Time, Efficacy and Cost Considerations of e-Collaboration in Online University Courses

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(1) This paper reports the findings of a research project performed at Syracuse University (SU) and funded by the Andrew W. Mellon Foundation as part of its Cost Effective Use of Technology in Teaching (CEUTT) Initiative. The full Final Report, presented to the Andrew W. Mellon Foundation, is entitled: Cost and Learning Effects of Alternative e-Collaboration Methods in Online Settings. The present paper provides an overview of the research project undertaken at Syracuse University (SU), Syracuse, NY, 13244, USA.

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Abstract
Three online courses and one face-to-face course were investigated to gain an understanding of the effects of different forms of communication and collaboration on learning and instruction. Emphasis was placed on the time demands on students and instructors in online course environments involving the use of e-mail, threaded discussion forums, and online chat sessions. Findings suggest that learning outcomes and retention in Syracuse University (SU) online courses are comparable to outcomes and retention in face-to-face courses at SU. However, students report spending somewhat more time with online courses and faculty report spending considerably more time with online courses. Cost effectiveness analysis suggests that important issues in the initial design of e-Learning systems include consideration of whether decisions are related to technology supplementing or supplanting the previously employed instructional resources. So also are concerns for equity in relation to access, student time and especially faculty time. Integrating these factors into judgments about the cost-efficiency and cost-effectiveness of online courses is addressed in this study.

Resumo
Três cursos online e um presencial foram pesquisados para melhor compreender os efeitos de diferentes formas de comunicação e colaboração sobre o processo de aprendizagem e ensino. Uma ênfase especial foi dada ao estudo do tempo gasto pelos estudantes e instrutores em ambientes online, envolvendo o uso de e-mail, fóruns de discussão e sessões de chat. As pesquisas sugerem que os resultados de aprendizagem e a retenção em cursos online ministrados na SU são comparáveis com os resultados obtidos em versões presenciais dos mesmos cursos. Porém, os estudantes reportam haver gasto um pouco mais tempo estudando nas versões online e os professores reportam ter gasto muito mais tempo. Uma análise de custo-eficácia sugere que uma consideração importante no design inicial de um sistema de e-Learning é se a nova tecnologia vai suplementar ou substituir os recursos instrucionais previamente utilizados. Outras considerações importantes incluem questões de igualdade de acesso à tecnologia, de tempo exigido dos estudantes e, especialmente, do pessoal docente. O estudo investiga abordagens para a integração desses fatores no processo de julgamento de custo-eficiência e custo-eficácia de cursos online.

Resumen
Tres cursos online y un presencial han sido investigados para una comprensión más amplia de los efectos de diferentes formas de comunicación y de colaboración sobre el proceso de aprendizaje-enseñanza. Un énfasis especial ha sido dado al estudio de tiempo usado por los estudiantes y instructores en ambientes online, involucrando el uso de e-mail, foros de discusión y sesiones de chat. Las investigaciones sugieren que los resultados de aprendizaje y la retención en cursos online enseñados en la SU son comparables a los resultados obtenidos en versiones presenciales de los mismos cursos. Sin embargo, los estudiantes revelan que han usado un poco más de tiempo estudiando en las versiones online y los profesores revelan que han usado mucho más tiempo. Un análisis de costo-eficacia sugiere que una consideración importante en el design inicial de un sistema de e-Learning es si la nueva tecnología va a complementar o sustituir los recursos instruccionales previamente utilizados. Otras consideraciones importantes incluyen cuestiones de igualdad de acceso a la tecnología, de tiempo exigido de los estudiantes y, especialmente, del equipo docente. El estudio investiga diversas abordajes para la integración de esos factores en el proceso de evaluación de costo-eficiencia y de costo-eficacia de cursos online.

Time, Efficacy and Cost Considerations of e-Collaboration in Online University Courses (1)

Background and rationale

Motivation for the study

Online learning is relatively new but rapidly growing within and outside university settings (Rosenberg, 2001). Many important questions remain unanswered or unexplored, including which instructional approaches and methods are optimal in terms of cost and learning effectiveness in various settings and situations. Syracuse University, like many other institutions, has supported a number of online learning initiatives that involve many differences, especially with regard to:

1. audiences (on-campus undergraduate and graduate students, off-campus adult learners, students and teachers in remote schools, etc.);
2. access situations (home access via modem, high-speed access on campus and in the workplace, no Web access, time constraints, etc.);
3. implementation approaches (Web-supported campus courses, online courses for remote learners, blended environments, use of facilitators and assistants for group work, etc.);
4. communication methods (asynchronous threaded discussions, synchronous forums, video-conferencing, blended environments, etc.);
5. learning perspectives (structured learning activities, discovery learning, problem-based learning, etc.);
6. learning goals (conceptual knowledge, understanding complex relationships, procedural training, etc.); and
7. tools and technologies (web course management systems, courseware authoring tools, interactive simulations, etc.).

It is unlikely that any single instructional approach, method, tool or perspective will be appropriate for all audiences, situations and desired outcomes (Spector & Anderson, 2000). Taxonomies around these kinds of differences can be constructed to guide instructional decision making. However, important information to guide taxonomy users is missing or inconclusive, including how effective a particular technology is in

achieving a desired goal with a particular community of learners (Spector & Anderson, 2000).

The overall goal of this research study at Syracuse University was to address some of the missing pieces of knowledge concerning the cost, relative efficiency and learning effects of online teaching - one form of technology-enhanced teaching. Specifically, this study targeted the fourth item in the list above (communication methods), focusing on different forms of e-collaboration and their effects on learning outcomes, direct costs and teacher and student time. We use 'e-collaboration' to define alternative methods and different communications technologies that students can use to work with each other and with teachers and tutors to achieve specific learning outcomes. Common e-collaboration techniques include:

1. collaboration with a tutor/teacher via asynchronous means such as e-mail; we consider this minimal collaboration;
2. asynchronous, threaded discussions with topics posted; we consider this a form of modest collaboration, especially when combined with e-mail;
3. synchronous forum groups with semi-structured small group assignments and goals; we consider this more elaborate collaboration, especially when also used with e-mail and discussion forums; and,
4. asynchronous and synchronous audio- and video-based methods (tele-conferencing, video-conferencing, and Web-casting); we consider this elaborate collaboration but did not explore its cost and learning effects in this study.

This study involved the first three of these e-collaboration techniques. We did not explore the fourth technique in this study although the effects of such audio- and video-based collaboration methods on costs and learning deserve exploration (Richey, 2000; Saba, 2000). This study provides a framework for expanded studies of e-collaboration that could include replication efforts as well as audio- and video-based technologies.

One particular method of collaboration is not known to promote or inhibit learning outcomes. All students had opportunities for some kind of collaboration, and were offered a choice to participate or not participate. Records specific to this research study (e.g., the weekly logs) were kept anonymously. Based on this, we easily obtained Institutional Review Board (IRB) approval to conduct this study.

We view the first technique (e-mail or minimal collaboration) as a comparative reference point for the other more sophisticated forms of e-collaboration. We do not advocate creating online courses that only use e-mail communications to support collaboration and none of our courses were designed this way. We also used a face-to-face course for purposes of comparison.

The major elements involved in this study were the:

· Audiences: adult learners taking university courses; the audience included undergraduates and graduates some of whom were on campus and some were off campus.
· Access situations: high or low speed Web access with access occurring at home, at the university or in the workplace.
· Implementation approaches: the online courses involved were completely online and involved two different Web course management systems (BlackBoard and WebCT).
· Communication methods: the online courses involved e-mail, threaded discussions and chat sessions but did not involve audio- or video-based methods.
· Learning perspectives and goals: in all cases, learning perspectives mirrored those that were used in the courses when they were taught face-to-face, although some

researchers argue that different perspectives are required for online teaching (Goodyear, 2000; Jonassen, Hernandez-Serrano, & Choi, 2000).
· Tools and technologies: Web course management systems (BlackBoard and WebCT).

Focus of the study
The focus of this study was the effects of different forms of communication and collaboration on learning and instruction, including time and supplemental resources, in online courses. The three courses involved in the study were:

1. Religions of the World (REL 101) - lower division, undergraduate students residing on campus.
2. Latin American Geography (GEO/LAS 321) - upper division, undergraduate students some of whom were remotely located.
3. Instructional Design (IDE 614) - graduate students, most were resident in the local area but some were not.

A face-to-face version of IDE 614 was used to create a meaningful baseline and reference for comparison. All three courses included e-mail, discussion threads and chat sessions. None included audio- or video-based collaboration methods, although GEO/LAS 321 and IDE 614 both included some audio-video files as supporting Web-based resources. Data collected included grades, student-created artifacts, student time, student perceptions, attrition, faculty-created artifacts, faculty time, faculty perceptions, staff support, and supplemental infrastructure costs. Detailed information pertaining to student and faculty time was collected on a weekly basis.

Assumptions
We are assuming that our findings will form the basis for tentative generalizations to other online settings and situations. The relatively small number of courses and students will not provide strong evidence for generalizations with regard to other settings and methods. Nonetheless, the two Web-based course management systems involved, BlackBoard and WebCT, are the two most widely used systems for online courses in higher education (see the Report of AC4, a University of California-Davis subcommittee on course management systems published in March 2001, for example - available online at http://ac4.ucdavis.edu/subcomm/cms_report.html). Moreover, the three courses involve different kinds of students (lower division, upper division, and graduate students with some resident on campus, some living in the local area and some remotely located), different subject matter (religion, geography, instructional design), instructors with different levels of online experience (one with high level of online teaching experience, one with a moderate level of experience, and one who had only taught an online course twice prior to the data collected and reported here). These instructors in general had more online experience at the time data were collected (Spring 2002) than the typical instructor at Syracuse University. All three were full professors with significant teaching experience.

Faculty, staff and equipment costs are assumed to be generally representative of those in other institutions of higher education. Staff support time required to maintain the online environments is assumed to be generally representative. Time, effort and expertise required to develop the initial online versions of the courses involved in this study are reported; in addition, the time, effort and expertise required to convert one of the courses from TopClass to BlackBoard is also reported. Because all of the courses involved in this study had been offered in an online format prior to the data collected in the Spring of 2002, instructor time reported herein is primarily the time required to make minor changes to existing course materials and manage an online class. These time factors are, therefore, reasonably likely to generalize to other settings that do not

involve completely new development efforts.

Furthermore, we are assuming that the cost findings reported herein are relatively modest. We have not included audio-video based materials and environments that involve communication methods which are known to be more expensive in terms of initial investment as well as in terms of ongoing maintenance. Moreover, technical staff support personnel at this University are modestly paid and supported by graduate and work-study assistants who are paid relatively low salaries. Like most higher education institutions, computer equipment was purchased at discounted prices not widely available in business and industry. Judicious allocation of technical support staff and other resources (including time) is addressed where other online courses were also being served by the same resources.

We proceeded with the belief that we would not find significant differences in learning outcomes or learning effectiveness between online courses and face-to-face courses. The grades reported support the hypothesis of no significant difference in learning outcomes as do the general impressions of the instructors. Time-on-task is a reasonably reliable predictor of learning (Fisher & Berliner, 1985). Time-on-task data in this study also suggest that learning outcomes in online courses are comparable to those in face-to-face courses. The primary focus of this study, then, is on the time and other resource requirements that appeared in all the courses as reflected in student logs, faculty diaries, online data records, interviews and surveys of all the parties involved.

Description of the study
A Website that describes and summarizes this Mellon Foundation CEUTT study and its outcomes is located at http://idde.syr.edu/mellon/.

Hypotheses
The primary hypotheses addressed in this study were:

1. The specific forms of communication and collaboration in online settings effect the time demands placed on students and instructors.
2. Learning outcomes in online university courses are not significantly different from those in traditional university classrooms.
3. Time required to design, develop and deliver online courses are major factors in the cost effectiveness of online instruction.
4. Student and faculty experience with online instruction effect perceptions of effectiveness.
5. Student and faculty perception of the benefits of online instruction improve with experience in online environments.

Methods
The first hypothesis was explored in terms of three forms of e-collaboration (e-mail, threaded discussions, and chat sessions). Students and instructors were asked to complete weekly logs reporting time spent on various aspects of the course. The second hypothesis was explored in terms of grades as well as faculty and student reports about outcomes. Faculty reports of outcomes were taken from interviews with individual faculty members. Student reports were taken from end-of-course evaluations. The third hypothesis was analyzed in terms of specific resource requirements reported in this study and those reported in the literature. The fourth and fifth hypotheses were explored in terms of faculty interviews, background surveys, and end-of-course evaluations.

The experimental design used to address these hypotheses was a within-subjects

study of time, effort, perceptions and costs associated with the subjects (students, faculty, and support personnel) for each of the three courses studied. All students and instructors were involved with e-mail, threaded discussions and chat sessions at various times in each course. Week one of the online courses used only e-mail as a communication and collaboration method. Chat sessions occurred at least twice in each course in weeks when chats fit appropriately into the learning activities. Threaded discussions occurred throughout after week one. The numbers of subjects involved in each case were relatively small and do not support an inferential statistical analysis. Consequently, this study reports descriptive summaries of time, costs and outcomes and should be regarded as an exploratory study.

This research study funded by the Andrew W. Mellon Foundation's Cost Effective Use of Technology in Teaching (CEUTT) Initiative was conducted in the period January 2001 - January 2003. The study proceeded as follows:

Table 1. Project timetable

Time Period	Major Activities
January - May 2001	Baseline data collection
June - August 2001	Analyze baseline data, establish experimental conditions and develop instruments
September - December 2001	Pilot test instruments and collect data on face-to-face control group
January - May 2002	Collect data on online groups
June - August 2002	Collect and consolidate cost data
September - December 2002	Analyze time and effectiveness data
January 2003	Write and submit final report

Baseline effort
In order to develop a baseline against which findings would be interpreted, the following activities took place in the Spring and Summer of 2001:

· Reviewed the relevant literature on cost and learning effects in online settings;
· Interviewed instructors to be involved in the study with regard to prior experience in face-to-face and online settings;
· Determined how existing face-to-face and online courses were evaluated and what changes would be required or desired for this study;
· Identified a course that would be offered in face-to-face and online settings within the context of this study;
· Identified a doctoral student interested in research on online instruction to conduct supporting research outside the context of this study;
· Identified relevant standards to be used in developing instruments and materials for online courses;
· Collected data on the time, effort and expertise required to create the initial versions of the courses that had been offered online prior to the study;
· Proposed experimental conditions and drafted instruments for the study; and,
· Acquired Institutional Review Board (IRB) approval to conduct the study.

Pilot testing of instruments
The instruments developed in the baseline effort were pilot tested in the Fall of 2001 so

that there would be no surprise problems during the critical Spring 2002 data collection period. Discrepancies between the before and after perception questions were found and resolved prior to the Spring effort. In addition, the end-of-course evaluation was shortened somewhat as it was considered too long by many students.

The weekly log forms were also refined based on feedback from students and instructors. Additional clarification of the time unit (minutes) was provided at the beginning as this was not clear to all students. Frequent reminders to students and faculty to complete the weekly logs was identified as required in order to insure that these forms were completely regularly and reliably; during the Spring 2002 data collection effort, regular and more frequent reminders were provided to all involved.

No major changes to the experimental procedures beyond the minor changes to the instruments just indicated were required based on the pilot test effort.

Face-to-face comparison course
IDE 614 (Instructional Design) was identified as the course to be evaluated in both face-to-face and online settings. Enrollment expectations were sufficient to justify the possibility. Course content and structure made it possible to include the same activities, readings and requirements in both face-to-face and online settings. The instructor had experience in teaching this course in both settings using the same syllabus. The face-to-face IDE 614 was offered in the Fall of 2001. Data collected from students and the instructor in that course could then be compared directly with the Spring 2002 online version. Additionally, these data provided additional evidence of time and cost differences for online vis-à-vis face-to-face courses. The research literature (Gervedink Nijhuis & Collis, in press; McKenzie, Bennett, Mims, & Waugh, 2000) and the concomitant interview data suggest that teaching an online course is much more time intensive for teachers. The findings with regard to the online courses described below support this general finding, although it should be noted that the time requirements and demands are not simple to calculate and some researchers find specific efficiencies for online teachers (DiBiase, 2000).

Online courses
Table 2 describes the online courses offered in the Spring of 2002 involved in this study.

Table 2. Online courses involved in the Mellon study at Syracuse University.

Course # - Title	Credits - Level	System
REL 101 - Religions of the World (19 students)	3 semester credits, lower division, elective credit	BlackBoard 5 administered through University College
GEO/LAS 321 - Latin American Geography (19 students)	3 semester credits, upper division, required for majors	BlackBoard 5 administered through University College
IDE 614 - Instructional Design (16 students)	3 semester credits, graduate level, required for majors	WebCT 3.6 administered through the School of Education

These online courses differed in significant ways, including the students involved in the courses. REL 101 is a lower division elective course offered through University College primarily for campus-based Arts & Sciences students. GEO/LAS 321 is an upper division course offered through University College primarily for students enrolled in the

Maxwell School of Citizenship and Public Affairs and in Arts & Sciences who are pursuing an undergraduate major in International Relations or Geography - many of these students were off-campus and planning to pursue or already enrolled in a graduate degree program. IDE 614 is a required core course for students in the Instructional Design, Development & Evaluation program; most of these students reside in the Central New York area although a few were remotely located.

The instructors for these courses differed in experience with regard to online teaching. When the data were collected in the Spring 2002 semester, all courses had been taught by these instructors in an online setting at least twice. The three online instructors actively participated in the development of these courses and had taught the same course more than three times in face-to-face settings. The REL 101 professor had no other online design, development or delivery experience outside the context of this course and had only offered it twice in an online format prior to the data collection period - both times as part of the preliminary pilot effort preceding the data collection period. The GEO/LAS 321 professor had offered this course four times prior to the data collection period and had experience in teaching online courses in both TopClass and BlackBoard. Moreover, this professor was skilled in developing multimedia course materials, including graphics, animations and audio-video clips. The IDE 614 professor had offered this course once in WebCT prior to the data collection period and had experience with several other online course environments, including BlackBoard, Lotus Learning Space, and WebBoard.

The three courses also differed somewhat with regard to design, partly due to instructor experience with these courses and partly due to differing instructor experience with online courses. All three were designed so that the online components did not serve to reduce faculty involvement (i.e. to supplant) but were intended to expand opportunities for collaboration, communication and learning (i.e. to supplement). REL 101 was designed primarily around discussion topics and readings, closely paralleling the face-to-face version of that course. Students were required to write a short discussion paper every week on that week's reading, make an online presentation about a religion not one's own, and react to the topic discussions of other students. This course did not have exams. GEO/LAS 321 also had short weekly papers and a course project paper. IDE 614 required students to write 5 papers, participate in a project and present a project report to the class, and take a final exam modeled after the comprehensive masters exam in IDD&E. Participation in weekly discussions counted for 10% of the grade in all three courses. REL 101 emphasized the weekly discussions and made use of discussion threads for most course-related information; there was an online description of the course and course requirements. GEO/LAS 321 used a variety of ways to convey course information and broke the course syllabus into easily accessible chunks in the course information area. IDE 614 also used a variety of ways to convey course information and made extensive use of a dynamic course syllabus that was referred to on a weekly basis and updated to take into account the pace and specific circumstances of the course. See Appendix E for screen captures from each of the online courses.

Data sources and methods of collection
A variety of data sources and methods of collection were involved in this study, as shown by Table 3.

Table 3. Data instruments, sources and methods of data collection.

Data Instrument	Source and Method of Collection
Background survey	Required of all students - online form

End-of course evaluation	Required of all students - online form
Weekly logs of time usage	Required of students who agreed to participate in the study and of the instructors and technical support staff - online form
Instructor and concomitant interviews	Voluntary for instructors at Syracuse University and other institutions - collected face-to-face, via telephone and online
System data	Collected automatically on all enrolled students by the online course management systems - BlackBoard and WebCT
Infrastructure cost data	Collected by the cost effectiveness analyst from university expenditure records
University registration data	PeopleSoft student registration system at SU

Interpretation and limitations

This study explored time, cost and learning effectiveness data on three courses, one of which was offered both face-to-face and online; the other two were offered only online during the course of this study, although instructors had offered the courses in face-to-face settings at SU. The fact there is only one direct comparison possible between a face-to-face and online course limits the degree to which differences may generalize to other courses, although the findings in this case might be consolidated with findings in other CEUTT studies. Retention data and grades for IDE 614 (offered online and face-to-face) are not significantly different. Moreover, retention data for all of the online courses studied is quite good and comparable with face-to-face course retention rates at SU. Other studies have reported attrition in online courses as a problem area and a factor that complicates cost-effectiveness analysis (Diaz, 2000a; Phipps & Merisotis, 1999; Ridley & Sammour, 1996). Attrition was not a problem factor for any of these courses, although the concept of attrition in both face-to-face and online settings does warrant further study. For example, online and face-to-face students often view the first week or two of class as a shopping around or browsing exercise, so drop-outs in this time frame might be considered differently from those who drop out later in a course.

Many issues and costs that arise in face-to-face classroom settings also occur in online settings. In some cases it is easy to overlook the fact that there is a correlate issue or cost in the setting as it might be taken for granted in that setting. For example, plagiarism can occur in either kind of setting. In some cases, classroom instructors are already used to taking measures to insure against plagiarism. In online teaching, not many instructors know how to do this effectively. As a consequence, it may be tempting to conclude that time and costs involved in checking online student papers for plagiarism is unique to online settings, although this is not the case. Likewise, institutions have established procedures for evaluating face-to-face instructors and do not think of such evaluations as costing much if anything, which of course is not the case. However, not many institutions have procedures for evaluating online instructors, so the time and effort to develop and implement evaluation strategies is obvious. The reality is that there are development and ongoing costs associated with faculty evaluations in both settings, although these are not easily measured. Evaluating online faculty will be discussed in a subsequent section as it is a relatively new enterprise for most institutions.

Issues such as type of learner, location of course/learners, required course versus elective course, online strategies employed, and communications methods are all relevant factors that have not been adequately or exhaustively investigated in this or

any study. Recommendations for further study are discussed in the concluding section of this report.

Limitations and potential problem areas directly relevant to this study include:
· Problems in comparing BlackBoard and WebCT system data - the two systems collect and represent student data differently; the use of these data in this study was basically to develop confidence in the data reported in the weekly logs.
· Problems in comparing students and instructors in BlackBoard and WebCT environments - the two systems have basically the same capabilities but differences in their interfaces may have effected student and instructor attitudes and levels of satisfaction.
· Problems in using responses to semi-structured interview questions to confirm or disconfirm weekly log data - these data come from different sources and are in substantially different forms; this limits the degree of confidence that can be placed in a confirmation of findings.
· The total numbers of students involved in each course was relatively small, ranging from 16 to 19 (Table 4). All students were required to complete the background survey and end-of-course evaluation but some students did not respond to relevant items in the background survey or end-of-course evaluation. Mellon participation was smaller still. This small sample size limits the ability to generalize to larger student populations.
· The number of faculty directly involved is small - these three instructors may not be representative of other faculty; while an attempt was made to recruit faculty from different disciplines with different levels of experience, there is still a limit to the ability to generalize to other faculty, especially to faculty with no online teaching experience.

While these limitations are significant, they do not detract from the findings specific to these settings. Moreover, our analysis provides a reasonable foundation for further studies and is generally corroborated by the research literature and by the concomitant interviews with online instructors at other institutions.

Analysis of findings

Descriptive summaries

Enrollments
Enrollments for the courses involved in this study are typical for these courses at SU (see Table 4). It is noteworthy that attrition was low for these courses and that the participation rate was relatively high - much higher in the graduate course than in the undergraduate courses. There was a half-grade bonus incentive offered for a defined level of participation in each of the courses. Participation consisted of completing at least 10 (of 14) weekly logs indicating time and effort involved that week. All students were required to complete the background survey and end-of course evaluation. Students opting not to participate in the study were offered an opportunity to earn a half-grade bonus by other means that varied with the particular course, although no one elected to do so. Table 4 indicates the number of students enrolled, the number who dropped, the number enrolled at the end of the semester, and the number who actively participated in this research effort.

Table 4. Enrollments, attrition and Mellon participation.

Course Semester - Mode	Enrolled Initially	Student Drops	Enrolled Students	Mellon Participants
IDE 614 - Fall 2001 (face-to-face)	20	4	16	15

IDE 614 - Spring 2002 (online)	18	2	16	13
GEO/LAS 321 - Spring 2002 (online)	20	1	19	7
REL 101 - Spring 2002 (online)	21	2	19	6

"Mellon participation" is based on completion of 10 or more weekly logs and does not include all of those who remained in the course, as is evident in Table 8. The figures in Table 8 reflect enrollments and drops after the first week of class - that is, there is a correction factor taken into account for students who are shopping around for the best schedule the first week of class or who add during that first week. A more accurate indicator of effective enrollments and drops could be based on those enrolled at the add-drop deadline and then those who dropped after the add-drop deadline, in which case the attrition rate would be even lower for these courses. A total of 79 students enrolled and 9 dropped, leaving a subject pool of 70; 41 students actively participated in the study.

The course with the highest apparent attrition (IDE 614 Fall 2001) had an effective drop rate that was much lower. An online version of IDE 614 was also offered in the Fall of 2001 as all three courses underwent a pilot test of the online versions that semester. One of the four drops moved from the face-to-face course to the online course. Another of those who dropped IDE 614 in Fall 2001 decided to take the online course offered in Spring 2002. Yet another of those who dropped IDE 614 in Fall 2001 was called up to active military duty and had to drop all university courses. In summary, the effective number of drops from IDE 614 was only one.

Most online courses at SU are offered through University College (Syracuse University Continuing Education, SUCE); the School of Education and the School of Information Studies offer online courses independently of University College. The attrition rate for all courses offered through University College, which includes GEO/LAS 321 and REL 101 along with 33 other courses, was about 23%. GEO/LAS 321 and REL 101 had a combined attrition rate of about 8%, based on the data reported above. Attrition rates by semester for SUCE course offerings since 1999 vary from a low of 12% to a high of 33% (these rates are based on first versus last day registrations and do not take into account the fact that many students browse for the right classes the first week of the semester). The combined attrition rate for all of the courses involved in this study was about 11% with the highest rate being 20% for the face-to-face version of IDE 614.

As reported earlier, the attrition rates for the online courses involved in this study were lower than others that have been reported in the literature (Diaz, 2000a; Phipps & Merisotis, 1999; Ridley & Sammour, 1996). A reasonable conclusion is that the drop rates did not significantly impact outcomes of the study by creating a pool of self-selected subjects. Students typically reported selecting the online option for convenience and their expectations of convenience in the form of time flexibility were generally satisfied, as will be made evident in a subsequent section.

Grades

Students participating in this Mellon study were offered a half-grade bonus for completing at least 10 weekly logs. The grades reflected below include this bonus.

IDE 614 (Fall 2001 – face-to-face)

- 16 students completed the course

- 12 A, 3 A-, 1 Incomplete

IDE 614 (Spring 2002 – online)
- 16 students completed the course
- 6 A, 5 A-, 2 B+, 3 Incomplete

GEO/LAS 321 (Spring 2002 – online)
- 19 students completed the course
- 4 A, 6 A-, 4 B+, 2 B, 1 B-, 1 C, 1 Pass

REL 101 (Spring 2002 – online)
- 19 completed the course
- 9 A, 1 A-, 1 B+, 1 B, 1 C+, 1 D, 4 F, 1 Incomplete

All three instructors reported that these grades, not including the half-grade bonus, are very similar to grades normally awarded previously in both face-to-face and online versions of these courses. These claims are supported by a review of recent grade reports from these instructors.

There are two things worth reporting about the grades. First, the half-grade bonus for participation was shown to be an effective incentive for student participation during the pilot testing phase of this effort. Those students participating in the study and earning an A without the bonus were provided a $20 gift certificate at the University bookstore as their bonus. This was true during the pilot study in the Fall of 2001 as well as during the actual study in the Spring of 2002. This incentive was apparently less attractive to undergraduate students than to graduate students, however, and the participation rates in the two undergraduate courses were lower.

The second interesting thing to note about the grades is that REL 101 had the widest variation of grades. This is an elective course and student motivation may account for this result. However, a review of the time data from the Web course management system reveals a correlation between online activity and grades. There is one student who earned an A in REL 101 with minimal online activity. Apart from this student, all of the students who earned a grade lower than a B in REL 101 were among the least active in the online course environment (see Table 5). This is not a surprising outcome. Time on task has long been accepted as a reliable indicator of performance (Fisher & Berliner, 1985). However, it is also generally accepted that effective online learning requires self-discipline (Kearsley, 2002). The correlation between low online activity and low grades suggests that those students who do not work well independently and lack self-discipline will not generally do well in online courses. These same students might get by with somewhat higher grades by passive participation in a face-to-face setting that only requires enough discipline to show up for class. However, we have no direct data to support these suppositions.

The activity reported in Table 5 is derived from BlackBoard's student tracking system; counts of the number of visits - 'hits' - to different types of pages by individual students constitute BlackBoard's activity indicators. Communication Activity reflects the number of discussions, chats and e-mails for a student. Content Activity reflects the number of times a student visited content pages. Group and Peer Activity reflect small group work and student-student interactions, neither of which were required in REL 101. It is interesting to note that many of the better students engaged in student-student interaction anyway. Although "hits" in this case do not necessarily reflect student time allocation very well, the data do suggest relative time-on-task for each student.

The students' names were replaced with grades earned (after the half-grade boost

earned by the six Mellon participants). None of those earning less than a B in REL 101 chose to participate in the Mellon study nor did any of those earning less than a B opt for the alternative half-grade bonus. This fact suggests that those choosing to participate in this study were better than average students, although the data from the other courses cannot be used to confirm this finding. Grades and online activity for the other two courses are not reported since the grades were nearly all clustered in the B to A range.

Table 5. Grades and online activity in REL 101.

Grade	Communication Activity	Content Activity	Group Activity	Peer Activity	Total Activity
F	0	4	0	0	4
F	36	40	0	5	81
A	276	168	0	2	446
D	324	160	0	0	484
F	362	175	0	1	538
F	415	199	1	0	615
C+	398	228	0	7	633
A	513	197	1	1	712
I	431	330	0	3	764
A	582	231	1	19	833
B	519	345	0	21	885
A	617	297	0	0	914
A	759	219	0	9	987
A	732	344	4	21	1101
B+	1137	235	2	44	1418
A	1407	129	7	43	1586
A	1307	342	1	0	1650
A-	1360	311	0	0	1671
A	1887	966	1	10	2864

Student outcomes

Grades and faculty perceptions of student performance were the primary indicators of student learning outcomes in this effort. As already indicated, grades awarded in these classes were comparable with those awarded by these same instructors for other online and face-to-face offerings of these same courses. In short, there are no significant differences in grades to report. This is in fact a positive finding as student performance using the standard measure of grades appears not to be effected by whether or not one of these courses is offered in a classroom or online setting.

This interpretation is reinforced in faculty interviews. The three online instructors involved in this study all reported the view that online discussions were of a higher quality than classroom discussions. They also reported that there were no noticeable differences in papers or projects developed by online students in comparison with face-to-face students. Our conclusion based on these data sources is that student learning in these courses was not directly effected by modality of course (face-to-face versus online).

Student time

A well-established predictor of learning outcomes has been time-on-task (Bloom, 1971; Carroll, 1963, Fisher & Berliner, 1985). Table 6 reflects student time in the courses involved in this study. For the three online courses offered in the Spring of 2002, the time reflected in Table 6 is broken down into student time reportedly spent while online in the course environment and time spent offline. Since the Fall 2001 course was primarily face-to-face and intended to serve as a baseline point of reference, total student time is reflected. The weekly logs used to collect these data had more specific categories than the logs employed during the Spring 2002 semester. One obvious pattern of behavior evident from the summary of student time in Table 6 is that the graduate students in IDE 614 on average devoted more time than the undergraduate students in GEO/LAS 321 and REL 101. Moreover, the upper division undergraduate students in GEO/LAS 321 put in more time on average than the lower division students in REL 101.

Time, Efficacy and Cost Considerations of e-Collaboration in Online University Courses (part II)

Philip L. Doughty, J. Michael Spector and Barbara A. Yonai

Table 6. Student time reported on weekly logs (minutes weekly; totalsin hours).

(NOTE. Some figures in this table are highlighted in either red or blue - in thecase of reading a black/white printout of this paper, the highlighted data will appear shaded. Please note that the LIGHTER shading is RED and the DARKER shadingis BLUE)

Week	IDE 614 Fall 01 Total	IDE 614 Spring 02 Online	IDE 614 Spring 02 Offline	GEO 321 Spring 02 Online	GEO 321 Spring 02 Offline	REL 101 Spring 02 Online	REL 101 Spring 02 Offline
1	292.0	270.5	275.4	99.8	164.4	133.4	81.3
2	315.7	365.8	282.7	204.3	231.9	107.9	134.0
3	435.0	211.3	274.7	115.9	225.9	100.0	87.5
4	633.8	278.1	321.8	142.6	180.6	127.7	130.0
5	687.8	235.4	249.7	180.6	188.8	79.3	91.0
6	482.5	260.0	217.6	232.1	201.9	82.7	144.2
7	488.2	219.3	375.5	143.7	134.4	100.8	57.5
8	482.9	260.7	280.3	146.1	260.9	125.2	91.3
9	418.2	141.5	371.7	166.4	227.1	65.8	102.5
10	369.3	146.2	320.4	201.2	215.6	77.0	141.0
11	452.3	152.5	360.9	156.4	78.2	124.0	
12	420.4	140.9	316.4	202.4	146.0	159.5	260.0
13	No data	196.6	312.9	101.2	160.8	72.0	76.7
14	No data	265.3	300.7	147.7	262.9	64.3	98.3
15	No data	364.1	498.8	250.8	391.7	275.0	113.3
AVG	456.5	233.9	317.3	165.0	209.9	109.9	115.5
Hours	91.3	58.5	79.3	41.3	52.5	27.5	28.9
Total hrs	**91.3**		**137.8**		**93.7**		**56.4**

Week number one (depicted in red shading in Table 6) involved only e-mail communication in the online courses. The areas shaded in blue for the remaining weeks indicate weeks that chat was the primary means of communicating and collaborating. What these data reflect is that e-mail was not generally more time consuming for students, based on the assumption that week one activity in these courses is not nominal. In REL 101, the week when there were two chat sessions (week 13) appears to have placed less time burden on students than other weeks. This same phenomenon did not appear in GEO/LAS 321 or in IDE 614, where there were no significant differences in time reports in relationship to modality of communication.

Figure 1 shows how students in the Fall 2001 face-to-face IDE 614 devoted time by week in comparison with students in the online Spring 2002 IDE 614. Data for the last two weeks of the Fall face-to-face course were not collected. This was the only direct comparison between an online and face-to-face course made as part of this study. The student time data suggest that students in the online course on average spent more time than those in the face-to-face course. Not reflected in the face-to-face data, however, is the time students spent online at the course Website. Additionally, all online students were asked about general time demands of their online course courses compared with traditional classroom experiences (see Appendix B). Their answers to this end-of-course evaluation question indicate no significant difference. Although these IDE 614 comparison data seem to reflect that online students spent more time than their face-to-face counterparts, it is likely that not much difference actually exists. What is evident is that the two courses exhibited similar peaks and valleys in student time, which reflects the fact that the basic design of the course remained the same in both settings.

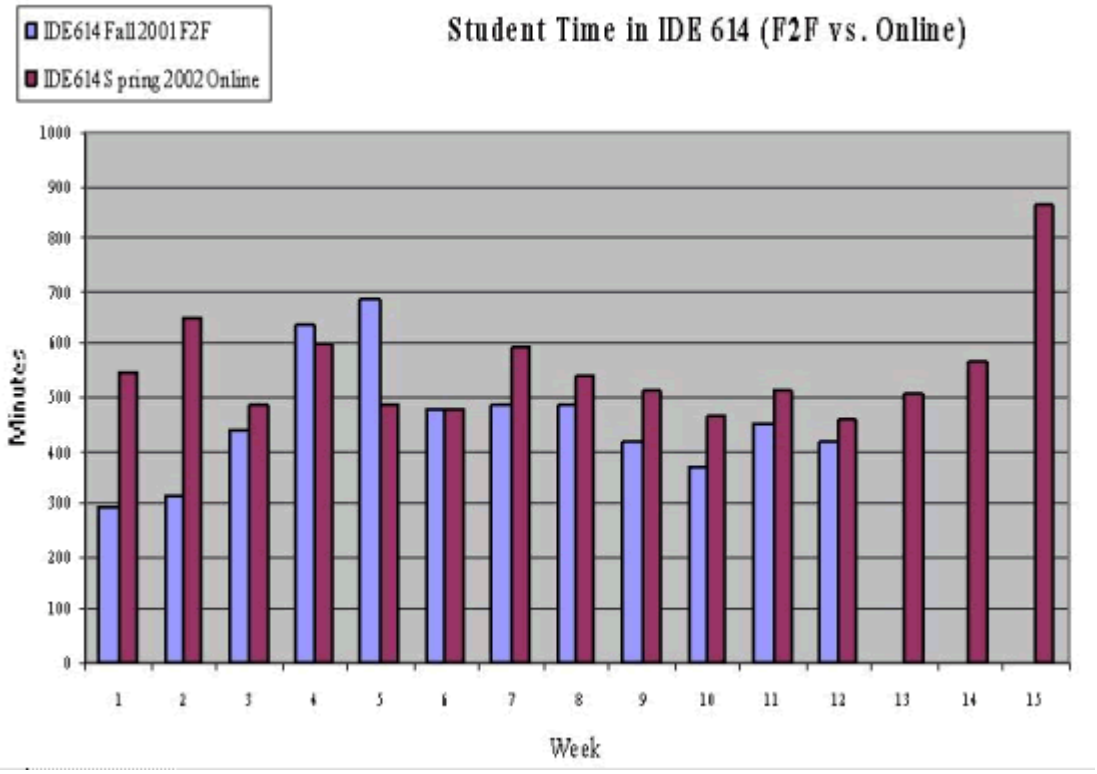

Figure 1. Student time in IDE 614 (no F2F data included for weeks 13-15).

Data collected by the two Web-course management systems (BlackBoard and WebCT) was also examined for the three online courses offered in the Spring of 2002. These data reveal that the average posting length for e-mail and discussion board messages

was as follows: REL 101 - 348 words; GEO/LAS 321 - 62 words; IDE 614 - 348 words. The average length of posting directly reflects the design of the course in these cases. REL 101 was designed primarily (almost exclusively) around threaded discussion boards. GEO/LAS 321 was designed around many external readings and Websites. IDE 614 contained a balance of communication and other activities.

Before reviewing the remaining student data, it is worth noting that differences might be accounted for partly in terms of course design. In short, it is not simply whether or not the course was online or offered with a certain instructor or involved subject matter of a particular kind that particular effects may have occurred. Indeed, the cause and explanation for specific differences in student outcomes, especially involving media and technology, have a long history in the research literature (Clark, 1994; Kozma, 1994a, 1994b). Specific causes and explanations for differences in student outcomes cannot be attributed to specific instructors, subject matter, instructional setting or delivery modality based on this study. This is an area that requires significant follow-on investigation.

Another interesting time comparison involves the three online courses (see Figure 2). As already indicated, students in IDE 614 spent more time overall on that course than did students in either GEO/LAS 321 or REL 101. Students in the lower division REL 101 spent less time on their course than did students in either GEO/LAS 321 or IDE 614. This could reflect basic and expected differences between graduate courses, upper division undergraduate courses, and lower division undergraduate courses. An alternative explanation is that the particular instructors involved or the design of these particular courses effected time demands placed on students. Regardless of explanation, an assumption is that the time reported by students reflects the time required for those students to complete course activities to their satisfaction. Furthermore, it is assumed that time reported reflects actual time. The former assumption warrants further study and could be addressed through student interviews. The latter assumption was addressed in this study by examining data other than self-reports on weekly logs. With regard to the reliability of student time data, data collected by the Web-based course management system was examined to see if what students reported with regard to time online was supported by system reports of the number of course pages visited. While these data are incommensurate (one being time and one being counts), there was a general correspondence between those students who reported more than average time online and those students who visited more pages than average. While there are always problems with the accuracy of self-reports, our conclusion was that these data were reasonably indicative of time devoted to the course. Moreover, the time reported for specific online activities on the weekly logs corresponded reasonably well with which part of REL 101 and GEO/LAS 321 (the two BlackBoard courses) students were visiting (see Figures 2 and 3).

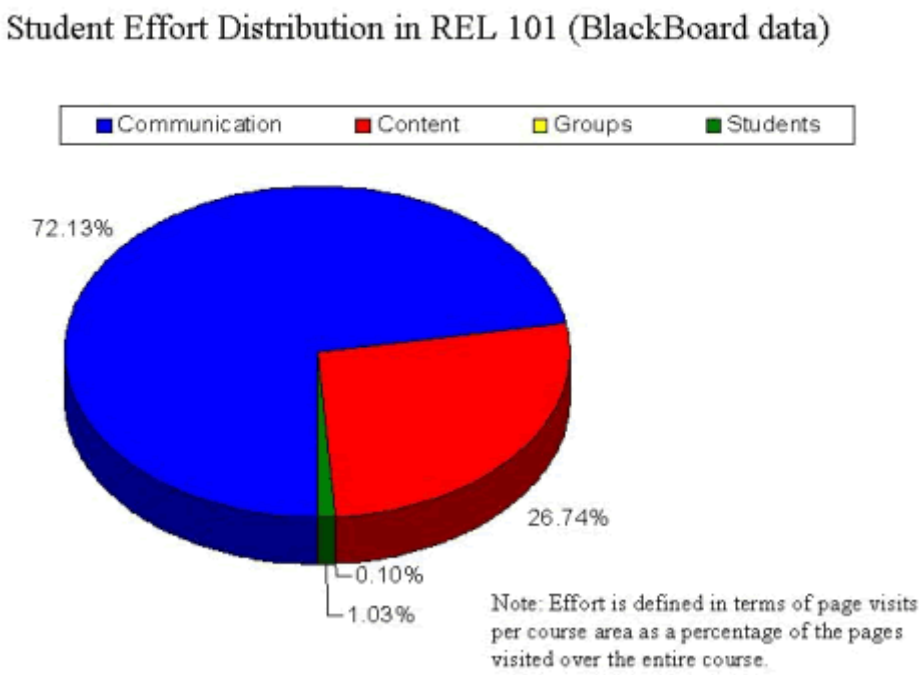

Figure 2. Student effort distribution in REL 101 (BlackBoard tracking system).

The distribution of student effort derived from the BlackBoard tracking system for REL 101 reveals that most of the time was spent in the communication area of the course (discussion boards and chat sessions). This reflects the design of this course as consisting primarily of weekly discussions of topics and presentations in the discussion area of student papers.

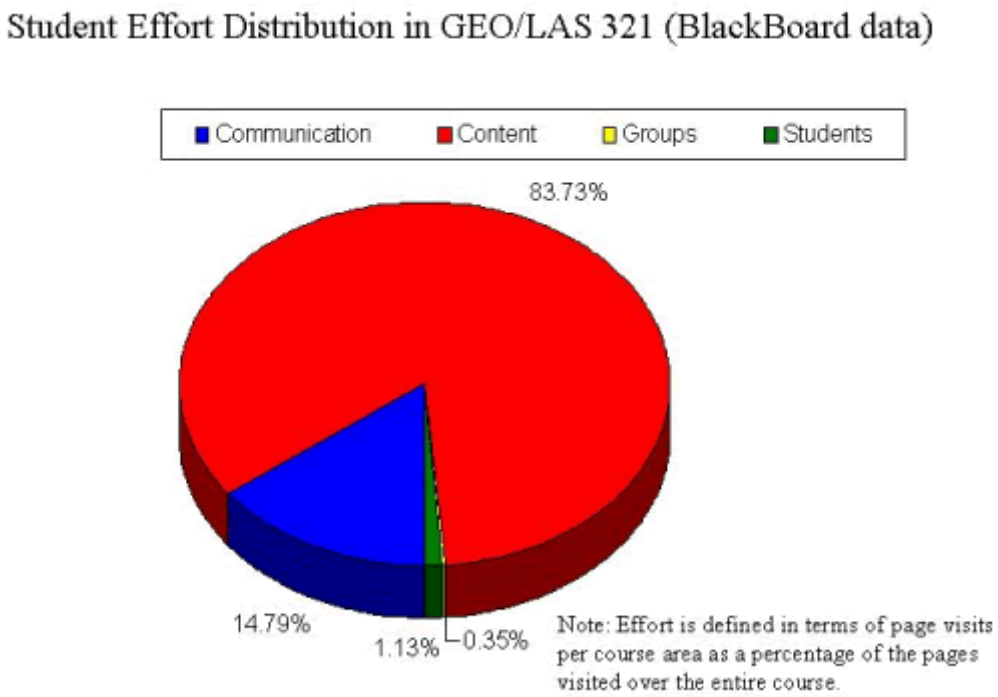

Figure 3. Student effort distribution in GEO/LAS 321 (BlackBoard tracking system).

The student effort distribution for GEO/LAS 321 stands in sharp contrast with REL 101 (Figure 3). In GEO/LAS 321, the course design required students to spend

considerable time and effort reading course content directly posted to the site or linked to through the course site. As a consequence, student effort was concentrated on the course content area of GEO/LAS 321.

As already indicated, the overall student time devoted to each course increased with the level of the course (Figure 4). Whether or not this finding will generalize to other courses is not known. What is noteworthy in the overall time pattern is that there were peaks and valleys - weeks when students were generally more active or less active. Once again this is a common phenomenon with which instructors are familiar from their face-to-face teaching experience. A general conclusion that emerges from this study is that there are significant parallels in online and classroom courses in terms of student activity as well as in other areas. In the courses examined here, the outcomes are not significantly different. This leads us to focus on supplemental activities by students and especially by instructors as key to the cost effectiveness analysis below.

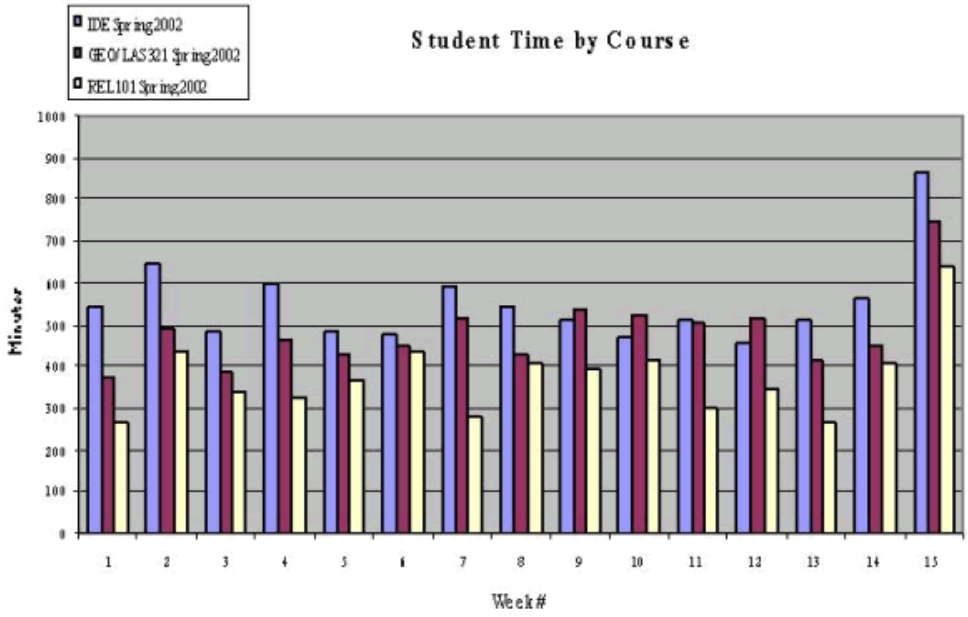

Figure 4. Student time by week per course (online Spring 2002 courses).

When the separate time data reported on weekly logs for each course are examined week by week (Figure 5), other interesting patterns emerge. As already noted, the expected correlation with mode was not evident in student time data, although there was evidence of such a correlation in instructor time data (see below). In REL 101, online and offline waxed or waned together. The opposite pattern is evident in IDE 614. In that course, the more time spent offline, the less time spent online and vice versa, as a general rule. Neither pattern was evident in GEO/LAS 321. What accounts for these differences is not evident in the data collected and certainly warrants further investigation.

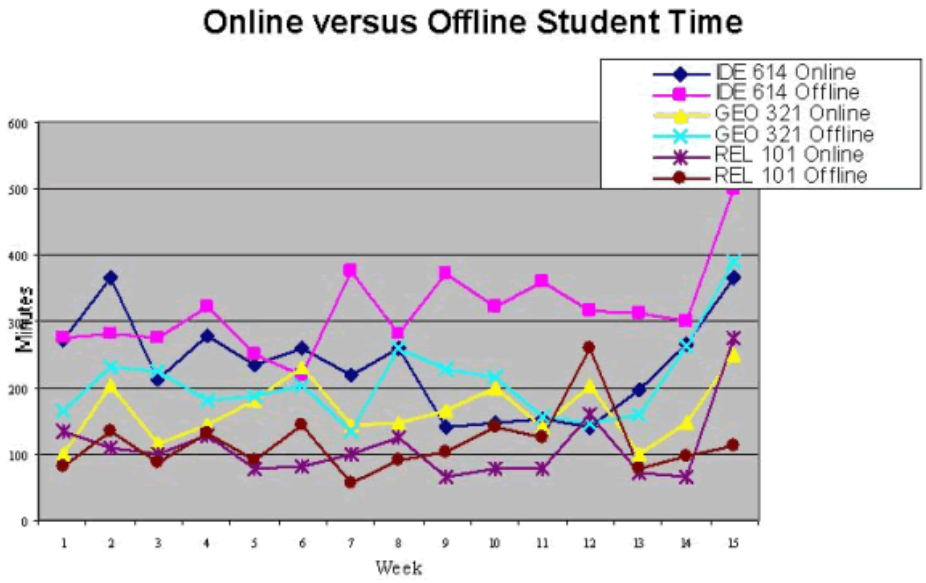

Figure 5. Student online versus offline time by week per course.

Student perceptions

As mentioned earlier, the background survey and end-of-course surveys requested information on student perceptions of the course compared with other classroom-based courses. The perception questions were in these categories: Difficulty, Time Involved, Enjoyment, Convenience, Interest, Pace, Workflow, Workload, Motivation, Problem Resolution and Participation. The survey forms used in the Fall 2001 were refined to match before and after perceptions more closely and to ask about Motivation, Problem Resolution and Participation Time. A different bar graph is used for the Fall 2001 course to make evident these differences. The responses from the Fall 2001 IDE 614 course and the three online courses studied in Spring 2002 are depicted in Figures 6 - 9.

The student perception data for IDE 614 Fall 2001 (face-to-face) indicate that students thought this face-to-face course would be more convenient in comparison with other courses than it actually was. They also thought it would require more time than it did, and this probably influenced perceptions about the pace of this face-to-face course. Before and after differences in the three online courses tended to be less dramatic, with the expectation of communication modes and participation levels in REL 101 - students reported fewer opportunities and less participation at the end of the course.

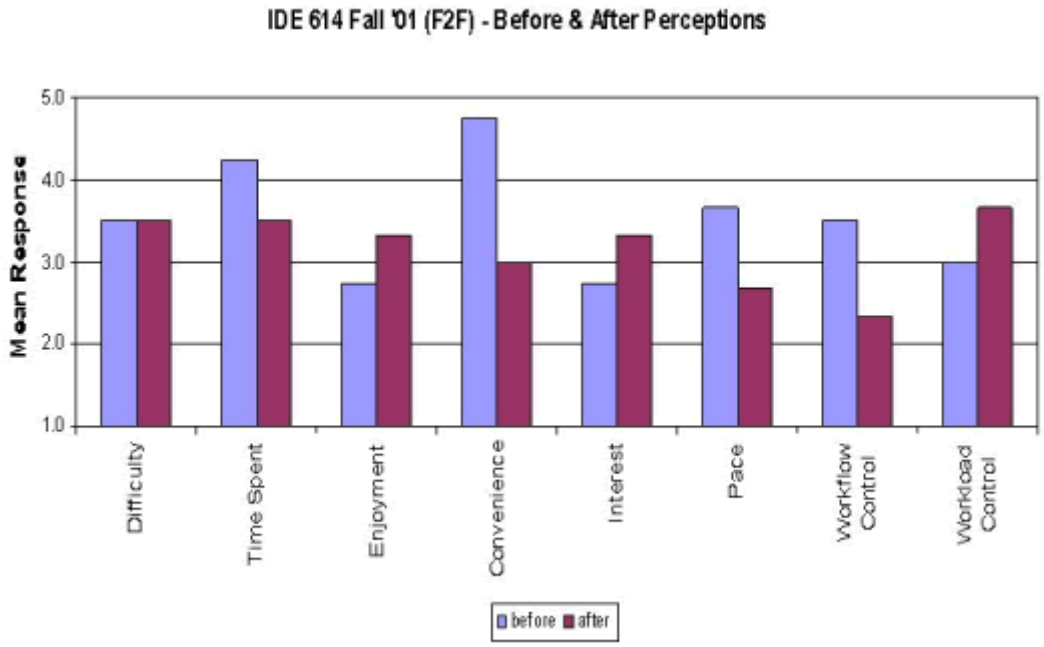

Figure 6. Before and after student perceptions in IDE 614 Fall 2001 (F2F).

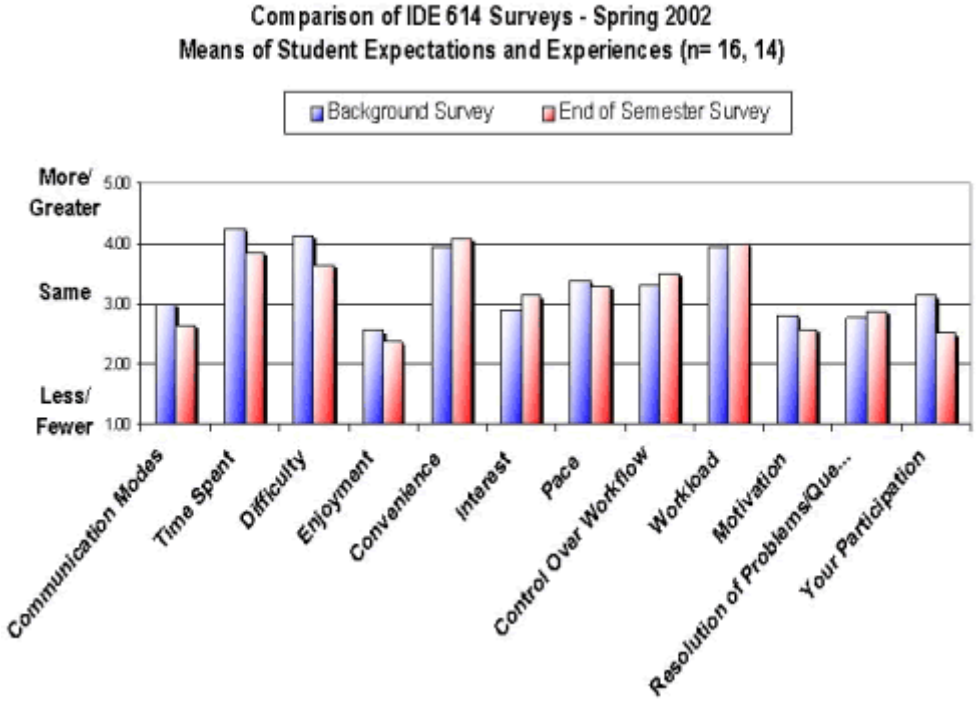

Figure 7. Before and after student perceptions in IDE 614 Spring 2002.

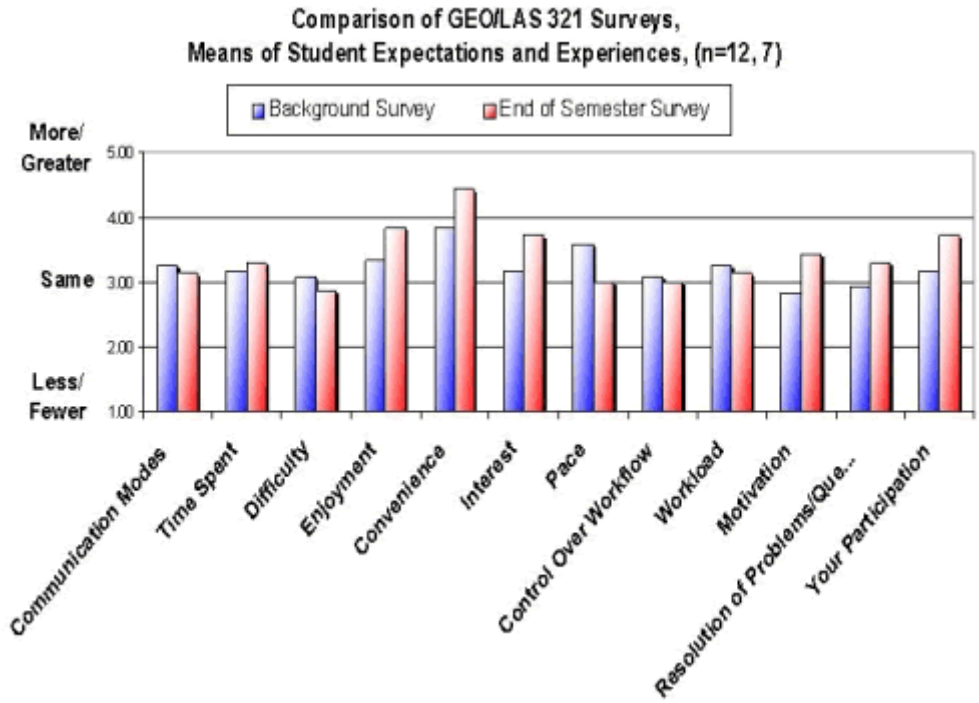

Figure 8. Before and after student perceptions in GEO/LAS 321 Spring 2002.

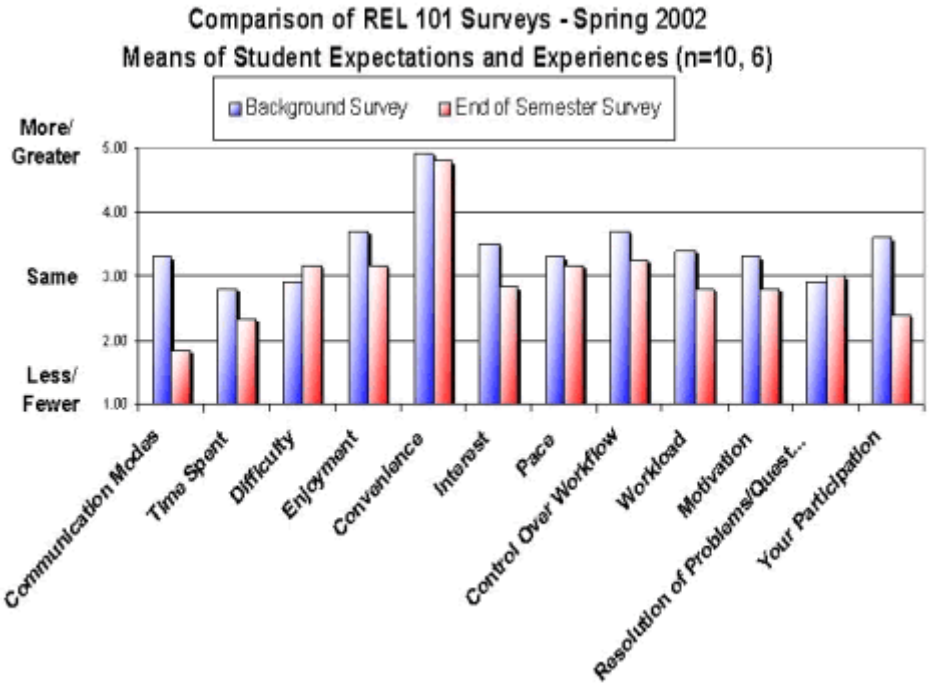

Figure 9. Before and after student perceptions in REL 101 Spring 2002.

In summarizing the before and after perceptions with regard to the face-to-face and online IDE 614 courses, the difficulty, time required, enjoyment, interest, pace, workflow and workload data are about the same. Students in the face-to-face course expected it to be more convenient than it was (this was an evening course offered from 4:00 - 6:45 pm on Mondays).

With regard to the online courses, communication opportunities in the online courses in comparison with those in traditional courses were reported as being fewer at the end of

the course in all three cases, although the difference was more pronounced in REL 101. Participation levels were reported as being lower at the end of the course in REL 101 and IDE 614 and somewhat higher in GEO/LAS 321. Students in GEO/LAS 321 also reported more time required for this course in comparison with face-to-face courses at the end of the course than at the beginning; IDE 614 and REL 101 students reported slightly less time required.

Other perception categories from the background survey and end-of-course evaluation do not reflect notable differences, which suggests that student perceptions remained relatively stable over the course of this study. This relative stability lends credence to those cases cited above in which there were before and after differences. It should also be noted that students did not anticipate significantly more or less time required for an online course at the beginning of their online course and reported similar perceptions at the end. These perceptions of time requirements are consistent with the weekly log and system data.

Instructor outcomes

It is clear from the weekly logs and interviews with the online instructors (discussed below in more detail) that instructors perceived a supplemental time burden associated with online teaching and actually spent more time with their online courses than they reported spending with their face-to-face courses. It should be noted that when the data for the three online courses involved in this study were collected in the Spring of 2002, the online courses had already been developed and offered at least twice in every case. In short, the time and effort reported below do not reflect the substantial development effort required to initiate an online course, which would include extra time and effort to properly train faculty on the use of the system as well as the time and effort of supplemental technical personnel assisting with the development of digital course materials. The cost-effectiveness analysis in this report will not, therefore, focus on the entire life cycle costs involved with the design, development, delivery, evaluation and management of online courses. Rather, the focus will be on the middle phases of redesigning online course materials and leading and managing the online class environment.

It is noteworthy that GEO/LAS 321, one of the three online courses, was converted from one course management system (TopClass) to another (BlackBoard) at the beginning of this study as part of a standardization effort at Syracuse University Continuing Education (SUCE). This conversion effort required only 4 hours of time on the part of the technical coordinator for distance education at SUCE. This short conversion time was a result of having digital course materials easily available outside the course management system and having designed course materials that were easily reusable, consistent with the ambitions of learning objects (Wiley, 2001a, 2001b). Moreover, both the BlackBoard and WebCT systems were upgraded during this study. These upgrades were uneventful and none of the involved course materials for any of these online courses were lost or corrupted.

(1) This paper reports the findings of a research project performed at Syracuse University (SU) and funded by the Andrew W. Mellon Foundation as part of its Cost Effective Use of Technology in Teaching (CEUTT) Initiative. The full Final Report, presented to the Andrew W. Mellon Foundation, is entitled: Cost and Learning Effects of Alternative e-Collaboration Methods in Online Settings. The present paper provides an overview of the research project undertaken at Syracuse University (SU), Syracuse, NY, 13244, USA.

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Abstract
Three online courses and one face-to-face course were investigated to gain an understanding of the effects of different forms of communication and collaboration on learning and instruction. Emphasis was placed on the time demands on students and instructors in online course environments involving the use of e-mail, threaded discussion forums, and online chat sessions. Findings suggest that learning outcomes and retention in Syracuse University (SU) online courses are comparable to outcomes and retention in face-to-face courses at SU. However, students report spending somewhat more time with online courses and faculty report spending considerably more time with online courses. Cost effectiveness analysis suggests that important issues in the initial design of e-Learning systems include consideration of whether decisions are related to technology supplementing or supplanting the previously employed instructional resources. So also are concerns for equity in relation to access, student time and especially faculty time. Integrating these factors into judgments about the cost-efficiency and cost-effectiveness of online courses is addressed in this study.

Resumo
Três cursos online e um presencial foram pesquisados para melhor compreender os efeitos de diferentes formas de comunicação e colaboração sobre o processo de aprendizagem e ensino. Uma ênfase especial foi dada ao estudo do tempo gasto pelos estudantes e instrutores em ambientes online, envolvendo o uso de e-mail, fóruns de discussão e sessões de chat. As pesquisas sugerem que os resultados de aprendizagem e a retenção em cursos online ministrados na SU são comparáveis com os resultados obtidos em versões presenciais dos mesmos cursos. Porém, os estudantes reportam haver gasto um pouco mais tempo estudando nas versões online e os professores reportam ter gasto muito mais tempo. Uma análise de custo-eficácia sugere que uma consideração importante no design inicial de um sistema de e-Learning é se a nova tecnologia vai suplementar ou substituir os recursos instrucionais previamente utilizados. Outras considerações importantes incluem questões de igualdade de acesso à tecnologia, de tempo exigido dos estudantes e, especialmente, do pessoal docente. O estudo investiga abordagens para a integração desses fatores no processo de julgamento de custo-eficiência e custo-eficácia de cursos online.

Resumen
Tres cursos online y un presencial han sido investigados para una comprensión más amplia de los efectos de diferentes formas de comunicación y de colaboración sobre el proceso de aprendizaje-enseñanza. Un énfasis especial ha sido dado al estudio de tiempo usado por los estudiantes y instructores en ambientes online, involucrando el uso de e-mail, foros de discusión y sesiones de chat. Las investigaciones sugieren que los resultados de aprendizaje y la retención en cursos online enseñados en la SU son comparables a los resultados obtenidos en versiones presenciales de los mismos cursos. Sin embargo, los estudiantes revelan que han usado un poco más de tiempo estudiando en las versiones online y los profesores revelan que han usado mucho más tiempo. Un análisis de costo-eficacia sugiere que una consideración importante en el design inicial de un sistema de e-Learning es si la nueva tecnología va a complementar o sustituir los recursos instruccionales previamente utilizados. Otras consideraciones importantes incluyen cuestiones de igualdad de acceso a la

tecnología, de tiempo exigido de los estudiantes y, especialmente, del equipo docente. El estudio investiga diversas abordajes para la integración de esos factores en el proceso de evaluación de costo-eficiencia y de costo-eficacia de cursos online.

Time, Efficacy and Cost Considerations of e-Collaboration in Online University Courses (1)

Background and rationale

Motivation for the study

Online learning is relatively new but rapidly growing within and outside university settings (Rosenberg, 2001). Many important questions remain unanswered or unexplored, including which instructional approaches and methods are optimal in terms of cost and learning effectiveness in various settings and situations. Syracuse University, like many other institutions, has supported a number of online learning initiatives that involve many differences, especially with regard to:

1. audiences (on-campus undergraduate and graduate students, off-campus adult learners, students and teachers in remote schools, etc.);
2. access situations (home access via modem, high-speed access on campus and in the workplace, no Web access, time constraints, etc.);
3. implementation approaches (Web-supported campus courses, online courses for remote learners, blended environments, use of facilitators and assistants for group work, etc.);
4. communication methods (asynchronous threaded discussions, synchronous forums, video-conferencing, blended environments, etc.);
5. learning perspectives (structured learning activities, discovery learning, problem-based learning, etc.);
6. learning goals (conceptual knowledge, understanding complex relationships, procedural training, etc.); and
7. tools and technologies (web course management systems, courseware authoring tools, interactive simulations, etc.).

It is unlikely that any single instructional approach, method, tool or perspective will be appropriate for all audiences, situations and desired outcomes (Spector & Anderson, 2000). Taxonomies around these kinds of differences can be constructed to guide instructional decision making. However, important information to guide taxonomy users is missing or inconclusive, including how effective a particular technology is in achieving a desired goal with a particular community of learners (Spector & Anderson, 2000).

The overall goal of this research study at Syracuse University was to address some of the missing pieces of knowledge concerning the cost, relative efficiency and learning effects of online teaching - one form of technology-enhanced teaching. Specifically, this study targeted the fourth item in the list above (communication methods), focusing on different forms of e-collaboration and their effects on learning outcomes, direct costs and teacher and student time. We use 'e-collaboration' to define alternative methods and different communications technologies that students can use to work with each other and with teachers and tutors to achieve specific learning outcomes. Common e-collaboration techniques include:

1. collaboration with a tutor/teacher via asynchronous means such as e-mail; we consider this minimal collaboration;
2. asynchronous, threaded discussions with topics posted; we consider this a form of

modest collaboration, especially when combined with e-mail;
3. synchronous forum groups with semi-structured small group assignments and goals; we consider this more elaborate collaboration, especially when also used with e-mail and discussion forums; and,
4. asynchronous and synchronous audio- and video-based methods (tele-conferencing, video-conferencing, and Web-casting); we consider this elaborate collaboration but did not explore its cost and learning effects in this study.

This study involved the first three of these e-collaboration techniques. We did not explore the fourth technique in this study although the effects of such audio- and video-based collaboration methods on costs and learning deserve exploration (Richey, 2000; Saba, 2000). This study provides a framework for expanded studies of e-collaboration that could include replication efforts as well as audio- and video-based technologies.

One particular method of collaboration is not known to promote or inhibit learning outcomes. All students had opportunities for some kind of collaboration, and were offered a choice to participate or not participate. Records specific to this research study (e.g., the weekly logs) were kept anonymously. Based on this, we easily obtained Institutional Review Board (IRB) approval to conduct this study.

We view the first technique (e-mail or minimal collaboration) as a comparative reference point for the other more sophisticated forms of e-collaboration. We do not advocate creating online courses that only use e-mail communications to support collaboration and none of our courses were designed this way. We also used a face-to-face course for purposes of comparison.

The major elements involved in this study were the:

· Audiences: adult learners taking university courses; the audience included undergraduates and graduates some of whom were on campus and some were off campus.
· Access situations: high or low speed Web access with access occurring at home, at the university or in the workplace.
· Implementation approaches: the online courses involved were completely online and involved two different Web course management systems (BlackBoard and WebCT).
· Communication methods: the online courses involved e-mail, threaded discussions and chat sessions but did not involve audio- or video-based methods.
· Learning perspectives and goals: in all cases, learning perspectives mirrored those that were used in the courses when they were taught face-to-face, although some researchers argue that different perspectives are required for online teaching (Goodyear, 2000; Jonassen, Hernandez-Serrano, & Choi, 2000).
· Tools and technologies: Web course management systems (BlackBoard and WebCT).

Focus of the study
The focus of this study was the effects of different forms of communication and collaboration on learning and instruction, including time and supplemental resources, in online courses. The three courses involved in the study were:

1. Religions of the World (REL 101) - lower division, undergraduate students residing on campus.
2. Latin American Geography (GEO/LAS 321) - upper division, undergraduate students some of whom were remotely located.
3. Instructional Design (IDE 614) - graduate students, most were resident in the local area but some were not.

A face-to-face version of IDE 614 was used to create a meaningful baseline and reference for comparison. All three courses included e-mail, discussion threads and chat sessions. None included audio- or video-based collaboration methods, although GEO/LAS 321 and IDE 614 both included some audio-video files as supporting Web-based resources. Data collected included grades, student-created artifacts, student time, student perceptions, attrition, faculty-created artifacts, faculty time, faculty perceptions, staff support, and supplemental infrastructure costs. Detailed information pertaining to student and faculty time was collected on a weekly basis.

Assumptions

We are assuming that our findings will form the basis for tentative generalizations to other online settings and situations. The relatively small number of courses and students will not provide strong evidence for generalizations with regard to other settings and methods. Nonetheless, the two Web-based course management systems involved, BlackBoard and WebCT, are the two most widely used systems for online courses in higher education (see the Report of AC4, a University of California-Davis subcommittee on course management systems published in March 2001, for example - available online at http://ac4.ucdavis.edu/subcomm/cms_report.html). Moreover, the three courses involve different kinds of students (lower division, upper division, and graduate students with some resident on campus, some living in the local area and some remotely located), different subject matter (religion, geography, instructional design), instructors with different levels of online experience (one with high level of online teaching experience, one with a moderate level of experience, and one who had only taught an online course twice prior to the data collected and reported here). These instructors in general had more online experience at the time data were collected (Spring 2002) than the typical instructor at Syracuse University. All three were full professors with significant teaching experience.

Faculty, staff and equipment costs are assumed to be generally representative of those in other institutions of higher education. Staff support time required to maintain the online environments is assumed to be generally representative. Time, effort and expertise required to develop the initial online versions of the courses involved in this study are reported; in addition, the time, effort and expertise required to convert one of the courses from TopClass to BlackBoard is also reported. Because all of the courses involved in this study had been offered in an online format prior to the data collected in the Spring of 2002, instructor time reported herein is primarily the time required to make minor changes to existing course materials and manage an online class. These time factors are, therefore, reasonably likely to generalize to other settings that do not involve completely new development efforts.

Furthermore, we are assuming that the cost findings reported herein are relatively modest. We have not included audio-video based materials and environments that involve communication methods which are known to be more expensive in terms of initial investment as well as in terms of ongoing maintenance. Moreover, technical staff support personnel at this University are modestly paid and supported by graduate and work-study assistants who are paid relatively low salaries. Like most higher education institutions, computer equipment was purchased at discounted prices not widely available in business and industry. Judicious allocation of technical support staff and other resources (including time) is addressed where other online courses were also being served by the same resources.

We proceeded with the belief that we would not find significant differences in learning outcomes or learning effectiveness between online courses and face-to-face courses. The grades reported support the hypothesis of no significant difference in learning

outcomes as do the general impressions of the instructors. Time-on-task is a reasonably reliable predictor of learning (Fisher & Berliner, 1985). Time-on-task data in this study also suggest that learning outcomes in online courses are comparable to those in face-to-face courses. The primary focus of this study, then, is on the time and other resource requirements that appeared in all the courses as reflected in student logs, faculty diaries, online data records, interviews and surveys of all the parties involved.

Description of the study
A Website that describes and summarizes this Mellon Foundation CEUTT study and its outcomes is located at http://idde.syr.edu/mellon/.

Hypotheses
The primary hypotheses addressed in this study were:

1. The specific forms of communication and collaboration in online settings effect the time demands placed on students and instructors.
2. Learning outcomes in online university courses are not significantly different from those in traditional university classrooms.
3. Time required to design, develop and deliver online courses are major factors in the cost effectiveness of online instruction.
4. Student and faculty experience with online instruction effect perceptions of effectiveness.
5. Student and faculty perception of the benefits of online instruction improve with experience in online environments.

Methods
The first hypothesis was explored in terms of three forms of e-collaboration (e-mail, threaded discussions, and chat sessions). Students and instructors were asked to complete weekly logs reporting time spent on various aspects of the course. The second hypothesis was explored in terms of grades as well as faculty and student reports about outcomes. Faculty reports of outcomes were taken from interviews with individual faculty members. Student reports were taken from end-of-course evaluations. The third hypothesis was analyzed in terms of specific resource requirements reported in this study and those reported in the literature. The fourth and fifth hypotheses were explored in terms of faculty interviews, background surveys, and end-of-course evaluations.

The experimental design used to address these hypotheses was a within-subjects study of time, effort, perceptions and costs associated with the subjects (students, faculty, and support personnel) for each of the three courses studied. All students and instructors were involved with e-mail, threaded discussions and chat sessions at various times in each course. Week one of the online courses used only e-mail as a communication and collaboration method. Chat sessions occurred at least twice in each course in weeks when chats fit appropriately into the learning activities. Threaded discussions occurred throughout after week one. The numbers of subjects involved in each case were relatively small and do not support an inferential statistical analysis. Consequently, this study reports descriptive summaries of time, costs and outcomes and should be regarded as an exploratory study.

This research study funded by the Andrew W. Mellon Foundation's Cost Effective Use of Technology in Teaching (CEUTT) Initiative was conducted in the period January 2001 - January 2003. The study proceeded as follows:

Table 1. Project timetable

Time Period	Major Activities
January - May 2001	Baseline data collection
June - August 2001	Analyze baseline data, establish experimental conditions and develop instruments
September - December 2001	Pilot test instruments and collect data on face-to-face control group
January - May 2002	Collect data on online groups
June - August 2002	Collect and consolidate cost data
September - December 2002	Analyze time and effectiveness data
January 2003	Write and submit final report

Baseline effort
In order to develop a baseline against which findings would be interpreted, the following activities took place in the Spring and Summer of 2001:

· Reviewed the relevant literature on cost and learning effects in online settings;
· Interviewed instructors to be involved in the study with regard to prior experience in face-to-face and online settings;
· Determined how existing face-to-face and online courses were evaluated and what changes would be required or desired for this study;
· Identified a course that would be offered in face-to-face and online settings within the context of this study;
· Identified a doctoral student interested in research on online instruction to conduct supporting research outside the context of this study;
· Identified relevant standards to be used in developing instruments and materials for online courses;
· Collected data on the time, effort and expertise required to create the initial versions of the courses that had been offered online prior to the study;
· Proposed experimental conditions and drafted instruments for the study; and,
· Acquired Institutional Review Board (IRB) approval to conduct the study.

Pilot testing of instruments
The instruments developed in the baseline effort were pilot tested in the Fall of 2001 so that there would be no surprise problems during the critical Spring 2002 data collection period. Discrepancies between the before and after perception questions were found and resolved prior to the Spring effort. In addition, the end-of-course evaluation was shortened somewhat as it was considered too long by many students.

The weekly log forms were also refined based on feedback from students and instructors. Additional clarification of the time unit (minutes) was provided at the beginning as this was not clear to all students. Frequent reminders to students and faculty to complete the weekly logs was identified as required in order to insure that these forms were completely regularly and reliably; during the Spring 2002 data collection effort, regular and more frequent reminders were provided to all involved.

No major changes to the experimental procedures beyond the minor changes to the instruments just indicated were required based on the pilot test effort.

Face-to-face comparison course
IDE 614 (Instructional Design) was identified as the course to be evaluated in both

face-to-face and online settings. Enrollment expectations were sufficient to justify the possibility. Course content and structure made it possible to include the same activities, readings and requirements in both face-to-face and online settings. The instructor had experience in teaching this course in both settings using the same syllabus. The face-to-face IDE 614 was offered in the Fall of 2001. Data collected from students and the instructor in that course could then be compared directly with the Spring 2002 online version. Additionally, these data provided additional evidence of time and cost differences for online vis-à-vis face-to-face courses. The research literature (Gervedink Nijhuis & Collis, in press; McKenzie, Bennett, Mims, & Waugh, 2000) and the concomitant interview data suggest that teaching an online course is much more time intensive for teachers. The findings with regard to the online courses described below support this general finding, although it should be noted that the time requirements and demands are not simple to calculate and some researchers find specific efficiencies for online teachers (DiBiase, 2000).

Online courses
Table 2 describes the online courses offered in the Spring of 2002 involved in this study.

Table 2. Online courses involved in the Mellon study at Syracuse University.

Course # - Title	Credits - Level	System
REL 101 - Religions of the World (19 students)	3 semester credits, lower division, elective credit	BlackBoard 5 administered through University College
GEO/LAS 321 - Latin American Geography (19 students)	3 semester credits, upper division, required for majors	BlackBoard 5 administered through University College
IDE 614 - Instructional Design (16 students)	3 semester credits, graduate level, required for majors	WebCT 3.6 administered through the School of Education

These online courses differed in significant ways, including the students involved in the courses. REL 101 is a lower division elective course offered through University College primarily for campus-based Arts & Sciences students. GEO/LAS 321 is an upper division course offered through University College primarily for students enrolled in the Maxwell School of Citizenship and Public Affairs and in Arts & Sciences who are pursuing an undergraduate major in International Relations or Geography - many of these students were off-campus and planning to pursue or already enrolled in a graduate degree program. IDE 614 is a required core course for students in the Instructional Design, Development & Evaluation program; most of these students reside in the Central New York area although a few were remotely located.

The instructors for these courses differed in experience with regard to online teaching. When the data were collected in the Spring 2002 semester, all courses had been taught by these instructors in an online setting at least twice. The three online instructors actively participated in the development of these courses and had taught the same course more than three times in face-to-face settings. The REL 101 professor had no other online design, development or delivery experience outside the context of this course and had only offered it twice in an online format prior to the data collection period - both times as part of the preliminary pilot effort preceding the data collection period. The GEO/LAS 321 professor had offered this course four times prior to the data collection period and had experience in teaching online courses in both TopClass and

BlackBoard. Moreover, this professor was skilled in developing multimedia course materials, including graphics, animations and audio-video clips. The IDE 614 professor had offered this course once in WebCT prior to the data collection period and had experience with several other online course environments, including BlackBoard, Lotus Learning Space, and WebBoard.

The three courses also differed somewhat with regard to design, partly due to instructor experience with these courses and partly due to differing instructor experience with online courses. All three were designed so that the online components did not serve to reduce faculty involvement (i.e. to supplant) but were intended to expand opportunities for collaboration, communication and learning (i.e. to supplement). REL 101 was designed primarily around discussion topics and readings, closely paralleling the face-to-face version of that course. Students were required to write a short discussion paper every week on that week's reading, make an online presentation about a religion not one's own, and react to the topic discussions of other students. This course did not have exams. GEO/LAS 321 also had short weekly papers and a course project paper. IDE 614 required students to write 5 papers, participate in a project and present a project report to the class, and take a final exam modeled after the comprehensive masters exam in IDD&E. Participation in weekly discussions counted for 10% of the grade in all three courses. REL 101 emphasized the weekly discussions and made use of discussion threads for most course-related information; there was an online description of the course and course requirements. GEO/LAS 321 used a variety of ways to convey course information and broke the course syllabus into easily accessible chunks in the course information area. IDE 614 also used a variety of ways to convey course information and made extensive use of a dynamic course syllabus that was referred to on a weekly basis and updated to take into account the pace and specific circumstances of the course. See Appendix E for screen captures from each of the online courses.

Data sources and methods of collection
A variety of data sources and methods of collection were involved in this study, as shown by Table 3.

Table 3. Data instruments, sources and methods of data collection.

Data Instrument	Source and Method of Collection
Background survey	Required of all students - online form
End-of course evaluation	Required of all students - online form
Weekly logs of time usage	Required of students who agreed to participate in the study and of the instructors and technical support staff - online form
Instructor and concomitant interviews	Voluntary for instructors at Syracuse University and other institutions - collected face-to-face, via telephone and online
System data	Collected automatically on all enrolled students by the online course management systems - BlackBoard and WebCT
Infrastructure cost data	Collected by the cost effectiveness analyst from university expenditure records
University registration data	PeopleSoft student registration system at SU

Interpretation and limitations
This study explored time, cost and learning effectiveness data on three courses, one of which was offered both face-to-face and online; the other two were offered only online during the course of this study, although instructors had offered the courses in face-to-face settings at SU. The fact there is only one direct comparison possible between a face-to-face and online course limits the degree to which differences may generalize to other courses, although the findings in this case might be consolidated with findings in other CEUTT studies. Retention data and grades for IDE 614 (offered online and face-to-face) are not significantly different. Moreover, retention data for all of the online courses studied is quite good and comparable with face-to-face course retention rates at SU. Other studies have reported attrition in online courses as a problem area and a factor that complicates cost-effectiveness analysis (Diaz, 2000a; Phipps & Merisotis, 1999; Ridley & Sammour, 1996). Attrition was not a problem factor for any of these courses, although the concept of attrition in both face-to-face and online settings does warrant further study. For example, online and face-to-face students often view the first week or two of class as a shopping around or browsing exercise, so drop-outs in this time frame might be considered differently from those who drop out later in a course.

Many issues and costs that arise in face-to-face classroom settings also occur in online settings. In some cases it is easy to overlook the fact that there is a correlate issue or cost in the setting as it might be taken for granted in that setting. For example, plagiarism can occur in either kind of setting. In some cases, classroom instructors are already used to taking measures to insure against plagiarism. In online teaching, not many instructors know how to do this effectively. As a consequence, it may be tempting to conclude that time and costs involved in checking online student papers for plagiarism is unique to online settings, although this is not the case. Likewise, institutions have established procedures for evaluating face-to-face instructors and do not think of such evaluations as costing much if anything, which of course is not the case. However, not many institutions have procedures for evaluating online instructors, so the time and effort to develop and implement evaluation strategies is obvious. The reality is that there are development and ongoing costs associated with faculty evaluations in both settings, although these are not easily measured. Evaluating online faculty will be discussed in a subsequent section as it is a relatively new enterprise for most institutions.

Issues such as type of learner, location of course/learners, required course versus elective course, online strategies employed, and communications methods are all relevant factors that have not been adequately or exhaustively investigated in this or any study. Recommendations for further study are discussed in the concluding section of this report.

Limitations and potential problem areas directly relevant to this study include:
· Problems in comparing BlackBoard and WebCT system data - the two systems collect and represent student data differently; the use of these data in this study was basically to develop confidence in the data reported in the weekly logs.
· Problems in comparing students and instructors in BlackBoard and WebCT environments - the two systems have basically the same capabilities but differences in their interfaces may have effected student and instructor attitudes and levels of satisfaction.
· Problems in using responses to semi-structured interview questions to confirm or disconfirm weekly log data - these data come from different sources and are in substantially different forms; this limits the degree of confidence that can be placed in a confirmation of findings.
· The total numbers of students involved in each course was relatively small, ranging

from 16 to 19 (Table 4). All students were required to complete the background survey and end-of-course evaluation but some students did not respond to relevant items in the background survey or end-of-course evaluation. Mellon participation was smaller still. This small sample size limits the ability to generalize to larger student populations. · The number of faculty directly involved is small - these three instructors may not be representative of other faculty; while an attempt was made to recruit faculty from different disciplines with different levels of experience, there is still a limit to the ability to generalize to other faculty, especially to faculty with no online teaching experience.

While these limitations are significant, they do not detract from the findings specific to these settings. Moreover, our analysis provides a reasonable foundation for further studies and is generally corroborated by the research literature and by the concomitant interviews with online instructors at other institutions.

Analysis of findings

Descriptive summaries

Enrollments
Enrollments for the courses involved in this study are typical for these courses at SU (see Table 4). It is noteworthy that attrition was low for these courses and that the participation rate was relatively high - much higher in the graduate course than in the undergraduate courses. There was a half-grade bonus incentive offered for a defined level of participation in each of the courses. Participation consisted of completing at least 10 (of 14) weekly logs indicating time and effort involved that week. All students were required to complete the background survey and end-of course evaluation. Students opting not to participate in the study were offered an opportunity to earn a half-grade bonus by other means that varied with the particular course, although no one elected to do so. Table 4 indicates the number of students enrolled, the number who dropped, the number enrolled at the end of the semester, and the number who actively participated in this research effort.

Table 4. Enrollments, attrition and Mellon participation.

Course Semester - Mode	Enrolled Initially	Student Drops	Enrolled Students	Mellon Participants
IDE 614 - Fall 2001 (face-to-face)	20	4	16	15
IDE 614 - Spring 2002 (online)	18	2	16	13
GEO/LAS 321 - Spring 2002 (online)	20	1	19	7
REL 101 - Spring 2002 (online)	21	2	19	6

"Mellon participation" is based on completion of 10 or more weekly logs and does not include all of those who remained in the course, as is evident in Table 8. The figures in Table 8 reflect enrollments and drops after the first week of class - that is, there is a correction factor taken into account for students who are shopping around for the best schedule the first week of class or who add during that first week. A more accurate indicator of effective enrollments and drops could be based on those enrolled at the add-drop deadline and then those who dropped after the add-drop deadline, in which

case the attrition rate would be even lower for these courses. A total of 79 students enrolled and 9 dropped, leaving a subject pool of 70; 41 students actively participated in the study.

The course with the highest apparent attrition (IDE 614 Fall 2001) had an effective drop rate that was much lower. An online version of IDE 614 was also offered in the Fall of 2001 as all three courses underwent a pilot test of the online versions that semester. One of the four drops moved from the face-to-face course to the online course. Another of those who dropped IDE 614 in Fall 2001 decided to take the online course offered in Spring 2002. Yet another of those who dropped IDE 614 in Fall 2001 was called up to active military duty and had to drop all university courses. In summary, the effective number of drops from IDE 614 was only one.

Most online courses at SU are offered through University College (Syracuse University Continuing Education, SUCE); the School of Education and the School of Information Studies offer online courses independently of University College. The attrition rate for all courses offered through University College, which includes GEO/LAS 321 and REL 101 along with 33 other courses, was about 23%. GEO/LAS 321 and REL 101 had a combined attrition rate of about 8%, based on the data reported above. Attrition rates by semester for SUCE course offerings since 1999 vary from a low of 12% to a high of 33% (these rates are based on first versus last day registrations and do not take into account the fact that many students browse for the right classes the first week of the semester). The combined attrition rate for all of the courses involved in this study was about 11% with the highest rate being 20% for the face-to-face version of IDE 614.

As reported earlier, the attrition rates for the online courses involved in this study were lower than others that have been reported in the literature (Diaz, 2000a; Phipps & Merisotis, 1999; Ridley & Sammour, 1996). A reasonable conclusion is that the drop rates did not significantly impact outcomes of the study by creating a pool of self-selected subjects. Students typically reported selecting the online option for convenience and their expectations of convenience in the form of time flexibility were generally satisfied, as will be made evident in a subsequent section.

Grades

Students participating in this Mellon study were offered a half-grade bonus for completing at least 10 weekly logs. The grades reflected below include this bonus.

IDE 614 (Fall 2001 – face-to-face)
- 16 students completed the course
- 12 A, 3 A-, 1 Incomplete

IDE 614 (Spring 2002 – online)
- 16 students completed the course
- 6 A, 5 A-, 2 B+, 3 Incomplete

GEO/LAS 321 (Spring 2002 – online)
- 19 students completed the course
- 4 A, 6 A-, 4 B+, 2 B, 1 B-, 1 C, 1 Pass

REL 101 (Spring 2002 – online)
- 19 completed the course
- 9 A, 1 A-, 1 B+, 1 B, 1 C+, 1 D, 4 F, 1 Incomplete

All three instructors reported that these grades, not including the half-grade bonus, are very similar to grades normally awarded previously in both face-to-face and online

versions of these courses. These claims are supported by a review of recent grade reports from these instructors.

There are two things worth reporting about the grades. First, the half-grade bonus for participation was shown to be an effective incentive for student participation during the pilot testing phase of this effort. Those students participating in the study and earning an A without the bonus were provided a $20 gift certificate at the University bookstore as their bonus. This was true during the pilot study in the Fall of 2001 as well as during the actual study in the Spring of 2002. This incentive was apparently less attractive to undergraduate students than to graduate students, however, and the participation rates in the two undergraduate courses were lower.

The second interesting thing to note about the grades is that REL 101 had the widest variation of grades. This is an elective course and student motivation may account for this result. However, a review of the time data from the Web course management system reveals a correlation between online activity and grades. There is one student who earned an A in REL 101 with minimal online activity. Apart from this student, all of the students who earned a grade lower than a B in REL 101 were among the least active in the online course environment (see Table 5). This is not a surprising outcome. Time on task has long been accepted as a reliable indicator of performance (Fisher & Berliner, 1985). However, it is also generally accepted that effective online learning requires self-discipline (Kearsley, 2002). The correlation between low online activity and low grades suggests that those students who do not work well independently and lack self-discipline will not generally do well in online courses. These same students might get by with somewhat higher grades by passive participation in a face-to-face setting that only requires enough discipline to show up for class. However, we have no direct data to support these suppositions.

The activity reported in Table 5 is derived from BlackBoard's student tracking system; counts of the number of visits - 'hits' - to different types of pages by individual students constitute BlackBoard's activity indicators. Communication Activity reflects the number of discussions, chats and e-mails for a student. Content Activity reflects the number of times a student visited content pages. Group and Peer Activity reflect small group work and student-student interactions, neither of which were required in REL 101. It is interesting to note that many of the better students engaged in student-student interaction anyway. Although "hits" in this case do not necessarily reflect student time allocation very well, the data do suggest relative time-on-task for each student.

The students' names were replaced with grades earned (after the half-grade boost earned by the six Mellon participants). None of those earning less than a B in REL 101 chose to participate in the Mellon study nor did any of those earning less than a B opt for the alternative half-grade bonus. This fact suggests that those choosing to participate in this study were better than average students, although the data from the other courses cannot be used to confirm this finding. Grades and online activity for the other two courses are not reported since the grades were nearly all clustered in the B to A range.

Table 5. Grades and online activity in REL 101.

Grade	Communication Activity	Content Activity	Group Activity	Peer Activity	Total Activity
F	0	4	0	0	4
F	36	40	0	5	81
A	276	168	0	2	446

D	324	160	0	0	484
F	362	175	0	1	538
F	415	199	1	0	615
C+	398	228	0	7	633
A	513	197	1	1	712
I	431	330	0	3	764
A	582	231	1	19	833
B	519	345	0	21	885
A	617	297	0	0	914
A	759	219	0	9	987
A	732	344	4	21	1101
B+	1137	235	2	44	1418
A	1407	129	7	43	1586
A	1307	342	1	0	1650
A-	1360	311	0	0	1671
A	1887	966	1	10	2864

Student outcomes
Grades and faculty perceptions of student performance were the primary indicators of student learning outcomes in this effort. As already indicated, grades awarded in these classes were comparable with those awarded by these same instructors for other online and face-to-face offerings of these same courses. In short, there are no significant differences in grades to report. This is in fact a positive finding as student performance using the standard measure of grades appears not to be effected by whether or not one of these courses is offered in a classroom or online setting.

This interpretation is reinforced in faculty interviews. The three online instructors involved in this study all reported the view that online discussions were of a higher quality than classroom discussions. They also reported that there were no noticeable differences in papers or projects developed by online students in comparison with face-to-face students. Our conclusion based on these data sources is that student learning in these courses was not directly effected by modality of course (face-to-face versus online).

Student time
A well-established predictor of learning outcomes has been time-on-task (Bloom, 1971; Carroll, 1963, Fisher & Berliner, 1985). Table 6 reflects student time in the courses involved in this study. For the three online courses offered in the Spring of 2002, the time reflected in Table 6 is broken down into student time reportedly spent while online in the course environment and time spent offline. Since the Fall 2001 course was primarily face-to-face and intended to serve as a baseline point of reference, total student time is reflected. The weekly logs used to collect these data had more specific categories than the logs employed during the Spring 2002 semester. One obvious pattern of behavior evident from the summary of student time in Table 6 is that the graduate students in IDE 614 on average devoted more time than the undergraduate students in GEO/LAS 321 and REL 101. Moreover, the upper division undergraduate students in GEO/LAS 321 put in more time on average than the lower division students in REL 101.