

Distance Learning Courses in Engineering Technology at Rochester Institute of Technology

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Abstract

Two Engineering Technology departments at Rochester Institute of Technology have participated in distance learning initiatives since 1989. The Department of Electrical, Computer, and Telecommunications Engineering Technology presently offers eleven different courses in two different distance learning formats. The Department of Manufacturing and Mechanical Engineering Technology offers a bachelor of science degree in Electrical and Mechanical Engineering Technology. These Engineering Technology departments have experienced growth in the credit hours generated in these courses during the past four years. The distance learning courses have increased the productivity of the departments during times of lower student enrollments and are now providing opportunities for increases in credit hours generated by each of the departments. This paper describes the implementation of distance learning courses in the Department of Electrical, Computer, and Telecommunications Engineering Technology.

Introduction

Rochester Institute of Technology (RIT) is one of many institutions that are developing alternative learning environments to meet the educational needs of their students. Distance learning at RIT started in 1979 using the local cable TV service. The course delivery has changed considerably since 1979 and the courses in the current programs focus on delivery systems based on widely available consumer technologies. Two Engineering Technology departments at RIT started providing distance learning courses in 1989 and presently provide thirteen different courses for two different bachelor of science degree programs.

Distance learning programs at RIT are keeping us competitive with other colleges and universities. The programs meet the needs of a growing population of RIT learners for whom distance delivered instruction is the only viable means by which they can meet their education needs. Changing lifestyles, multiple career paths and the need for continuation education are fueling rapid growth in the distance learning population.¹

Distance Learning Population and Programs

In 1992-93 RIT registered 2000 students in 130 distance learning courses² and in 1995-96 registered 3500 students in 148 distance learning courses. In 1995-96 about one half (49%) of these students lived more than 30 miles from campus, across the United States and in other countries. The remaining (51%) students were Rochester-area students who utilized distance learning to overcome the barriers of time and place. During this time period 15% of these students were full-time RIT students and 9% were part-time evening students.¹ While the number of remote students has continued to grow, distance delivered courses also remain popular with co-op and full-time students with scheduling problems.

The distance program at RIT includes four different Master of Science degrees, three Bachelor of Science degrees, and eleven professional certificates. The Department of Electrical, Computer, and Telecommunications (ECT) Engineering Technology (ET) offers courses for three of the professional certificates and two of the Bachelor of Science degrees in two different formats.

The number of quarter credit hours delivered through the RIT distance learning program has been increasing each year since 1979. In 1996-97 RIT generated more than 16,500 quarter credit hours through 148 distance learning course offerings. The ECT ET Department generated 1,560 credit hours or about 9.4% of the RIT total distance learning course hours. In 1995-96 19% of the 15,126 distance learning credit hours generated came from site-based forms of delivery while in 1996-97 14% of the distance learning courses came from site-based courses. The ECT ET Department delivered 356 credit hours in 1995-96 in the three site-based courses and 844 credit hours in the six flexible format distance learning courses in the department. In 1996-97 the ECT ET department delivered 228 credit hours in the site-based courses and 1332 in the flexible format distance learning courses. In this department the percentage of credit hours delivered in distance learning courses increased to 17% in 1996-97 from 13% in 1995-96.

RIT has used different formats for their distance learning programs: flexible format, remote classroom, combination, and videoconferencing. The most popular format today at RIT is the flexible format that is an “anywhere, anytime” course format. Students using the flexible format have the course materials delivered to their homes. Students use a computer, telephone, and an Internet Service Provider to access library resources and participate in class discussions with their instructor and other students in the class. The flexible format generated 80% of the distance learning credit hours in the academic year 1996-97 and provides courses to a wide audience with minimal technology risk. The next most popular format for delivering distance learning courses at RIT is the site-based forms of delivery which generated 19% of the distance learning credit hours in 1995-96 and 14% in 1996-97.

Engineering Technology Site Courses and Laboratories

RIT started offering site-based distance learning courses in the fall of 1989. These courses were provided for a Bachelor of Science program in Electrical and Mechanical

Engineering Technology which was accredited in 1997 by the Technology Accreditation Commission (TAC) of the Accreditation Board for Engineering and Technology (ABET). The site-based distance learning courses use video tapes of live campus lecture sections. An electronic blackboard is used to provide a weekly recitation hour for each course at the site.

The ECT ET department offers five courses for the Electrical/ Mechanical (E/M) ET program, the Manufacturing and Mechanical Engineering Technology (MMET) department offers eight courses, and the College of Science provides the math and science courses. The five ECT courses are Circuits, Electronics, Machines and Transformers, Applied Microprocessors, and Power Systems. Not all of the courses in the E/M ET program have laboratories and the Power Systems course does not have a laboratory. Four of the ECT site courses have laboratories. Students enrolled in these courses travel to a site or RIT to do the laboratory experiments weekly or three times during a ten week quarter. These are the same laboratories that day and evening students complete when they take the courses on campus. Adjunct laboratory instructors at the sites teach the laboratories. Many of the sites are community colleges and the laboratory instructors are often faculty member of the college. This method has limited enrollments in these courses as students need to be within driving distance of a site or RIT to take the course. ET departments at RIT have started development of laboratories that do not require site facilities. The new laboratories will use computer simulations do some experiments. Laboratory kits that individual students will purchase or borrow for the quarter may also be used. Some courses may still require one trip to RIT during the quarter to develop and verify instrumentation skills.

Flexible Format Distance Learning Courses

In the spring of 1990 the ECT ET department offered its first course, Telecommunications Fundamentals, in the flexible format. Three years later the ECT ET department was offering six different telecommunications courses once a year in the flexible format. The ECT department also offers distance learning courses in Voice Communications, Networking Technologies, Telecommunications Policy, Switching Technologies, and Network Management. The frequency of the six course offerings increases each year. In 1996-97 the ECT ET department offered Telecommunications Fundamentals in each of the four academic quarters and each of the other courses one or two times during the academic year. The credit hours generated by the distance learning telecommunications courses has increased in each of the past three years. The department generated 568 quarter credit hours in 1994-95, 844 hours in 1995-96, and 1332 hours in 1996-97. The telecommunications fundamentals class will be offered four times this year to fifty students each quarter and two other telecommunications courses have been offered more than once a year in 1997-98. The number of quarter credit hours generated by the ECT department during 1997-98 will exceed the 1332 quarter hours generated in 1996-97.

All of the telecommunications distance learning courses offered by the ECT ET department use traditional textbooks, video-taped lectures, and conferencing systems.

Lectures have been taped during a live lecture of the course offering on campus or without a live audience. Each instructor decides on the format that they want to use. The course material and instructional techniques in each course are constantly being updated as the courses are offered on campus so each course is retaped about every two years. The six flexible format telecommunications courses and three courses in information technology provide three of the professional certificates offered by RIT. The courses in Information Technology offered in the flexible format are Introduction to Programming (C++), Program Design and Validation (C++), and Data Communications and Computer Networks. The ECT telecommunications courses are used by the students matriculated in the Bachelor of Science degree program in Applied Arts and Science for a concentration in telecommunications technology.

Four of the six telecommunications courses offered in the flexible format do not have laboratories. The two courses that have laboratories are the Voice Communications and Networking Technologies courses. The laboratory for the Voice Communications course uses the Telecommunications Systems laboratory. This laboratory is difficult to duplicate at a site as it contains over one-half million dollars of telecommunications equipment. Laboratory experiments for the voice communications courses are on video tape. These tapes show the instructor doing each experiment for this laboratory. Students watch the instructor performing the experiment and then write the laboratory reports. Six of the laboratories for the Networking Technologies courses are done remotely with a modem and computer. The other two laboratories are completed by analyzing data that is obtained from a software sniffer in a laboratory on campus and mailed to each student. The video tapes for the class show the professor using the software program.

Distance Learning Conferencing Systems

Three different conferencing systems have been used by the faculty in the department since 1989. The three site-based distance learning courses provided by the department have always used two phone lines and an Audiographic system with PC's to provide electronic white boards for the course recitations. Students in the flexible format distance learning courses used a conferencing system that was available on a Digital VAX system from 1991 to the spring of 1997. A new conferencing format, First Class, is now used for all RIT flexible format classes. The new First Class groupware product provides much better faculty and student and student and student interaction than the prior VAX conferencing system. This new conferencing system will be used in the fall of 1998 for all ECT site classes for the Electrical and Mechanical ET program.

Student Outcomes

The distance learning course formats have worked well for us. In those cases where we have had on-campus and off-campus students in the same course, we have found that there is no significant difference in the performance of students. A comparison study of 30 classes site-based distance learning classes was reported at the

1994 College Industry Education Conference.³ It was found that the off-campus students class averages were almost 0.3 points better than the on-campus students. Only four of the 30 site-based distance learning courses showed poorer student performance than the on-campus courses. We suspect that the off-campus students are more mature and more willing to take the time to study than our on-campus students.

Accreditation Review

The Commission on Higher Education of the Middle States Association of College and Schools has prepared guidelines to assist the planning, coordination, and management of distance learning programs.⁴ This report discusses many aspects of distance learning programs. These guidelines state that the evaluation and accreditation of distance learning programs will rest on an institution's efforts to demonstrate that it accepts and complies with Commission on Higher Education's standards for accreditation.

The departments using the distance learning courses in the engineering technology programs have not had problems showing that the courses provided by distance learning are equivalent to the campus courses. Distance learning is defined, for the purposes of accreditation review, as a formal educational process in which the majority of the instruction occurs when the learner and the instructor are not in the same place at the same time.⁵ RIT was accredited in 1997 by the Middle States Association of College and Schools that reviewed the bachelor of science programs provided by distance learning. All of the six telecommunications courses are required courses in the Telecommunications Engineering Technology program in the department which was the first TAC/ABET accredited program in the United States in 1992. The Bachelor of Science upper division program in the Electrical and Mechanical Engineering Technology was accredited by TAC/ABET in 1997 and became the first accredited distance learning program in engineering technology.

Institutional Support

The distance learning courses provided by the Engineering Technology (ET) departments at RIT have received institutional support during their development. The departments are not directly charged for production and distribution of the video tapes, marketing of the certificate programs, and support for the Office of Distance Learning staff. Network management for the conferencing systems is done by this office. This office also answers general student questions on distance learning by phone or e-mail and develops and distributes orientation material for new distance learning students. The office also provides the course materials, approves examination proctors, receives and logs incoming proctored examinations, and does course evaluations.

The ET departments have provided faculty release time for course development and hire the adjunct faculty that teaches the laboratories at the sites. Coordinators are hired to manage the facilities for conferencing and laboratories at the sites. The ET departments are responsible for course development and scheduling the taping of courses with the campus Educational Technology Center. In the ECT ET department faculty

members have developed courses while teaching campus courses and then been provided a course release to tape the course. The course development continues in the campus courses after the course is taped. During the past six years each course and the voice communications course laboratory in the department have been retaped every two to three years. The quality of the course provided is directly proportional to time used for course development. The RIT Ad Hoc Committee on Distance Learning estimates that it takes over 600 hours to develop a course. The Office of Distance Learning schedules seminars to introduce faculty to new technologies and have staff to assist faculty doing course development. The Institute has also provided funding to department faculty developing distance learning courses in the past with productivity grants and the department has paid faculty members for course overloads during the summer to tape courses.

Future of Distance Learning in Engineering Technology at RIT

RIT is expanding their distance learning initiatives as part of their current Strategic Plan. RIT will be trying to generate up to 10% of the total credit hours through distance learning within six years. Distance learning credit hours are presently 1.8% of the credit hours generated by the Institute. Last year the provost created a Distance Learning Task force to establish a planning basis for achieving a goal of the RIT Strategic Plan to increase the credit hours generated by distance learning. The task force reported to the RIT Academic Senate in the fall of 1997 that a 8% goal was realistic. The task force stated that RIT may be able to surpass this goal and obtain a 10% goal if significant investments in additional staff and capital equipment are made during the next six years. The engineering technology departments are being encouraged by their Dean to develop new courses and programs for these initiatives.

Distance learning initiatives increased engineering technology department productivity in the past when full-time student enrollment decreased. The ECT ET department was able to release faculty to do course development without paying overloads during the times of decreased student enrollment. Enrollments of freshman students in the three programs in department have increased for the past three years. Some faculty members who were enthusiastic about the distance learning course development have retired or left the department. Not all of the remaining engineering technology faculty members in the department are enthusiastic about these initiatives. New faculty positions are being created due to increased enrollments. The ECT department is presently recruiting new faculty members that are willing to participate in these efforts in order to maintain engineering technology leadership in course and program development at RIT.

1. Antonnietti, Reno "RIT Distance Learning Task Force Report "dated 10/97
2. Rogers, Susan M. and Warner Susan M. "Distance Learning: Flexible Options in Alternative Learning Environments" Proceedings of 1994 College Industry Education Conference pp. 112-116
3. Scudder, James "Experiences with Audiographic Technology to Support Site-based Extension Program" Proceedings of 1994 College Industry Education Conference pp. 108-111

4. "Guidelines for Distance Learning Programs" Draft for Membership Approval dated 1/97 published by the Commission on Higher Education of the Middle States Association of Colleges and Schools
5. "CHE/MSA Policy Statement on Distance Learning dated 1/97 published by the Commission on Higher Education of the Middle States Association of Colleges and Schools

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