monday through Friday), holiday periods, subject matter content (information technology), and primary language (English). Preparatory exercises to introduce the concepts, terminology, and technology were developed. After the fundamental concepts were understood, two group projects were assigned to provide CSCW experience. The first project was designed such that the large scale expertise needed to solve the problem at each site existed at the remote school. The second project had students from both schools assigned to one of six CSCW teams working on the same problem.

### Course Structures and Descriptions

PU students met three times per week in two 50-minute lectures and one 110-minute lab. VCU students met twice per week in two 75-minute lectures. Both classes had access to lab facilities to send and receive Email outside of scheduled class meetings. The level of instruction introducing students to Email and the Internet varied somewhat, due primarily to the differences in course structures.

PU students, as described earlier, were all manufacturing technology students in their junior or senior year. Their interdisciplinary program required three classes from the Information Systems Department, concluding with this information technology course. VCU students were business majors in their junior year. Regardless of their specific field of study (e.g., accounting, finance, real estate, etc.) within the business school, this is a required core course.

### Project Changes

The assignment itself was significantly changed from the original, international pro-

ject, but the need to contact the partners at the other school remained. Students at PU completed three preparatory assignments 1) to introduce them to the terminology and concepts of Email and the Internet, and 2) to gain practice using the Email system (see Preparatory Exercises section). Students at VCU were provided with reference materials on the same subject and the third Email practice assignment. Both groups of students also completed a survey.

### Preliminary Email Survey

In order to more accurately assess the overall background of the students in both courses, an anonymous 35-question survey of their past computing experiences and attitudes was administered at the start of the project. 50 students completed the survey, 17 from PU and 33 from VCU. The tables in the following sections summarize the results. (A copy of the survey instrument may be requested from the authors.)

### Student Demographics

Tables 1-3 summarize the demographics of the students in both courses. Based upon the results, the majority of students were upper-classmen, at least 21 years old, and maintained at least a C average.

### Student Literacy Levels & Attitudes

Table 1: Classification

Freshmen .....	2
Sophomore .....	8
Junior .....	26
Senior .....	14

Table 2: Age Group

< 21 .....	10
21-25 .....	27
> 25 .....	13

Table 3: GPA (4.0 scale)

3.5 - 4.0 .....	6
3.0 - 3.4 .....	15
2.0 - 2.9 .....	26
1.0 - 1.9 .....	2
0.0 - 0.9 .....	0

Table 4: Prior Background

Survey Question	Yes	No
Have you ever taken a class or received formal training on computers?	43	6
Have you ever taken a class or received formal training in (data) communications or networking?	6	42
Prior to this class, have you ever used an electronic mail package?	25	25
If you have used electronic mail, did you send Email outside your school or company?	14	18
Prior to this class, have you ever used the Internet?	14	34
Have you ever used the Internet to participate in discussion groups?	4	28
Have you ever used the Internet to access newsgroups?	10	21
Have you ever used the Internet to conduct research for class assignments?	5	27

In order to assess the students' self-perceived electronic communication literacy levels, several questions about their past experience with various technologies were included on the survey (see Table 4). For some technologies, an additional question regarding frequency of use was asked. Periods included D=daily, W=weekly, M=monthly, I=infrequently, and N=never (see Table 5). Based upon the survey, although 86% had prior experience using computers and 50% had used an electronic mail package, only 28% had prior experience sending Email outside of their local environment or accessing the Internet. This suggested a need to provide appropriate reference materials or introductory assignments.

Questions to gauge the students' incoming attitudes regarding the usefulness of computers, Email, and the Internet were also included on the survey instrument. Categories included C=crucial, V=very useful, S=somewhat useful, M=minimally useful, and N=not at all useful (see Table 6). It is interesting to note that although 50% did not have prior experience using Email, nearly everyone (96%) felt that it would be important to their future career success (rated usefulness as somewhat useful or higher). Likewise, 68% had no prior experience with the Internet, yet 78% felt it would be important to their career success.

In addition, students were asked to state which medium they preferred to use in order to complete a task. From the responses, 15 preferred the computer, 6 preferred a manual method, and 29 preferred a combination of the two. This suggests that nearly all of the students were quite comfortable using the computer as a tool by itself or in conjunction with manual methods.

*Preparatory Exercises*

Before assigning the first project to the students, three preparatory exercises were devel-

oped to introduce students to Email, the Internet, and other related material. PU students were given all three exercises, while VCU students, who had no formal lab meeting, were given only the third exercise.

*Article Summaries*

The goal of the first exercise was to introduce students to common Email/Internet terminology in as non-threatening a manner as possible. Through sheer serendipity, three articles related to the project topic appeared in the campus newspaper during the first week of the semester. [13, 14, 15] Time magazine also ran a cover story on the Internet. [16] The newspaper articles were distributed to the students along with their first exercise. Their task was to research and summarize the three newspaper articles plus another recent article relating to electronic communication. The Time article was referenced to help them

23] After completing this exercise, students were more confident about using Email or accessing the Internet. They also asked more questions on related topics, like flaming, superhighway, etc., which appeared in the articles.

*Graphical Presentations*

The second preparatory electronic communication exercise applied the results of the article summary exercise to a mock problem using a popular presentation package. Students were given a short business scenario describing a request from an immediate supervisor to develop a presentation on the value of the Internet to the organization. Although the focus of the lab was to provide an introduction to the presentation tool, the backdrop of the business problem provided a smooth transition from researching the Internet to predicting its usefulness to business. Most students were quite creative in developing presentation slides which conveyed, through words and suitable pictures, how an organization could effectively use the Internet.

*Setting Up Accounts and Sending Email*

Students actually "logged in" to their computer accounts for the first time as part of the third preparatory exercise. The instructor distributed account user ids and passwords and provided vocal instructions to prepare their accounts for using Email. The preparatory steps included the following:

- 1) Modifying login script so desired short cut keys could be used and so the output was directed to the most conveniently-located printer.
- 2) Building a nicknames or alias file that

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get started. Although some students opted to use the Time article, most students found many other articles. [17, 18, 19, 20, 21, 22,

included all students on the same team at both schools, both instructors, and distribution lists for the local group, remote

Table 5: Technology Usage Frequency

Survey Question	D	W	M	I	N
How often do you use a communications package (ex: using modem software to dial-up a University system from home)?	5	4	1	11	29
How frequently have you used an electronic mail package?	12	7	2	6	23
How frequently have you accessed the Internet?	1	7	0	9	33

group, and instructors. This step eliminated the need to remember cryptic Email addresses by assigning descriptive nicknames or aliases to them.

3) Designing a signature file to be appended automatically to any outgoing Email message.

4) Practicing use of the system editor and commands to accomplish specific functions on the system being used.

After the preparatory steps were completed, each student was asked to send mail to the local group, the remote group, and both instructors. At some point before the next meeting, they were to have read all of the mail and saved it for documentation purposes.

#### First Group Project

When the preparatory exercises were completed, the first group project was distributed. The design of the assignment was such that PU students and VCU students had different, but related tasks which could not be accomplished without input from their remote partners. Both groups would give a quality resource rating to their remote partners and group contribution rating to their local partners. Each student's final grade was based on the local group's report grade, the quality of the Email exchange, the individual student's group contribution rating, and the individual student's remote quality resource rating. To evaluate the quality of the communication,

*"One of the greatest challenges all students face during job hunting is defining exactly what skills they have..."*

each instructor considered not only the amount of messages exchanged across the two sides, but also the questions asked and the information provided.

#### Case Scenario

The scenario for both groups was a graduating senior named Sam majoring in the same subject as the local group. The goal of the group was to help Sam locate a job in the remote area. In order to find out about job opportunities in the remote area, the local group had to use Email to educate their remote partners about Sam's career goals, to ask questions of their remote partners about job opportunities, and to work with their remote partners in proposing the best course of action for Sam. (A copy of the assignment may be requested from the authors.)

#### Career Relevancy

Table 6: Students' Attitudes on Usefulness

Survey Question	C	V	S	M	N
How useful do you believe Email might be to you in your personal/family life?	0	20	13	16	1
How useful do you believe Email might be to you during the remainder of your academic career?	7	20	16	7	0
How useful do you believe Email might be to you in your future career?	6	30	12	2	0
How useful do you believe the Internet might be to you in your personal/family life?	1	9	21	12	7
How useful do you believe the Internet might be to you during the remainder of your academic career?	3	19	13	10	5
How useful do you believe the Internet might be to you in your future career?	1	21	17	8	3

One of the greatest challenges all students face during job hunting is defining exactly what skills they have and what job markets are most suitable to their background and career goals. Once they know what their career options are, they have to convince other technical and non-technical people that they are the ideal candidate for a desired position. This first group project provided all students with an excellent opportunity to gain practice in both areas. Thus, the students not only experienced using Email to complete a major course assignment, but also practiced defining their career goals and explaining their background

exchanging messages through Email, the focus of this task was on analyzing the electronic medium as a research tool and as a collaborative tool.

#### Project Description

The assignment itself was a variation of the Internet Treasure Hunt that can be found on the Internet. To customize the hunt for the student hunters, the instructors navigated the Internet several weeks prior to the distribution of the assignment, searching for facts relevant to their respective classes. The paths used to find the information were recorded to be used as grading keys. Next, questions were developed which required students to navigate the Internet to locate the answers. Students were required to submit the navigation path, along with the actual answer, to all of the questions. The final report also required a brief user's guide on navigating the Internet as well as the group's evaluation of the Internet in conducting research and completing a group project. Although there are excellent tools for navigating the Internet to access desired information, the only tools available to the students through the assigned computer accounts were electronic mail and a character-based gopher system to access other Internet sources.

#### Project Evaluation

Although the actual treasure hunt game is a competition, this assignment had fixed criteria for assigning grades. The report grade, the quality of the Email exchange and Internet navigation, and the individual student's group contribution rating would be used to determine a final project grade. To provide additional incentives for excellence, token prizes were awarded to students for recognition of unique accomplishments in completing the project.

to non-technical people who directly impacted their future careers (in the mock situation).

#### Second Group Project

After the first project was completed, the second group project was distributed. While the first project had the local and remote groups working on separate problems and providing resource information for their partners, the second assignment required both groups to work together to jointly create a single solution. The amount of work involved in the four weeks allotted for the project forced each group to subdivide the research and report writing tasks among its members. Furthermore, the requirements mandated that the results be consolidated into a single report with additional analysis to be completed jointly. While the focus of the first task was

## CONCLUSION

The design of the inter-university project was meant to provide hands-on practice using the technology in a realistic, group setting. The preparatory exercises built the necessary foundation for success, while the two group projects reinforced the course objectives through experience. Both groups of students received the project well and informally expressed approval of the project. The students also expressed appreciation for the "hands-on" real-life experience of collaborating with geographically dispersed peers.

Additional modifications of this project are being planned for future implementations. The on-going design goal is to build a set of assignments that meet the stated objectives of the original project implementation, regardless of the background of the two groups brought together. Other academicians interested in implementing this project at their educational institutions should consider the following guidelines:

Research about the available tools to access Internet resources. A minimum of electronic mail and a character-based gopher system is required. Automatic logging of messages should be included with the email system.

Find a colleague at a remote site who has access to similar tools and can provide similar access to students, and has the desire to work on a joint Internet project.

Develop a research assignment where the knowledge cannot be found easily through local sources, but which the partner institution can provide quickly and conveniently. Generally, specifying characteristics that take the unique geographic location or cultural orientation of the partner school into account work well.

Consider each school's schedule so that each side has sufficient time to pose questions, send responses, and analyze responses, without interference from holidays/break periods.

Establish standards for minimum (expected) communication (number and quality) within groups, particularly with remote partners.

Design additional preparatory exercises to provide students with a stronger foundation on the use of the communications technology, and deliver these exercises several weeks prior to the group assignments.

By providing practical CSCW experience to students, instructors can help them realize the unique and important benefits of collaborative work. Through this experience, today's students will be better prepared for the global communication needs of future businesses.

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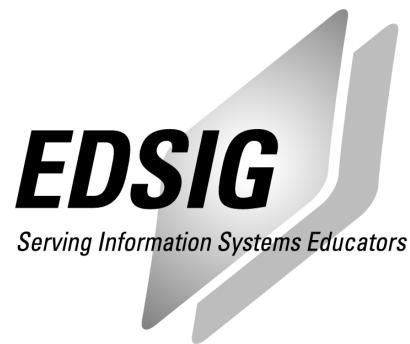
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