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

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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.

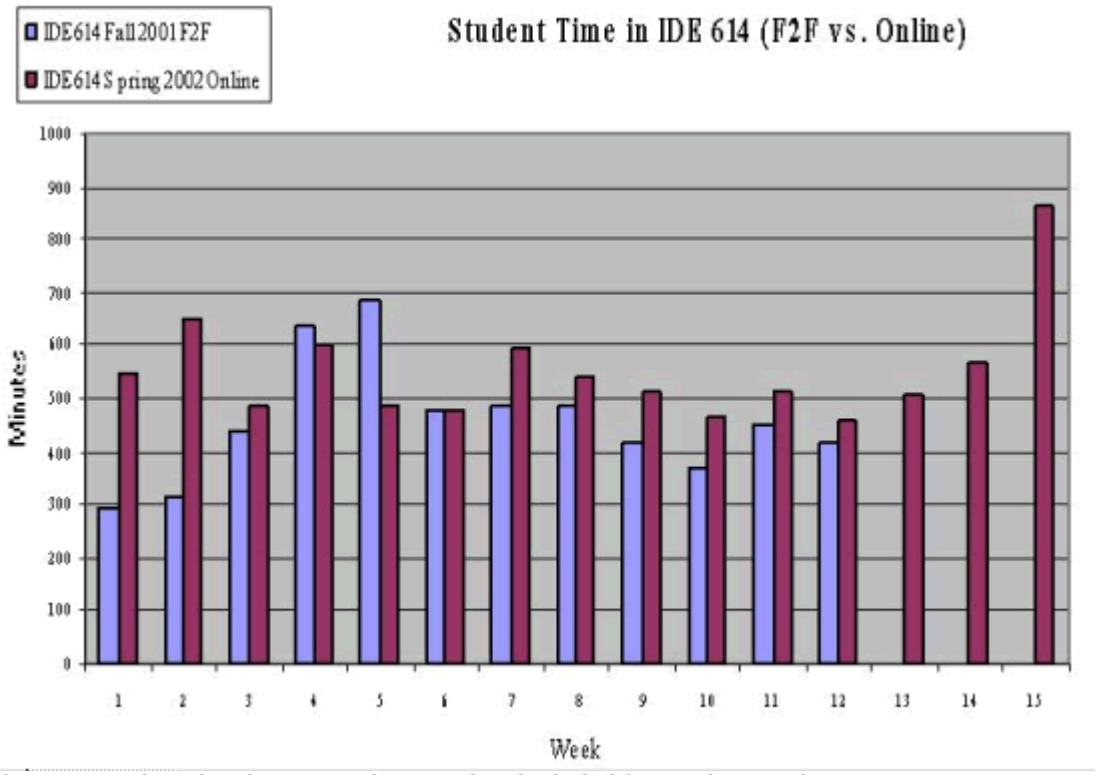

Figure 1. Student time in IDE 614 (no F2F data included for weeks 13-15).

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).

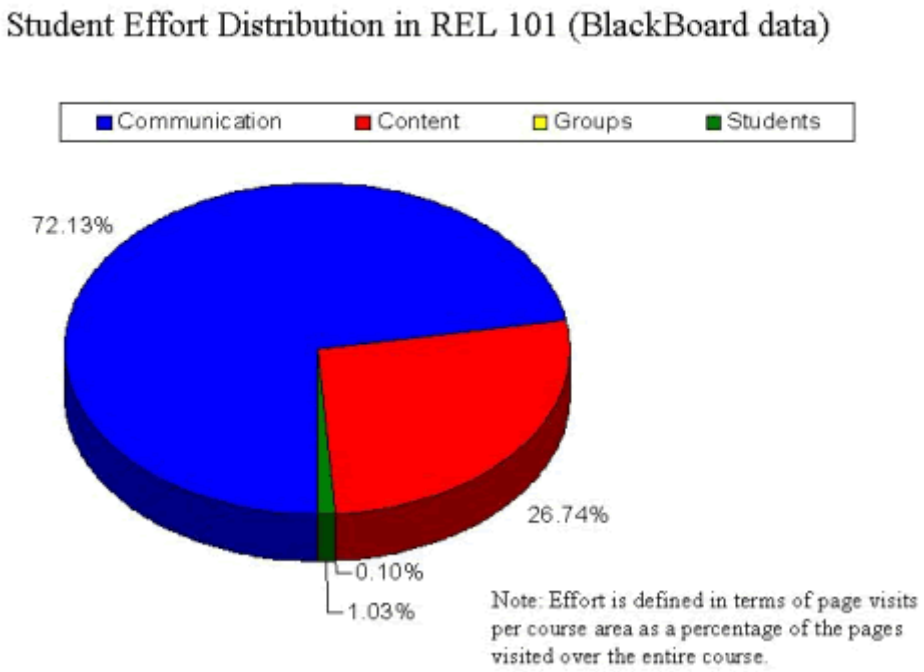

Figure 2. Student effort distribution in REL 101 (BlackBoard tracking system).

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.

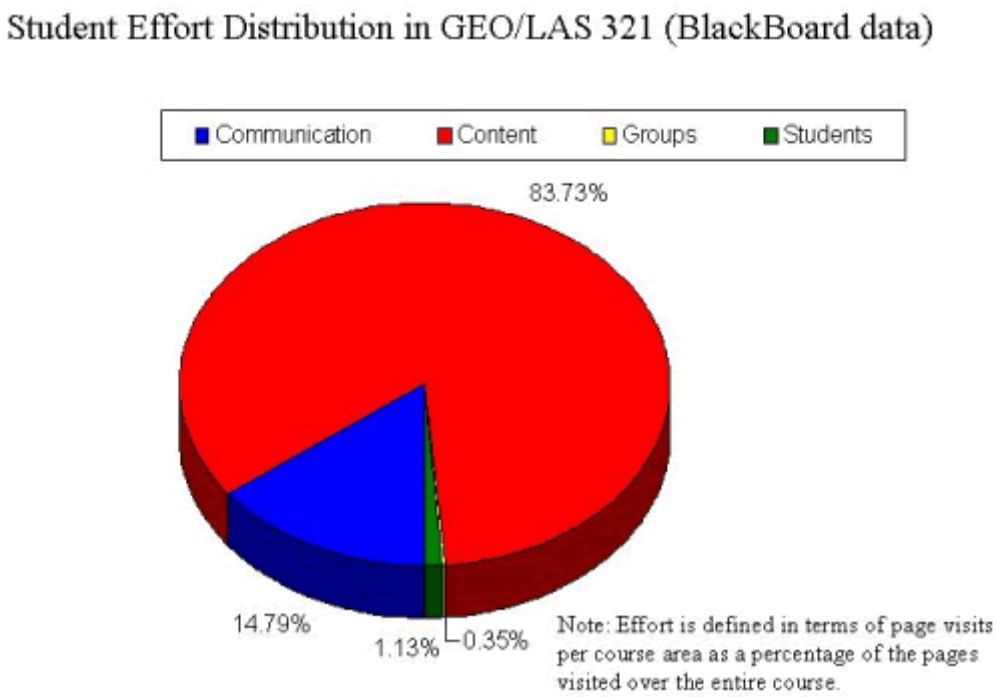

Figure 3. Student effort distribution in GEO/LAS 321 (BlackBoard tracking system).

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.

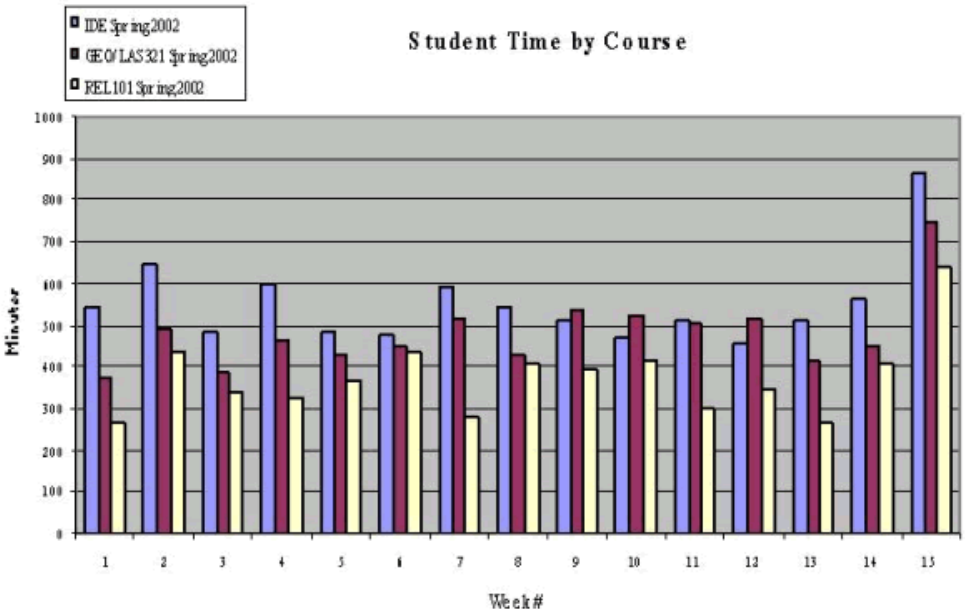

Figure 4. Student time by week per course (online Spring 2002 courses).

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.

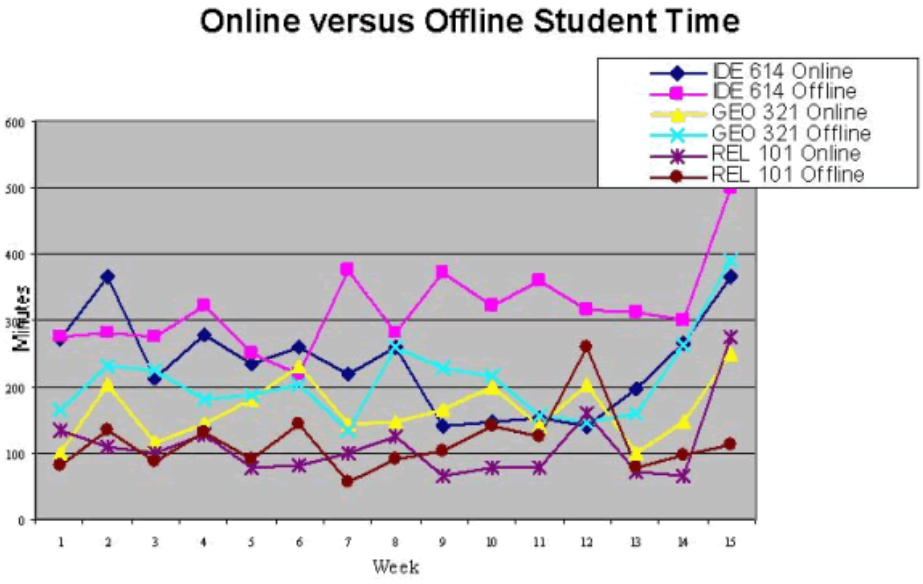

Figure 5. Student online versus offline time by week per course.

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.

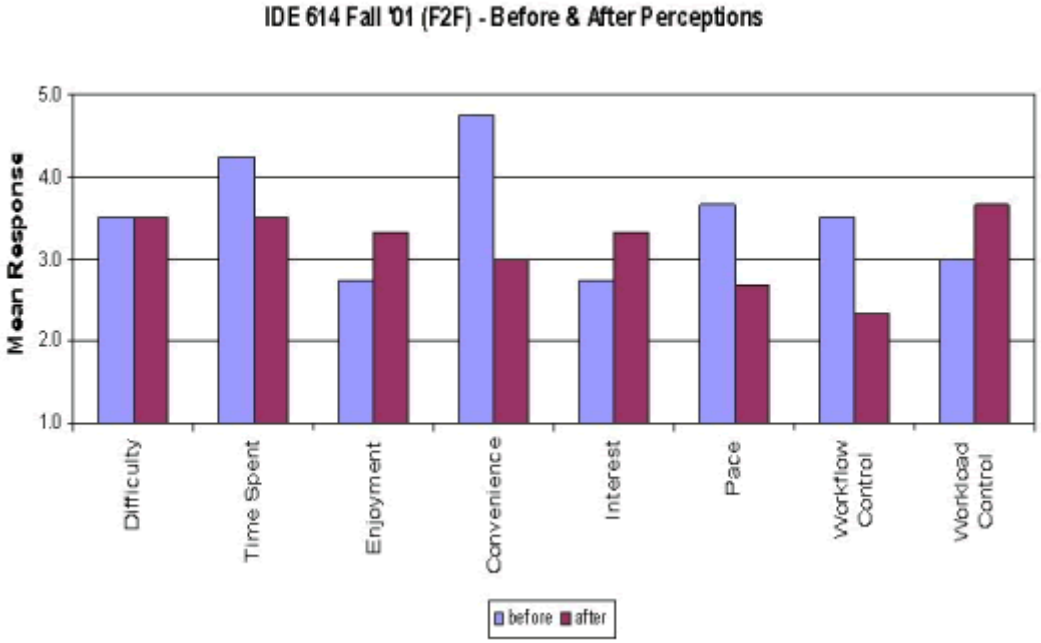

Figure 6. Before and after student perceptions in IDE 614 Fall 2001 (F2F).

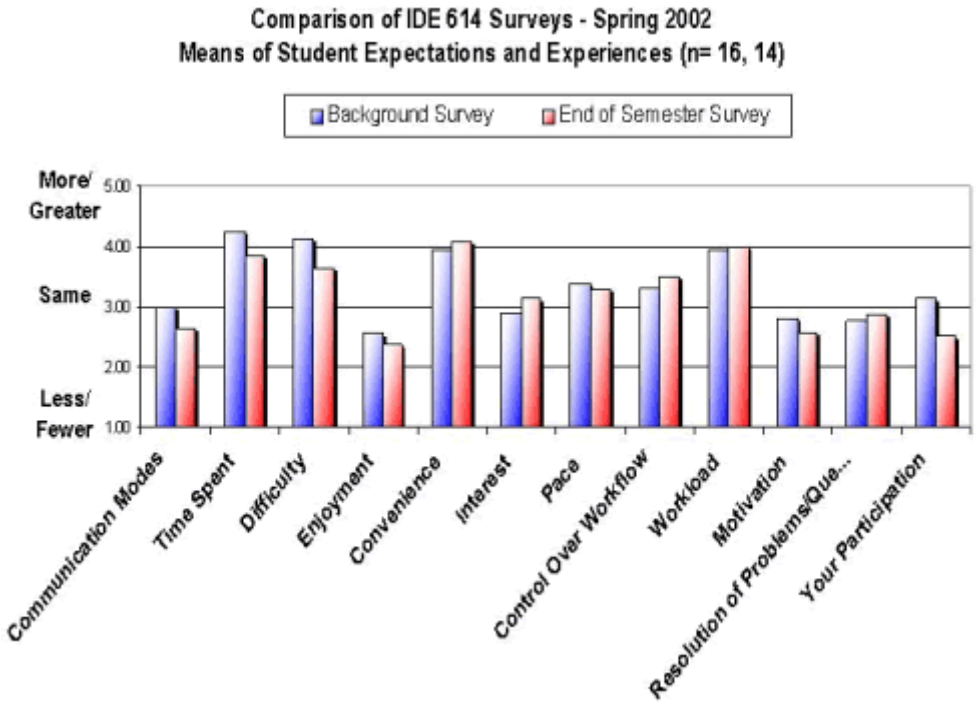

Figure 7. Before and after student perceptions in IDE 614 Spring 2002.

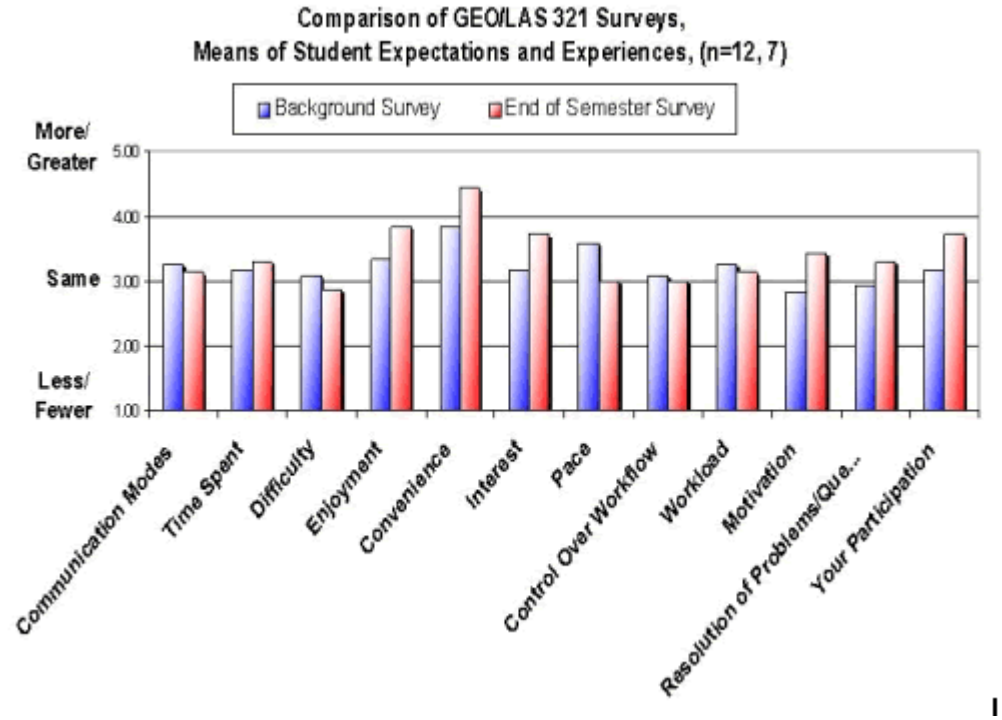

Figure 8. Before and after student perceptions in GEO/LAS 321 Spring 2002.

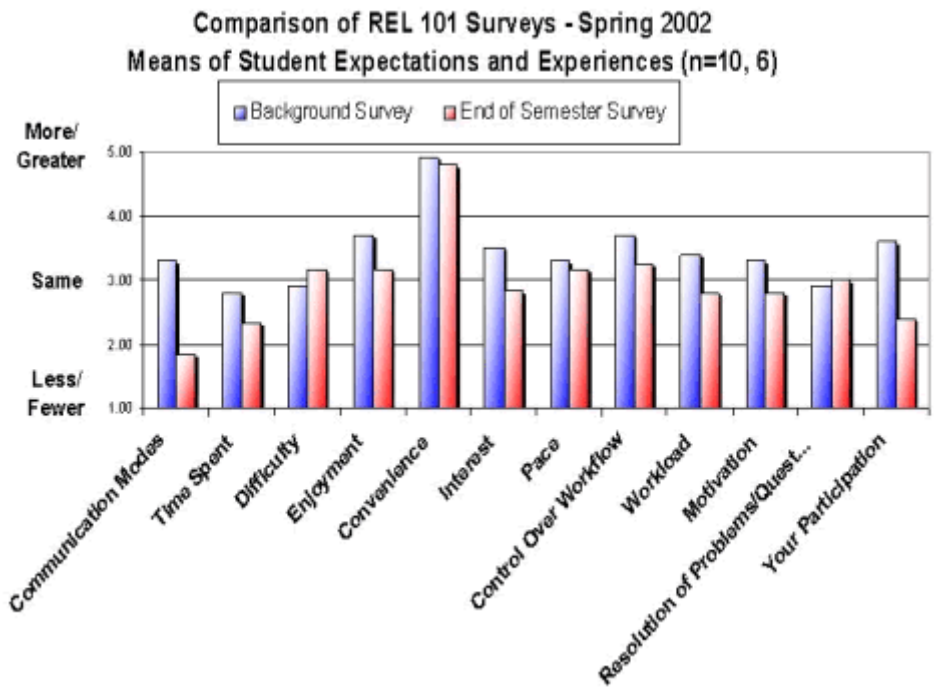

Figure 9. Before and after student perceptions in REL 101 Spring 2002.

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

Instructor time
Data on time for the instructors involved in this study came primarily from their weekly logs. Additional and corroborating data came from an estimate of time spent responding to e-mails and from interviews with faculty. The following table summarizes time from the weekly logs:

Table 7. Faculty time reported on weekly logs (minutes weekly; totals in hours).
(If viewing in black/white, lighter shaded data are RED and darker shaded data are BLUE)

Week	IDE 614 Fall 01 Total	IDE 614 Spr 02 Online	IDE 614 Spr 02 Offline	GEO 321 Spr 02 Online	GEO 321 Spr 02 Offline	REL 321 Spr 02 Online	REL 321 Spr 02 Offline
1	292.0	270.5	275.4	99.8	164.4	133.4	81.3
2	315.0	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	678.8	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	140.9	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**

Table 7 summarizes the weekly log data into two major categories - time spent online and time spent offline. The Fall 2001 IDE 614 course was a Web-supported, face-to-face-course so online time data were also collected for this course although it was primarily a face-to-face course, as the time data reflect. Null entries were treated as 0, per confirmation with faculty respondents. The semester lasted 14 weeks; week 15 was exam week although only IDE 614 had an exam. Weeks 16 and 17 were included so that instructor time grading papers could be included. Weekly times and averages are reported in minutes; sums are reported in hours. The average was calculated only for weeks through 1-15, which comprised the formal course time period when there were significant interactions with students.

These courses were supported by a technical assistant who provided support for the BlackBoard or WebCT; in the case of IDE 614 that made use of WebCT, the technical support person was also the instructor. REL 101 had a teaching assistant whose time is not reflected in Table 7. The TA for REL 101 provided on average about 3.1 hours of online time and 1.2 hours of offline support time. These additional staff and TA times are included in Table 8. The IDE 614 instructor was traveling and unable to participate online in week 13. It is noteworthy that this fact did not seem to effect student activity online (see Table 6 above).

Table 8. Faculty/staff time reported on weekly logs (minutes weekly; totals in hours).
(If viewing in black/white, lighter shaded data are RED and darker shaded data are BLUE)

	IDE	IDE	IDE 614	IDE	GEO	GEO	REL	REL

	614 Fall 01 Online	614 Fall 01 Offline	Spr 02 Online	614 Spr 02 Offline	321 Spr 02 Online	321 Spr 02 Offline	321 Spr 02 Online	321 Spr 02 Offline
1	**425.0**	**615.0**	**1110.0**	**750.0**	**125.0**	**120.0**	**225.5**	**865.0**
2	**305.0**	**332.5**	**350.0**	**315.0**	**125.0**	**125.0**	240.0	90.0
3	177.0	120.0	285.0	135.0	90.0	155.0	290.0	120.0
4	151.0	127.5	**195.0**	**90.0**	95.0	80.0	305.0	60.0
5	127.0	165.0	390.0	195.0	165.0	65.0	255.0	60.0
6	115.0	180.0	415.0	315.0	**195.0**	**20.0**	205.0	30.0
7	25.0	90.0	314.0	180.0	165.0	145.0	235.0	45.0
8	120.0	180.0	410.0	240.0	100.0	25.0	235.0	75.0
9	75.0	240.0	320.0	360.0	75.0	135.0	235.0	0.0
10	60.0	120.0	265.0	105.0	80.0	75.0	80.0	0.0
11	120.0	480.0	200.0	135.0	**140.0**	**30.0**	210.0	0.0
12	140.0	165.0	115.0	120.0	130.0	0.0	335.0	30.0
13	0.0	0.0	265.0	90.0	140.0	55.0	**325.0**	**120.0**
14	235.0	**140.0**	**215.0**	**180.0**	30.0	45.0	355.0	150.0
15	125.0	**30.0**	**365.0**	**300.0**	80.0	300.0	252.5	240.0
16	0.0	0.0	365.0	240.0	0.0	0.0	0.0	0.0
17	0.0	0.0	205.0	270.0	75.0	85.0	0.0	0.0
SUM (hrs)	17.8	36.7	49.8	96.4	67.0	30.2	24.3	63.0
		86.7		163.4		54.5		94.4
AVG Wks 1-15	146.7	199.0	347.6	234.0	115.7	91.7	252.0	125.7
(min)								

The faculty/staff weekly logs were arranged for input of data with regard to online and offline time (in minutes) used in various planning activities, in delivering instruction, and in communicating with students and assistants. These data have been totaled for each week of the semester in Table 8 in order to determine how various communication and collaboration modalities effected time demands on instructors (see Hypothesis 1). The red numbers in week 1 indicate that this was an e-mail only week. Numbers in blue indicate when chat sessions were the primary mode of communicating (weeks 2, 4, 14 and 15 for IDE 614; weeks 2, 6 and 11 for GEO/LAS 321; week 13 for REL 101).

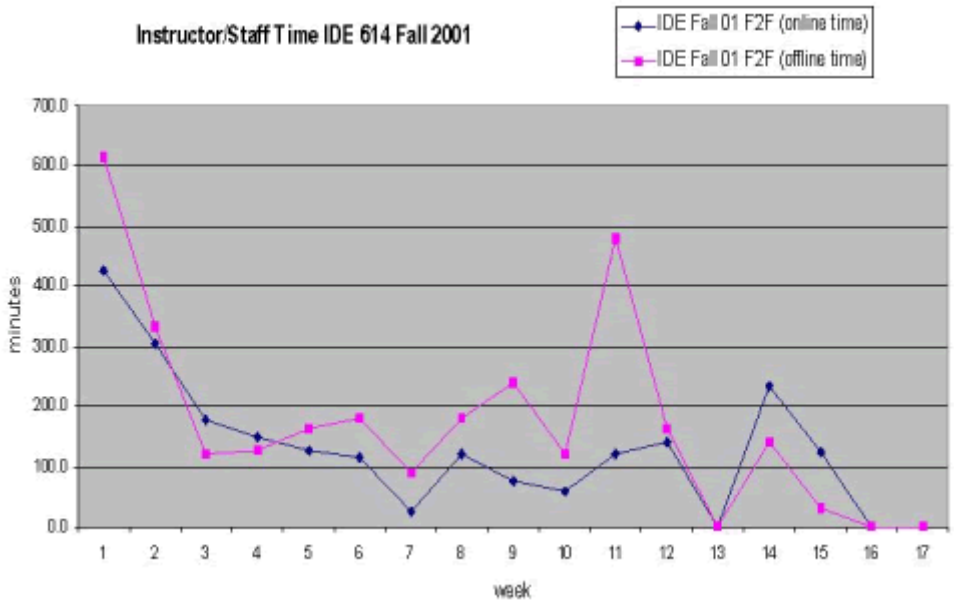

Figure 10. Faculty/staff time for IDE 614 Fall 2001.

The faculty and staff time required to support IDE 614 in the Fall semester of 2001 is depicted in Figure 10. This course was primarily delivered in a face-to-face mode, but did have Web support in the WebCT environment. This graph represents significant time initially which would be expected in most courses as there is a transition from planning to implementation. There is a spike in week 11 that was caused by the specific design of this course requiring a paper and a project outline that week; this design was changed for Spring 2002, and this spike did not recur. The instructor was out of the country in week 13 and spent no time on the course, although students were spending time on papers and projects (see Table 6).

Figures 11 - 13 depict the combined faculty/staff time for the three Spring 2002 online courses. The heavy initial investment at the beginning of each course reflects the time when the staff support personnel were most active (not including the TA for REL 101 who was active throughout). The data also show that faculty spent about as much time offline as they did online, with the exception of REL 101 which involved discussion as the primary instructional strategy and made extensive use of threaded discussions.

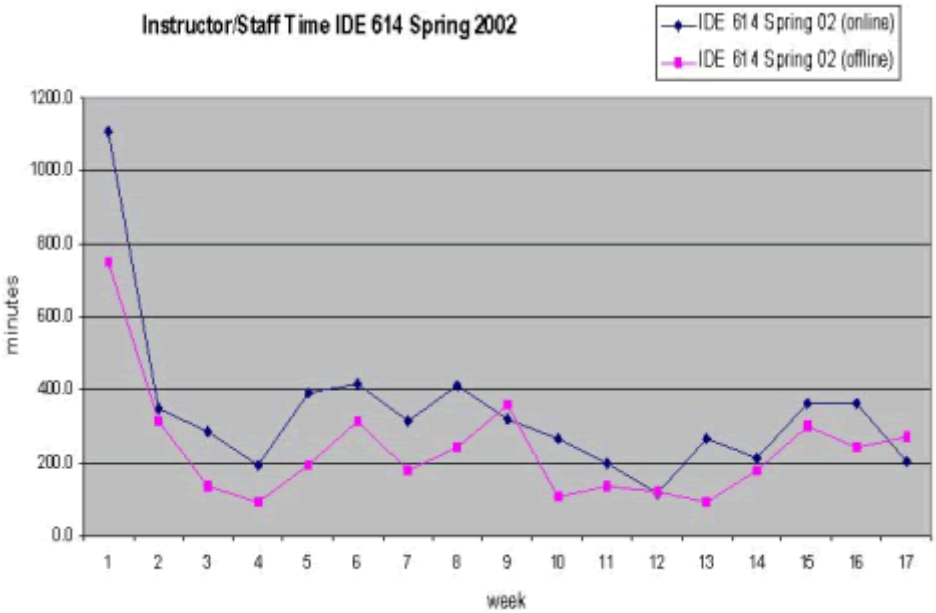

Figure 11. Faculty/staff time for IDE 614 Spring 2002.

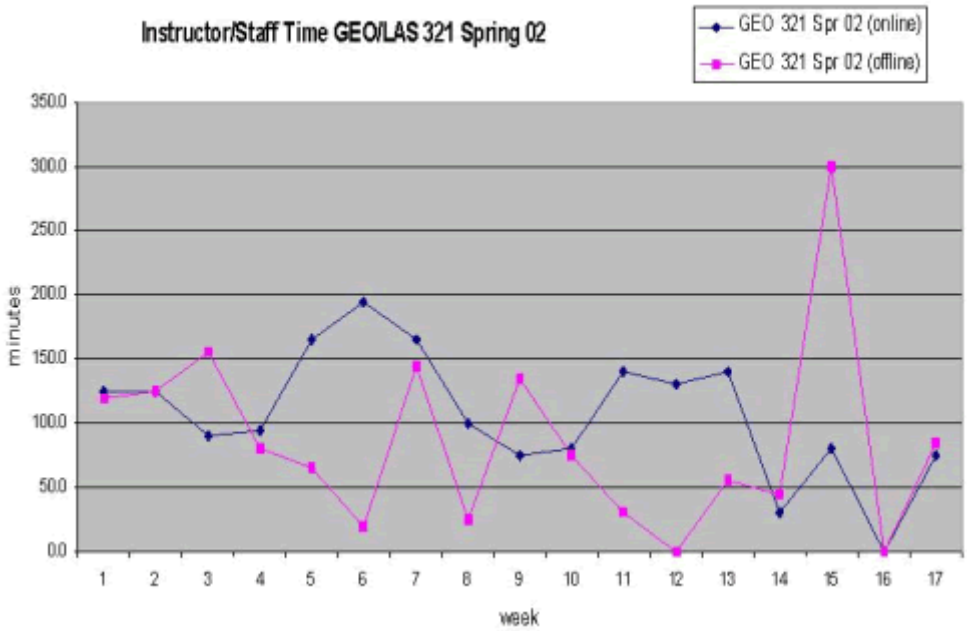

Figure 12. Faculty/staff time for GEO/LAS 321 Spring 2002.

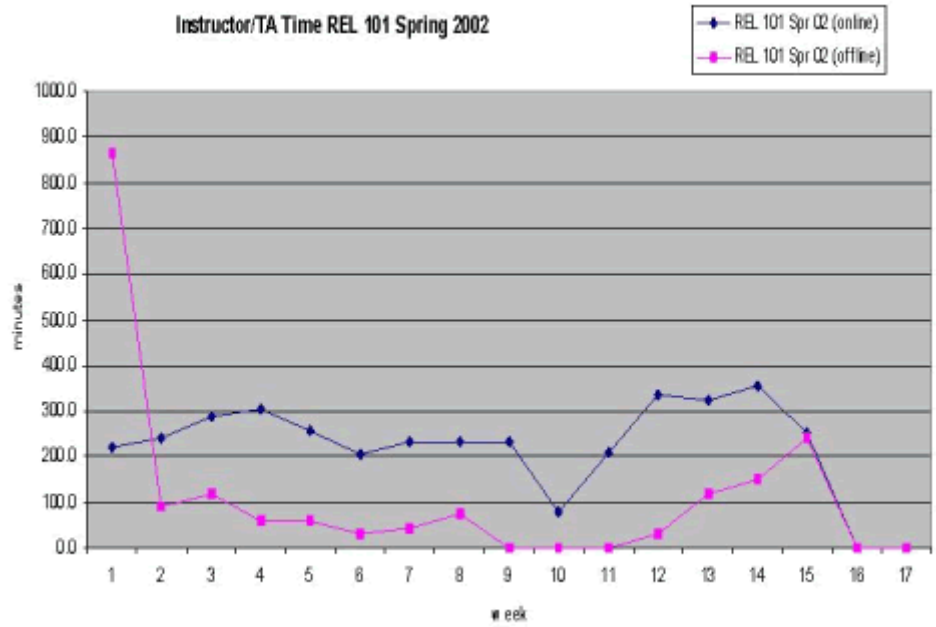

Figure 13. Faculty/staff time for REL 101 Spring 2002.

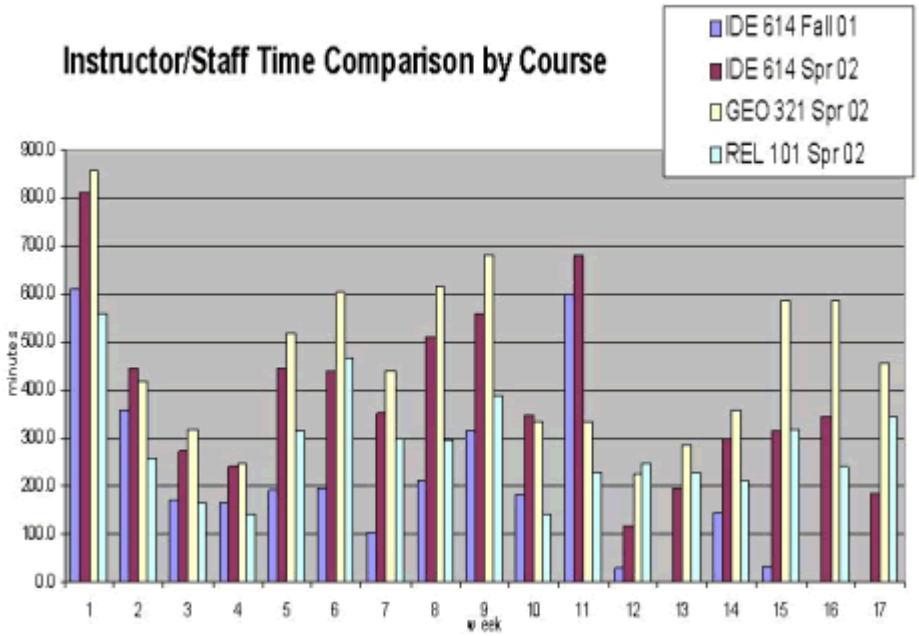

Figure 14. Faculty/staff time totals for all courses.

In all cases there is considerable time investment at the beginning of the course.

These time data do confirm the hypothesis that the communication modality effects online or offline faculty time, especially when the primary communication modality is e-mail. The expectation was that when e-mail was intensive that instructors would spend considerably more time online, especially compared with times when chat sessions were the primary communication modality. The e-mail-only week data (week one highlighted in red in Tables 7 and 8) generally reflect higher online time demands than most other weeks and is significantly higher than the average for all courses. Chat sessions typically replaced discussion threads the weeks they occurred (highlighted in blue in Table 7), but they did not offset e-mail activity.

Instructor perceptions
There were no before and after survey questions given to participating faculty, so data comparable to before and after student perceptions cannot be reported. We recommend that future studies of this nature collect this information as changes in faculty perceptions are just as valuable and significant as changes in student perceptions.

As already indicated in the section on faculty interviews, online instructors reported that preparing and leading online courses place additional time demands on them. Nevertheless, online instructors also suggested that there are new teaching opportunities in an online environment and they appreciate the time flexibility involved with the asynchronous aspects of online courses.

Online instructors were also concerned about how their online teaching is regarded in the context of promotion and tenure. This is indirectly related to the extra time required for online teaching as that time could be devoted to research and publishing which traditionally count significantly in the tenure and promotion process at many universities, including Syracuse University. Moreover, faculty were concerned that there are not established guidelines or procedures for evaluating online teaching.

In summary, faculty see the necessity for additional university support and encouragement to pursue online teaching. Those involved directly in this study and those interviewed in association with this study generally believe that learning outcomes can improve and that online environments offer new opportunities to students and faculty. Many other issues are discussed in the literature about distance education including who owns an online course, copyrights, plagiarism, and so on. None of these issues were prominent in the data collected in this study.

Cost effectiveness
E-learning by itself is not a new concept, yet determining the life cycle cost is a complex task that requires an understanding of the costs, benefits, and learning effects of instructional technology applied in an online setting. Determining the costs and learning effectiveness in an online setting can serve as a foundation to address whether, and under what conditions, technology might be deployed to reduce institutional costs and/or promote pedagogic gains.

Any Web browser can become a delivery vehicle for e-learning. A Web-based approach to learning allows for the independence of student time and place. At the same time, e-learning requires dedicated and disciplined learners with the motivation and perseverance to succeed in a virtual classroom.

But what are the costs and constraints to the learner and the institution? The constraints to the learner include the impact on their family, their job, direct costs of the registration fee (e.g., tuition) of the program, time commitments, and the literacy of the learner in the delivery medium. Constraints and costs to the institution relate to the development and production of the curriculum, faculty training and development, equipment costs, delivery expenses, and administrative support and staff. Each step of the life cycle costing is discussed below.

Life cycle cost perspective

By definition, life cycle costing (LCC) is the total cost of ownership over the useful life of an asset, product, structure or system (Levin & McEwan, 2001). LCC takes into account relevant costs for the development, investment, and operation over a period of time adjusting for differences in the timing of the costs. In this example of e-learning, LCC is based on a process involving three overlapping stages (Figure 15).

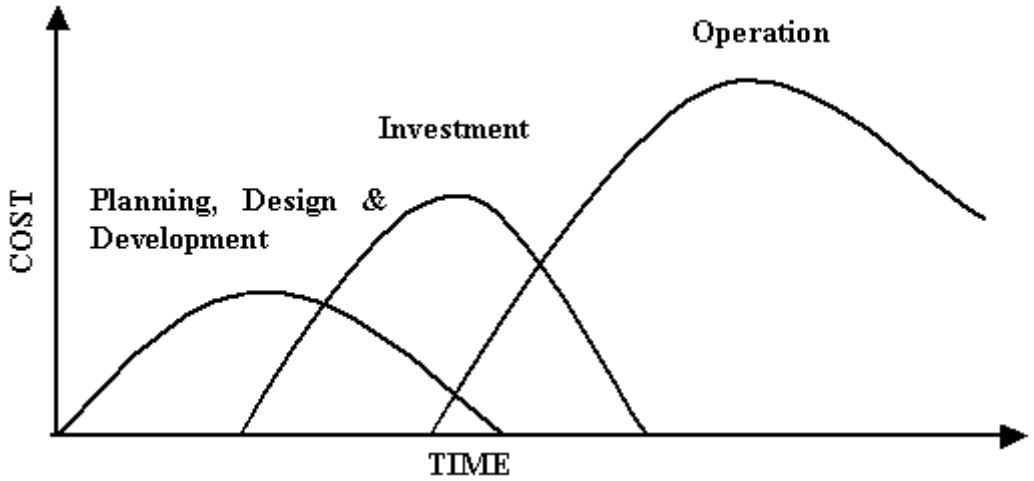

Figure 15. Life cycle cost perspective.

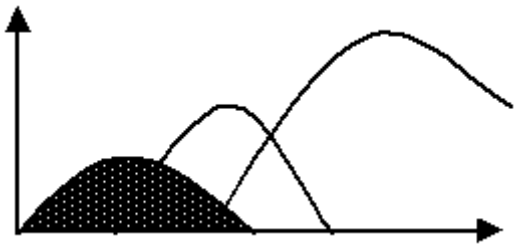

Figure 16. Stage 1 - planning, design, and development.

In planning for life cycle costing, the first task involves design (Figure 16). This stage is a multi-disciplinary activity that involves the planning, design, and development of the e-learning activity. Costs of designing the three online courses increased over time, as is the case with nearly all design efforts. This is true even though all three courses had been offered previously. Design costs then decreased as the investment and operation stages began.

Course development includes decisions on the format, structure and general content of each online course. Part of course development includes planning and designing specific content and instructional methods that were employed in each course. For example, at what time and in what context would it be appropriate to introduce students to an online chat room?

Part of this stage or phase involves the selection of instructional technology resources that would be used to augment the course. For example, determining which Web-based course management system would be employed for each of the three online courses occurred in this stage.

Finally, planning for formative and summative evaluation is the last activity in the design stage. Costing for

evaluation is an ongoing operations expense. Other activities that often take place during this first stage include:

· Planning for the format, structure, and general content of course or program;
· Planning and designing specific content and instructional methods to be used;
· Selecting from existing instructional materials;
· Selecting communication tools and techniques;
· Analyzing information and defining instructional sequences;
· Revising existing materials and strategies;
· Developing evaluation plans and procedures;
· Evaluating instructional materials (for revision and future use); and,
· Integrating materials and strategies into the Web course management system(s).

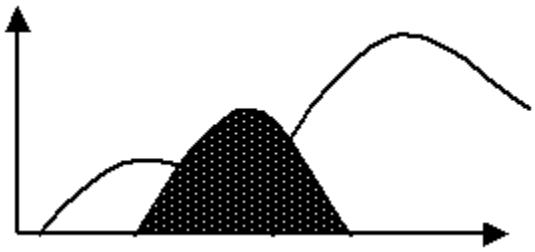

Figure 17. Stage 2 - investment.

The investment stage (Figure 17) refers to the hard and soft one-time direct costs that are required to develop a course. E-learning requires careful attention to recurring costs (which arise every time a program is offered) as well as nonrecurring costs (which are one-time expenses, such as hardware purchases). The recurring expenses are addressed in the operation stage discussed next.

When compared to traditional teaching environments, e-learning programs generally have higher nonrecurring costs and lower recurring costs, depending upon how courses are staffed and structured. E-learning requires the purchase of computer hardware and software to support Web-based management of course materials. These costs, however, can be amortized over the life of the course. The development of course materials is primarily a non-recurring cost, though modifications to the course may be viewed as a recurring expense.

Indirect costs, such as academic support, student services and other institutional support, are frequently not addressed in the life cycle cost perspective since these costs are borne by others responsible for the general operation of an institution. Occasionally these costs are embedded in budgets for specific projects and activities and labeled overhead or indirect costs.

Activities that typically take place during this stage include:
· Course development (or redevelopment);
· Purchase of hardware or equipment (e.g., server);
· Purchase of software (e.g., WebCT license);
· Purchase of instructional materials (e.g., reference books);
· Purchase of office equipment;
· Production of materials for class use;
· Renovation of facilities;
· One-time rentals; and,
· Replacement and upgrading of equipment and tools.

Not all of these expenditures were required for this project since all of the courses had been offered previously in the face-to-face mode or online using other Web-based support systems. In addition, the procurement and installation of Web-based course management systems (Blackboard and WebCT) had already been accomplished. Seeking to define how much of these investments could be attributed to the three courses was not deemed to be worthwhile.

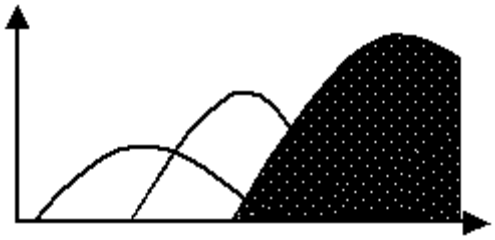

Figure 18. Stage 3 - operation.

The operation stage (Figure 18), refers to the instructional activities that take place to support the learning objectives. Examples of a recurring cost are software license fees (e.g., BlackBoard and WebCT licenses), technical support, and network/communication usage, all of which are involved each time the course is delivered.

Operational activities that took place in this effort included:
· Arranging payment of software fees;
· Providing classroom instruction;
· Advising/counseling students;
· Evaluating/assessing student work;
· Telling others about course or program;
· Ongoing instructional support activities;
· Typical pre-class review and preparation; and,
· Using networks, servers and Web-based course management software.

Cost analysis process and results
The three courses included in this study reflect relatively typical approaches to organization and delivery of instruction within most higher education contexts. For example, each course included one primary faculty member, a relatively standard time frame (one semester per course cycle), limited front-end planning and course redesign to accommodate online delivery supported by two marginally different Web-based course management systems, and a mix of instructional and learning strategies selected to support course objectives, students enrolled and the delivery systems employed. As such, describing the resources required to support any or all of these three courses could involve a straightforward one cycle operating cost (only) model, ignoring the efforts of other University and project personnel who assisted in redesigning course components, establishing information and communication networks, implementing the existing Web-based course management systems, or creating customized documentation and evaluation processes.

For a variety of reasons, particularly those relating to the intent of the Mellon CEUTT initiative, a more high-level conceptual view of the resources required to plan for and implement each course was adopted. This view is not necessarily unique. It is supported by those who seek to thoroughly document innovative instructional change ventures where the intervention must begin more-or-less "from scratch". This, more comprehensive, approach represents a longer-term perspective on resource requirements to support innovation and change. This long-term innovation life cycle view is reflected here as a life cycle cost analysis scheme that considers pre-instructional delivery efforts, multi-organization contributors and distribution of one-time front-end expenditures across multiple (lifetime) offerings of a course.

Figure 19. Focus of this study

In this particular project with these three courses, a full examination of all life cycle expenditures did not make sense given the already operational status of the three courses selected for the study. Since the courses and associated faculty members had considerable pre-study histories of development, delivery and online application, capturing or estimating the time and energy required to initially design each course, learn how to use a Web-based course management system or practice multiple communication strategies (chat, etc) was not considered (Figure 19). In another context (e.g., with new courses, or with faculty new

to the subject or new to online learning) a more comprehensive analysis approach would be warranted.

What is relatively unique about the overall analysis employed in this project is the multiple perspective approach taken to document and assess project resources (inputs), processes (including throughput measures) and outcomes. Typical analyses of such innovations adopt an institutional perspective of costs, processes and results. In this project, faculty and student perspectives of relative costs (e.g., student time), activities and impacts (including incentives and motivation - or lack thereof) are also considered. Thus when considering this project report as a whole, information related to faculty time, student time and activities, and comparisons to similar face-to-face course learner performance should be viewed from a variety of perspectives.

For this part of the report and the overall project, costs are defined to reflect institutional investments augmented by Mellon project resources. Donated, volunteer or inherited resources are addressed (see Table 9) but not explicitly included in costs although they could be estimated if the purpose was to help predict future costs (investments) of e-learning development ventures. The following sections thus reflect a constrained life cycle costing approach to investment analysis. Not addressed, for example, are the costs to establish a Web-based course management system (already existing), design a new course from the beginning (existing courses) or prepare an uninvolved faculty member to use e-learning support tools (experienced faculty). For the purposes of this study, faculty, support personnel and student time were reported for each course. E-learning instructional and communication strategies are described (e-mail, threaded discussions, chat sessions) for each course offering. The cost analysis focuses on these activities.

What follows here is a description of the approach taken to conduct one typical cost analysis using some average cost data (e.g., typical faculty salary) and actual student assistant and other support personnel costs. Actual costs for various project activities could be reflected when invoices, agency budget records or self-reported data were available or obtained. Valid life cycle cost comparisons between the three courses, with one course taught previously in a face-to-face role or with Web-supported courses at other institutions would be interesting if full life cycle costs could be identified for each. This is not the case for any of the cases reported here. Future studies of full-scale, cradle-to-grave instructional ventures, particularly those involving e-learning applications, will hopefully follow. Such an enterprise has been described by leading evaluation researchers (Baker & O'Neil, in press).

One final issue related to costing these ventures merits brief discussion. The currently predominant model for resource analysis is typically labeled ROI or return on investment analysis. It assumes the capacity (and wisdom) to carefully identify, categorize and cost all resources and ultimately aggregate those costs into some overall life cycle cost figure that can then be distributed across all cycles of the course under review. The other side of this model requires judicious review and assessment of all (or critical) outcomes, results and impacts such that those outcomes can be portrayed as quantifiable data suitable for valuing in monetary terms thus allowing comparison of outcomes (return) to inputs (investment) in common (monetary) terms. Whether we, or others, agree with this approach or not, some attempt to describe what was (and is) obtained for the effort (resources expended) does make sense. Absent this view of innovation, attention can be focused only on costs, activities (processes) or results, thus allowing selected evidence to influence decision making without more thorough consideration of a full range of evidence. This report seeks to present a relatively comprehensive view of the many facets of e-learning applied in higher education.

Cost categorization and allocation

Cost analysis of instructional design and implementation projects such as this one requires thoughtful consideration and clear rationale for classifying and allocating resources to project phases or activities. Typical university accounting schemes are not established or maintained to serve this purpose. The standard university accounting scheme exists to guide budget planning and especially expenditure documentation and control.

For purposes of describing and attributing the use of resources to various phases and functions of this project, some form of functional life cycle cost analysis was required. In addition to clearly (hopefully) defining the project phases or functional activities (e.g., planning, production and implementation), some way of categorizing project resources was also necessary. These categories could closely reflect standard institutional accounting labels but in many cases these are not monitored or reflected in activity-based budgets and costs. Such is the case, for example, with support personnel located throughout the institution in difference agencies and centers.

A fairly standard cost categorization scheme was employed to assist in classifying and documenting the use of each relevant resource. Most functional, life cycle costing schemes employ a similar scheme but the addition of e-learning design and implementation required some addition of sub categories.

The five major categories with selected sub-category labels are included in Table 9. Implications for e-

learning applications for each of the categories are discussed in the following sections. Some did not require attention in this study given where each course and faculty use in relation to initial design (not relevant), Web delivery (some relevance), and equipment procurement (little or none). For future Web-based application decisions, all five conversations merit some attention.

Table 9. Cost categories.

A. Personnel: Salaries and Benefits
1. Instructional staff: faculty, teaching assistants
2. Support staff: non-instruction, secretarial, Web managers, technology support
3. Program administration: managerial personnel, supervisors, project directors
4. Maintenance staff: support systems, design and development
B. Hardware
1. Simulators - trainers
2. Audiovisual equipment
3. Web connection and Web course management servers
C. Software and Courseware
1. Instructional materials and supplies
2. Training Aids
3. Expendable materials
4. Training manuals, technical manuals
D. Facilities
1. Classrooms
2. Laboratories
3. Administrative - managerial - support facilities
4. Web delivery and communication devices
E. Institutional Overhead/Administration
1. Institutional management
2. Libraries
3. Computer facilities
4. Contracted services - consultants, licenses, agreements
5. Institutional overhead