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ABSTRACT

This report summarizes eight case studies undertaken to evaluate the benefits and costs of mediated instruction and distributed learning. The case studies included: (1) "The Master's Degree in Social Work at Cleveland State University and the University of Akron: A Case Study of the Benefits and Costs of a Joint Degree Program Offered via Videoconferencing"; (2) "Teaching College Literacy: A Case Study in the Benefits and Costs of Daedalus Courseware at Baruch College"; (3) "The WESTNET Program--SUNY Brockport and the SUNY Campuses in Western New York State: A Case Study in the Benefits and Costs of an Interaction Television Network"; (4) "Courseware for Remedial Mathematics: A Case Study in the Benefits and Costs of the Mediated Learning System in the California State University"; (5) "The Education Network of Maine: A Case Study in the Benefits and Costs of Instructional Television"; (6) "TELETECHNET--Old Dominion University and 'Two Plus Two' Programs at Community Colleges in Virginia: A Case Study in the Benefits and Costs of an Intercampus Instructional Television Network"; (7) "The Human Computer Interaction Certificate Program at Rensselaer Polytechnic Institute: A Case Study in the Benefits and Costs of a Joint Industry/University Designed Program Featuring Integrated Delivery Methods"; and (8) "Course Restructuring and the Instructional Development Initiative at Virginia Polytechnic Institute and State University: A Benefit Cost Study." (MDM)

Case Studies in Evaluating the Benefits and Costs of Mediated Instruction and Distributed Learning:

Synopses/Summaries of Eight Cases

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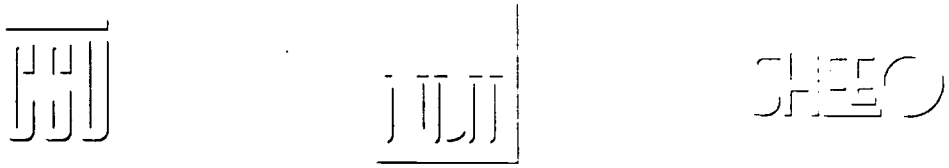
December 1998



This report is one of a series from a project entitled Case Studies in Evaluating the Benefits and Costs of Mediated Instruction and Distributed Learning. The project is funded through a Field-Initiated Studies Educational Research Grant by the National Institute on Postsecondary Education, Libraries and Lifelong Learning, Office of Educational Research and Improvement, U.S. Department of Education with additional funding provided by Information Resources and Technology in the Chancellor's Office of the California State University. The project is jointly sponsored by the California State University, the National Learning Infrastructure Initiative of EDUCAUSE, and the State Higher Education Executive Officers. Grant Award No. R309f60088.

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Introduction and Acknowledgments

This report is one of a series from a project entitled *Case Studies in Evaluating the Benefits and Costs of Mediated Instruction and Distributed Learning*. The project is funded through a Field-Initiated Studies Educational Research Grant by the National Institute on Postsecondary Education, Libraries, and Lifelong Learning, Office of Educational Research and Improvement, U.S. Department of Education, with additional funding provided by Information Resources and Technology in the Chancellor's Office of the California State University. The project is jointly sponsored by the California State University, the National Learning Infrastructure Initiative of EDUCAUSE, and the State Higher Education Executive Officers.

Eight case studies were undertaken and completed during the 1996-1998 period. The synopses/ summaries of the case studies are presented here to bring all of the results together in one place. The cases are:

"The Master's Degree in Social Work at Cleveland State University and the University of Akron: A Case Study of the Benefits and Costs of a Joint Degree Program Offered via Videoconferencing" Case study coordinators - Maggie Jackson, Cleveland State University, and Marvin Feit, University of Akron.

"Teaching College Literacy: A Case Study in the Benefits and Costs of Daedalus Courseware at Baruch College" Case study coordinator - George Otte.

"The WESTNET Program—SUNY Brockport and the SUNY Campuses in Western New York State: A Case Study in the Benefits and Costs of an Interactive Television Network" Case study coordinator - Bernard Petit.

"Courseware for Remedial Mathematics: A Case Study in the Benefits and Costs of the Mediated Learning System in the California State University" Case study coordinator - Marshall Cates, CSU Los Angeles.

"The Education Network of Maine: A Case Study in the Benefits and Costs of Instructional Television" Case study coordinators - Laurie Pruett and Pamela MacBrayne.

"TELETECHNET—Old Dominion University and "Two Plus Two" Programs at Community Colleges in Virginia: A Case Study in the Benefits and Costs of an Intercampus Instructional Television Network" Case study coordinators - Anne Savage and Edward Smith.

"The Human Computer Interaction Certificate Program at Rensselaer Polytechnic Institute: A Case Study in the Benefits and Costs of a Joint Industry/University Designed Program Featuring Integrated Delivery Methods" Case study coordinator - Susan Bray.

"Course Restructuring and the Instructional Development Initiative at Virginia Polytechnic Institute and State University: A Benefit Cost Study" Case study coordinator - Thomas Head.

All of the reports were completed in 1998 and published by the CSU Chancellor's Office. Copies are available at the benefit cost project website: <www.calstate.edu/special_projects/> and through the ERIC Higher Education Clearinghouse.

In addition to the individual case study coordinators whose names are listed above, support, assistance, and advice were also provided by members of the project's Steering, Review, and Oversight Committee: Tony Bates, Director of Distance Education and Technology, University of British Columbia; Dennis Jones, President of NCHEMS; Jim Mingle, Executive Director of SHEEO; and Tom West, Assistant Vice Chancellor for Information Resources and Technology, CSU Chancellor's Office. Frank Young, my colleague in the Chancellor's Office, wrote the summaries.

Frank Jewett

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The Master's Degree in Social Work at Cleveland State University and the University of Akron: A Case Study of the Benefits and Costs of a Joint Degree Program Offered via Videoconferencing

Context

The University of Akron (UA) and Cleveland State University (CSU) both have well developed baccalaureate programs in social work. During the 1980s there was a recognized need for a master's program. However, state policy prohibits campuses located less than 50 miles apart from offering parallel graduate degree programs in applied fields such as social work. At the time the initial program proposal was developed (early 1990s), prevailing financial constraints provided no incentive for either university to launch a new master's degree program in social work.

Objectives

To provide affordable access to a Master of Social Work degree program to students in the northeastern region of Ohio. To establish a model for collaboration between public universities. To demonstrate that a technology-mediated, distance learning program can meet the expectations of students and of a professional accrediting organization.

Method

Create a single, joint Master of Social Work program to accommodate 48 students per year. Design the program to share benefits, resources, responsibilities and costs equally between the two participating campuses. Employ high quality, digitally compressed, videoconferencing technology to enable origination and reception of live instruction in identically equipped facilities on both campuses.

Benefits

Learning Outcomes

There is no evidence of a difference in learning outcomes between students at send or receive sites, as measured by course grades, and no evidence that use of the technology affected student learning or instructor evaluations.

Student Access

The MSW program could not exist as two separate independent programs on the two campuses, and would not have been established by either campus acting alone. Students admitted to the program—80 percent female and 40 percent from minority groups—are typically place-bound, older working adults who cannot afford to relocate to attend school, and for whom lengthy commutes pose serious barriers to access.

Institutional Renewal

Faculty in social work at both universities share the professional benefits associated with graduate education. Most faculty feel that involvement in the joint program has been professionally enriching, and that the use of technology in this program has enhanced the value of the degree.

Costs

Program sharing as represented by the CSU-UA MSW degree program is less expensive than establishing independent programs at participating campuses. The total cost of the joint MSW is $1,040,000 or $12,100 per student, an estimated cost savings of over 33 percent compared with the cost of operating the two programs separately ($1,600,000 or $18,500).

The least expensive alternative would be to serve the same number of students with a single program on one of the campuses (for ca. $960,000 or $11,100 per student). However, the campuses estimate that fewer than one-half of the students now attending one of the campuses under the joint program would attend the other campus if the program were offered only at one site. Lower enrollments would result in per student costs higher than those for the joint program.

Teaching College Literacy: A Case Study in the Benefits and Costs of Daedalus Courseware at Baruch College

Context

In the mid-nineties Baruch College, part of the City University of New York system, created a limited-enrollment, noncredit course (English 0160) designed to serve a subset of students unable to demonstrate minimal proficiency in reading as well as writing. Typically, up to one-third of the students do not complete the course, and of those who do, about one-quarter fail the university's required writing assessment test given at the end of the course.

Objective

To test whether the use of computer-enhanced instruction (based upon Daedalus courseware) is effective in improving the writing ability of students who have repeatedly failed the university's required writing proficiency test.

Method

One of three spring 1997 sections of English 0160 was chosen to receive instruction using the Daedalus courseware. Two major features distinguished the computer-enhanced from the regular sections: (1) students in the computer-enhanced section received analyses of the type and frequency of errors for each written assignment; and (2) they were required to engage in weekly computer-mediated, synchronous discussions of questions about issues raised in specific reading assignments.

Benefits

Learning Outcomes

Compared with their peers in the conventionally taught sections, more students in the computer-enhanced section passed the university writing test (75 percent vs. 53 percent, one fourth of the computer section students passed with a better than minimum score, none in the conventionally taught sections had better than a minimum score), fewer failed the Writing Assessment Test (0 percent vs. 20 percent), and more passed above the minimum competency level (25 vs. 0 percent); about the same number did not complete the course (25 percent vs. 27 percent). The sample size was too small, however, to permit attribution of general improvements in student performance to the courseware. The instructor's assessment was that students in the computer group consistently wrote longer, more complex essays.

Student Access

The positive results of this limited study suggest that computer-enhanced instruction has positive, indirect potential for improving student access. To the extent students' writing skills are differentially improved through use of the technology, the persistence (and, eventually, the degree completion) rate of students from the target population should improve.

Institutional Renewal

Computer-enhanced instruction in remedial writing courses has not been institutionalized. There is no incentive for faculty who teach these courses to invest the additional time and energy initially required to use this technology.

Costs

The total costs of employing computer-enhanced instruction in the experimental section are estimated to be $544 per section (or $34 per student) more than regular classroom instruction. If the improvements in the pass rates on the required writing examination achieved in this case study could be achieved regularly, the institution could avoid costs incurred through re-enrollments of students who have previously taken the course but failed the test. Savings through cost avoidance associated with the higher passing rate are estimated at about 11 percent.

The WESTNET Program—SUNY Brockport and the SUNY Campuses in Western New York State: A Case Study in the Benefits and Costs of an Interactive Television Network

Context

Declining state support and increasing student tuition have jeopardized SUNY's mission of providing access to a quality education for all segments of the population. Downsizing of academic departments threatens the viability of degree programs associated with small departments with few majors.

Objectives

Combine faculty resources from several campuses in order to continue degree programs that otherwise would be eliminated due to insufficient enrollment at individual campuses. Enhance student learning through the use of innovative instructional approaches, exposure to students from other campuses, and opportunities to use information technologies.

Method

Establish a distance learning partnership of SUNY campuses in western New York and build the administrative and telecommunications infrastructure to link participating campuses. Create WESTNET, an intercampus network providing two-way video connections between multimedia-equipped classrooms at each of the member institutions. In spring 1997 five courses in three disciplines were shared via WESTNET: four between the originating and one receiving campus, and one between the originating and two receiving campuses.

Benefits

Learning Outcomes

Results from the first semester of implementation are mixed. The aggregate performance (as measured by final grades) of students (22) enrolled at receiving campuses was somewhat lower than that of students (54) at the originating sites. This difference may be attributable to the somewhat lower average ability (as measured by GPA) of receive-site students and to inexperience associated with initial implementation. Receive site students were uniformly supportive of WESTNET and student satisfaction surveys show no significant difference between the two groups.

Student Access

Without WESTNET, students in the five locations participating in the initial implementation of the program would not have had access to the courses offered. This experience demonstrates WESTNET's potential for maintaining student access to programs and courses in a period of curricular contraction.

Institutional Renewal

WESTNET provides an opportunity and an incentive for campuses to develop agreements and protocols for course sharing. Participating faculty and administrators benefit by cooperating with counterparts at member institutions in rethinking curriculum and redesigning courses to take advantage of information technologies.

Costs

WESTNET provides a less expensive way to deliver courses that would otherwise be at risk of being eliminated on the basis of low enrollment. Assuming the limits on enrollment and number of receive sites initially adopted, it costs about one fourth less to share a course with one campus—and about a third less for sharing with two—compared with offering the courses separately on each campus.

Courseware for Remedial Mathematics: A Case Study in the Benefits and Costs of the Mediated Learning System in the California State University

Context

Since 1983 the California State University (CSU) has required entering undergraduates to take a test of proficiency in mathematics. Students who score below the minimum required for admittance to baccalaureate level mathematics courses—typically about 50 percent of entering freshmen—must enroll in remedial courses. Failure to progress beyond the remedial level disqualifies students from further study at CSU campuses. In 1997 the CSU Board of Trustees adopted a policy aimed at reducing the percent of students requiring remedial work to 10 percent by the year 2007.

Objectives

To improve the success rate of students enrolled in remedial mathematics courses, two CSU campuses in spring 1994 began implementation of an interactive, multimedia learning system developed by Academic Systems Corporation. The intent was to exploit the ability of the courseware to: provide flexibility for individual pacing, accommodate better different learning styles, motivate students by introducing more real-life applications of mathematics, and allow for increased time on task.

Method

In fall 1996 eight CSU campuses using the Mediated Learning System participated in an evaluation comparing the learning outcomes of 4,687 students enrolled in 155 sections of elementary or intermediate remedial mathematics (algebra) courses; 1,614 in sections employing the multimedia courseware, 3,073 in traditional classroom instruction. A common pretest was given to all students, and the scores used to analyze differences in final examination results. Prior instructor familiarity with the Mediated Learning System differed considerably (from 0 to 5 semesters). Campus implementation of the system ranged from supplementing traditional classroom instruction to replacing all face-to-face instruction; on most campuses the mediated learning materials displaced 50 to 95 percent of traditional instruction.

Benefits

Learning Outcomes

The evaluation results across all eight campuses were inconclusive. Course passing rates in elementary sections uniformly favored the mediated approach; however, the difference was statistically significant in only one of seven campus comparisons. Final examination results at the elementary level were marginally higher for mediated sections on four of seven campuses, but significantly lower on two of the three remaining campuses. Similar patterns were seen at the intermediate level. The evidence suggests that the Mediated Learning System benefits elementary level students who are the most challenged mathematically. Development of computer skills and understanding is an additional learning benefit for students without prior experience with computers.

Student Access

At the time the evaluation for this case study was done, Mediated Learning System courseware was accessible only in campus computer labs. The advantages of the mediated learning approach—e.g., the ability to spend greater or lesser amounts of time on specific lessons and topics independent of instructor or tutor availability—were therefore subject to local lab access.

Institutional Renewal

Some campuses were able to increase the learning productivity of students in remedial mathematics courses by deploying the Mediated Learning System in appropriately configured laboratories and by training instructors—often graduate students preparing for careers teaching mathematics—to use the courseware effectively. One campus was able to double the number of students in each section while keeping performance levels equivalent or higher. At this campus, lessons learned each term are systematically applied to improving the quality of successive course iterations.

Costs[1]

Comparisons between the costs of mediated and traditional sections are possible only if the range of implementation modes is taken into consideration. While the cost of the site license for each campus was constant ($72,000), section enrollment in mediated classes varied between 15 and 50, usually because of computer lab capacities. Instructor costs varied depending on whether part-time or tenured faculty taught the class.

The following cost patterns emerged from the study:

- At lower levels of annual course enrollment, the costs of the Mediated Learning System always exceed those of traditional classroom instruction.
- Because of the potential to increase section size, the incremental cost of additional enrollments in the Mediated Learning System courses tends to be less than that of regular classroom course sections.
- With sufficient levels of annual enrollment (ca. 1,000 students) and the appropriate combination of cost and fee factors, Mediated Learning System costs can be less than that of classroom courses.

[1] These case study conclusions are based on the use of computer labs as the sole means of accessing Mediated Learning System courseware. Costs associated with network access may vary significantly.

The Education Network of Maine: A Case Study in the Benefits and Costs of Instructional Television

Context

About half of the total population of Maine (some 1.25 million people) is rural and distributed across heavily forested, mountainous terrain. In an effort to better serve the educational, economic, and social needs of this population, the Board of Trustees of the University of Maine System and the campus presidents in 1986 agreed to implement a statewide network of instructional television. Initially operated by the University of Maine at Augusta, the Education Network of Maine (ENM) was established as a separate entity in 1995. In 1997 the ENM was merged with the system's computing unit to form the University of Maine System Network for Education and Technology Services (UNET) and administratively attached to the systemwide Chancellor's Office.

Objectives

To improve educational access, especially to the state's rural and placebound residents.

Method

The Education Network of Maine (now UNET) provides college level learning opportunities to over 4,500 students[1] at ten established centers and approximately 100 additional receive sites around the state. Instruction originates on campuses of the University of Maine System—all of which are connected by a fiber optic network—and are broadcast via microwave channels and cable television networks. Instructional television is augmented by videotapes, online courses, and limited on-site classroom instruction at the centers.

For this case study, 1,886 students enrolled in 23 ITV courses were surveyed using Flashlight Project items associated with principles of good practice in technology-supported teaching and learning. Responses of students participating in courses from four different learning environments were compared: regular classroom (broadcast site), center site, community site, and individual student home. Statistical tests were performed to determine if there were significant differences in the responses of students located in these different sites.

Benefits

Learning Outcomes

An analysis of grade data from the 23 courses showed no statistically significant difference in student performance between students who enrolled at the broadcast locations and those at receive sites for 17 out of the 18 courses for which sufficient data were available. In only one course was there a significant difference, and that was in favor of the broadcast site.

Student Attitude

Few differences were found in the attitudes of students. Generally, the responses were positive. The only exception was with respect to access to library resources and the bookstore. Not surprisingly, on-campus students agreed more strongly than receive site students that access was adequate. In one course where videotapes were used, there was no evidence that receive site students preferred the live network course to the videotape version of the material.

1. Three thousand taking network courses and 1,500 taking live courses at the centers.

Student Access

Analysis of the 3,264 students enrolled in the sample courses suggests that of this population over 2,000 would not otherwise have been likely to enroll in a course. The availability of network courses has increased the state's total higher education participation rate by approximately 7 percent.

Costs

Network instruction is subject to scale economies. Because of the start-up and fixed costs associated with network courses, they are more expensive than classroom instruction for courses with relatively small enrollments. As course enrollments grow, network instruction becomes less expensive than classroom instruction.

Classroom instruction is the least expensive mode (about 80 percent less) for low enrollment (25 students all sites) courses. At the current (approximately 70 percent) level of network utilization, the costs of moderate enrollment (110 students) courses are essentially equal for classroom and network instruction. For high demand courses (220 students), network is less expensive than classroom instruction (by about 47 percent).

TELETECHNET—Old Dominion University and "Two Plus Two" Programs at Community Colleges in Virginia: A Case Study in the Benefits and Costs of an Intercampus Instructional Television Network

Context

The population of Virginia is growing and the proportion of occupations requiring a college degree is increasing. But funds to build new universities are not available. Old Dominion University (ODU) has been using television to deliver instruction since the mid 1980s.

Objectives

To provide expanded access to baccalaureate degree programs for students completing their lower division coursework at community colleges within Virginia. And to accomplish this result without increasing average costs.

Method

Establish an instructional television network (TELETECHNET) connecting Old Dominion University with the commonwealth's 23 community colleges. TELETECHNET is designed to transmit live classroom instruction from ODU to receive sites at the community colleges. Establish "2+2" agreements with each community college specifying the lower division courses to be taken at the community college and the upper division courses that will be provided to the site via TELETECHNET.

Benefits

Learning Outcomes

Extensive evaluation studies suggest that students taking the TELETECHNET courses at the community college sites learn the material at least as well as on-campus students. TELETECHNET students indicated a higher level of satisfaction with the courses than on-campus students. Student retention rates substantially exceed and graduation rates are comparable to on-campus rates.

Student Access

It is estimated that TELETECHNET is providing access to approximately 4,000 placebound students who otherwise would not have been able to complete bachelor's degree education. These remote site students have the effect of increasing the state higher education participation rate by over 3 percent.

Institutional Renewal

ODU has established curriculum articulation agreements with all 23 community colleges in the commonwealth. Faculty who teach TELETECHNET courses report, for the most part, that the experience is rewarding, and that training has improved their overall teaching skills.

Costs

TELETECHNET costs compare favorably with regular classroom costs for courses enrolling 200 or more students (assuming 25 students per section for the classroom version of the course). Classroom instruction costs less than TELETECHNET if course enrollment is 100 or less.

As TELETECHNET expands to its planned capacity it will achieve more economies of scale and its costs will compare even more favorably with those of classroom instruction.

The Human Computer Interaction Certificate Program at Rensselaer Polytechnic Institute: A Case Study in the Benefits and Costs of a Joint Industry/University Designed Program Featuring Integrated Delivery Methods

Context

Since 1987 Rensselaer Polytechnic Institute has offered graduate degrees and certificate programs via distance learning technologies to a growing number of corporate clients located primarily in North America. Personnel from Rensselaer's Department of Language, Literature, and Communication and IBM Corporation began joint development of the Human Computer Interaction (HCI) certificate program in 1996.

Objectives

To provide access, for individuals who work or plan to work in the computer industry, to effective, up-to-date instruction in the area of how people interact with computers. To make these courses available at a price that is acceptable to corporations and that generates revenue for the participating academic units and the Institute.

Method

The courses originate from distance learning classrooms at Rensselaer Polytechnic Institute. Students in the classroom are connected with students at multiple receive sites by an integrated satellite and videoconferencing system designed to support full interactivity and a wide range of instructional options (picture-in-picture, split screen, mixed video and computer images, etc.). Instruction includes weekly synchronous broadcasts, weekly problem-solving workshops and significant asynchronous components.

Benefits

Learning Outcomes

No significant performance differences were noted between 20 students who took an HCI course on-campus and 80 students participating from 15 corporate sites via videoconferencing (10 sites) or mailed videotapes (5 sites). (Videotapes were temporarily used in lieu of satellite transmissions owing to a failure of the carrier satellite during the term.)

Student Attitude

Survey responses indicate that both on-campus and distance learning students thought the course was very good. On-campus students strongly agreed that the presence of corporate students in the courses enhanced their learning. Students at remote sites did not consider distance learning to be "better than traditional" instruction.

Student Access

The vast majority of distance learning students indicated that they would not be able to take a course like the one in question without the joint program and without the distance learning technologies.

Institutional Renewal

Periodic meetings between IBM practitioners and Rensselaer faculty for the purpose of developing and improving courses in the program provide an "invaluable" forum for exchange of ideas beneficial to members of both groups.

Faculty members agree that learning to use distance learning technologies had a positive impact on their teaching in all courses.

The program has diversified the student population and enriched the curriculum of the Institute.

The program has provided Rensselaer an entry to major corporate locations across the nation, expanding both its visibility and reputation.

The program capitalizes on existing technical infrastructure and produces income without significant new expenditures.

Sharing of revenue generated through the program with faculty, departments and schools provides new incentives for entrepreneurial activity and innovation.

The program serves as a model to other universities for establishing effective corporate-university partnerships.

Costs

The estimated costs of an HCI course include: (1) one-time faculty start-up cost and a recurring overload payment, (2) a graduate assistant cost based upon course enrollments, (3) an allocated share of studio operation costs, and (4) an imputed share of RSVP's capital costs.

Based upon these costs and the tuition charge, the course has a break-even enrollment of about 15 receive-site students. For enrollments above that level, the course is a net revenue generator.

Course Restructuring and the Instructional Development Initiative at Virginia Polytechnic Institute and State University: A Benefit Cost Study

Context

In 1993 Virginia Tech initiated a strategic effort to encourage faculty to rethink their teaching and to explore the potential of digital technologies for improving the teaching-learning process. In addition to faculty development opportunities, the Instructional Development Initiative encompassed network improvements and equipment upgrades for classrooms, computer labs and offices. The early 1990s were also a period of significant budget cuts which required departments across campus to substitute larger enrollment courses for lower enrollment discussion courses.

Two courses representative of the course revisions supported by the Instructional Development Initiative—a freshman philosophy course and an introductory microbiology course, each enrolling about 200 students—are the basis for this case study.

Objectives

For the philosophy professor, the purpose of redesigning a freshman-level course was to simulate small group discussion sessions that were no longer possible in large enrollment courses. The goals of the biology professor were to improve student access to course materials and information, and to improve communication among students and between students and faculty.

Method

Both courses incorporated similar components:

(1) live lectures (three times per week for microbiology, one time for philosophy),(2) a class web page for posting information, course materials, links to other resources; (3) live chat room for required discussions and/or electronic office hours; (4) asynchronous, computer-mediated discussions of assigned topics; and (5) e-mail communication with instructor and classmates.

Benefits

Learning Outcomes

Philosophy: Students in the web-based course outperformed students from a parallel classroom section of the same course on 8 of 16 specific essay-scoring criteria (scores were tied on seven other criteria; the classroom section did better on one criterion). However, there were no significant differences as measured by essay grades assigned by independent evaluators in learning outcomes between students in the web-based course and their counterparts.

Microbiology: There were no significant grade differences between students who completed the technology-enhanced course and students who took the course prior to the integration of the technology components.

Student Attitude

Philosophy: Students in the web-based course emphasized the value of the technology in promoting discussion, peer review and providing access to resources on the Internet, and they appreciated the course's greater convenience and flexibility. The most frequently mentioned disadvantages were technical problems and the impersonal nature of the technology.

Microbiology: Students praised the ready access to course materials and to information outside of class provided through the web page. They did not find the chat room sessions or enrichment activities available over the web useful.

Student Access

The emphasis in the Instructional Development Initiative is on the use of the technology to improve communications with students and to improve access to course materials for on-campus students. Both objectives were accomplished.

Institutional Renewal

In the five years since the Instructional Development Initiative was launched over 1,400 faculty (out of approximately 1,500) have participated in workshops related to the instructional use of computers and the network. These faculty have been provided with high-end, networked computers and a full suite of software.

Costs

The cost of redesigning and restructuring courses to incorporate instructional technology is estimated to average $2,430 per course per term. Provision of computer access to students enrolled in restructured courses is approximately $18 per course enrollee. The total restructuring costs per course section offering, assuming 100 enrollments per section, would therefore be $4,228 (or $42 per enrollee); for sections with enrollments of 200 the totals would be $6,026 ($30 per enrollee).

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