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THE ROLE OF TECHNOLOGY IN NON-TRADITIONAL HIGHER EDUCATION

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Enclosed you will find a copy of a report entitled, "The Role of Technology in Non-Traditional Higher Education," by Mike D. Wong issued by the Center for Development Technology and the Program in Technology and Human Affairs as Report Nos. R(T)-74/3 and THA 74/5. This report constitutes Mr. Wong's M.S. thesis in the Program in Technology and Human Affairs.

Any comments you may have on this report would be appreciated.

Yours sincerely,

Bob Morgan

Robert P. Morgan

RPM:esp

Enclosure

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MIKE D. WONG

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ABSTRACT

This report analyzes the role of technology in non-traditional higher education with particular emphasis on technology-based networks. A brief overview is presented on non-traditional programs, institutions, and consortia. Non-traditional programs which utilize technology are studied. Technology-based networks are surveyed and analyzed with regard to kinds of students, learning locations, technology utilization, inter-institutional relationships, cost aspects, problems, and future outlook. An Appendix contains a comprehensive description of existing networks.

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THE ROLE OF TECHNOLOGY
IN NON-TRADITIONAL HIGHER EDUCATION

1. INTRODUCTION

1.1 BACKGROUND

The field of higher education has been undergoing major changes as it strives to serve the needs of people, society, and the higher educational structure itself. One of these changes has been the emergence of what has been termed "non-traditional" education. According to a report of the Commission on Non-Traditional Study, non-traditional education is described as:

> ". . . an attitude that puts the student first and the institution second, concentrates more on the former's need than the latter's convenience, encourages diversity of individual opportunity, and deemphasizes time and space or even course requirements in favor of competence and, where applicable, performance. It is not a new attitude; it is simply a more prevalent one than before. It has concern for the learner of any age and circumstance, for the degree aspirant or the person who finds sufficient reward in enriching life through constant periodic, or occasional study. It is an attitude that can stimulate exciting and high quality educational progress; it can also, unless great care is taken to protect the freedom it offers, be the unwitting

means to a lessening of academic rigor and even to charlatanism." (1)*

Through what are identified as non-traditional approaches to higher education, new academic changes and innovations are being instituted in colleges and universities. Many newly formed institutions have developed learning options and programs that attempt to more nearly fit the needs, conditions, and environment of the learner. Other colleges and universities have formed federations or unions to broaden their academic services and resources. Even various traditional institutions have responded by developing non-traditional options alongside traditional academic curricula.

Innovative learning options and programs have been and continue to be developed which include elements such as work-study, independent study, and field study. The faculty and the learner have cooperatively worked out learning contracts for the accomplishment of specific goals and often complete, individually-tailored learning programs result. Work experiences and skills attained from on-the-job learning or internships and apprenticeships may also serve as acceptable components of non-tradional study, as may travel experiences such as study abroad or other living-learning situations. In addition, credited work or entire degrees may be earned by elements or combinations of proficiency examinations or instruction conducted through the newspaper, correspondence, and the newer more sophisticated instructional technologies.

With these new ways of learning have come other changes that affect not only the learner, but the administration of higher education

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*The numbers in parentheses in the text indicate references in the Bibliography.

as well. Administrators seek to develop new policies and procedures for admissions, to devise new academic calendars and grading methods, to design more new, relevant degrees and programs of learning, and to reevaluate teaching ideas and testing processes.

As the non-traditional resource pool grows, the learner has a broader opportunity to receive partial or complete credentials or certification for learning experiences that are recognized within the higher education system. Furthermore, experiences are available whether the learner is interested in earning a degree or is simply seeking recognition of personal achievement. (2)

The work of the Commission on Non-Traditional Study (CNTS) has provided a wealth of information on non-traditional programs of various kinds. Included in the CNTS study are some data and analyses on the role of technology in non-traditional study. However, it was felt that additional analyses could be performed concerning technological inputs to non-traditional higher education, based in part upon CNTS data and in part upon additional information to be gathered concerning large-scale applications of technology. Much of the CNTS data is concerned with on-campus uses of audiotapes, films, etc. whereas there is a growing interest and utilization of technology to link geographically distant sites in technology-based networks.

1.2 TECHNOLOGY-BASED NETWORKS

Technology-based networks are defined in this study as networks which join geographically separate and distant locations to deliver instruction beyond the confines of a single campus by means of communications technology. Thus, technology-based networks constitute but one subset of the various elements which constitute the broad field of non-traditional study. They also represent a relatively small component of the number of instances in which technology utilization was cited in the work of the Commission on Non-Traditional Study. The latter investigation included on-campus uses of technology, which are, by definition, excluded from technology-based networks. These networks are singled out for particular attention in this thesis because of their growing numbers, their substantial capital requirements, and their increasing impact on higher education.

The particular kinds of technologies that will be considered in connection with the technology-based networks are broadcast radio and television (UHF-VHF), cable television (CATV), instructional television fixed service (ITFS), telephone conference networks, and telelecture and electrowriter link-ups. Also, networks not necessarily electronically linked, such as videotape mail-distribution systems are included. However, instructional networks involving computer-based instruction and computer resource sharing have not been examined.*

1.3 PURPOSE AND SCOPE OF INVESTIGATION

In this thesis the role of technology in non-traditional higher education will be examined. First, non-traditional programs are defined and illustrated with examples which are presented in Chapter 2. This is followed by an analysis of technology utilization in non-traditional higher education in Chapter 3. This latter work is based upon data gathered in connection with a study performed by Ruyle et al and the Center for Research and Development in Higher Education for the

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*For information on educational computer networks, see references (4) - (7).

Educational Testing Service and the Commission on Non-Traditional Study which was completed in 1973. (3) The analysis in Chapter 3 seeks to compare selected responses summarized in the Commission on Non-Traditional Study work for all institutions with those for institutions which utilize technology.

In Chapters 4 through 6, one specific aspect of technology in non-traditional higher education is singled out for particular emphasis. This aspect involves the use of technology-based networks for instructional delivery to geographically distant sites. Included are the results of a survey conducted by the author of a number of institutions which have such activity. Finally, conclusions are drawn concerning the role of technology in non-traditional higher education. An appendix contains an extensive catalogue of descriptive information on technology-based networks.

This thesis will examine that segment of non-traditional education which deals with the use of technology at the post-secondary level for identifiable learners and groups. Particular attention will be paid to specific characteristics of the programs and institutions that use the technology. These characteristics will include the kinds of student users, the modes of learning or instruction available, the focus of the programs, and the kinds of degrees or certification which are offered by the various programs. The level of technology utilization, the location of the learning activities, and the extent of inter-institutional cooperation are also of concern in the analysis. Finally, the problems encountered by the institutions using technology, the means of financing these technology-involved programs, the operating costs, and the future plans of these programs are central to the thesis. The particular kinds of technology and the manner of technology utilization are presented in considerable detail in the consideration of technology-based networks.

This study is limited by the requirement that there must be a relationship between the programs and accrediting or degree-granting higher educational institutions although the destination outlets may be such locations as the home, other educational institutions, business and industrial concerns, military facilities, and public agencies. It is also the intent to single out the more serious student from the casual learner. For this reason, ascertaining actual involvement via enrollment is used to distinguish the enrollee from the casual and infrequent student. Of the enrolled students, the degree-seeking learner or the participant in formal continuing education are of primary interest. However, other than the restriction to higher education and emphasis upon the degree or certificate seeking student, no other attempt is made at narrowing the student groups by manner of age, occupation, or previous educational levels. Neither are degree-oriented programs discriminated from those that are not. Further, for the degree-oriented curricula, the format need not be entirely non-traditional to be included. However in the latter instance, only that portion which is certified and involves the use of communication and information dissemination technologies will be of interest.

2. AN OVERVIEW OF NON-TRADITIONAL PROGRAMS

2.1 INTRODUCTION

In this Chapter, some examples of non-traditional higher education programs will be described to provide a basis for placing technology utilization in perspective within the field of non-traditional higher education as a whole. In order to accomplish this, it is necessary to emphasize the non-traditional character of the program or institution, rather than any one particular non-traditional approach. By this same rationale, external degree programs, or institutions described as "open universities" or "universities without walls" are accepted as non-traditional programs and institutions without regard to the implied semantic differences. A more specific definition of non-traditional study employed by Ruyle et al is presented in Chapter 3.

What will be established in this Chapter is the existence of many non-traditional programs and institutions which are characterized by less emphasis on structure and a lessening of the importance of on-campus activities. These approaches are also more readily intended to adapt to the individual's needs. In addition, identification, definition, and achievement of specific goals become as valid a means of certifying learning experiences as the traditional awarding of credits for courses completed.

Many of the programs operate within the infrastructure of the university, while others leave that setting to create independent institutions, such as Empire State College or Minnesota Metropolitan State College. Others work through consortia of colleges and universities like the Universities Without Walls of the Union of

Experimenting Colleges and Universities. The California State University and College System, affecting many campuses throughout that state, has awarded the traditional degree for largely off-campus academic work of a similar nature to that which conventional students on the campus have undertaken. On the other hand, institutions such as Minnesota Metropolitan State College and Empire State College are non-traditionally structured colleges awarding degrees. To a large extent, one of the characteristics of these programs and institutions is their apparent lack of utilization of technology at present.

In some instances, "non-traditional" has been interpreted to mean access to typical lecture courses at irregular times of the day. For others, it has meant learning contracts; to others still, it has referred to comprehensive examinations. Programs and institutions have developed which utilize comprehensive examinations to award or recommend accreditation for the learner's achievements. The College Proficiency Examination Program has done this for the State of New York, while the College-Level Examination Program has done so at a national level.

In some cases the access routes have been primarily for certain sectors of the population. For example, the University Without Walls HUD project is primarily for public service sector government employees, whereas the Syracuse University Independent Study Program is for students that are at least 25 years old. In other cases, previous higher educational academic records of applicants are significant factors in permitting entry into programs such as the Rochester Institute of Technology external degree program or the Union

Graduate School doctoral program, just as in more traditional graduate programs.

So under a variety of labels, composed of various elements, and by way of several applications, non-traditional higher education is expanding opportunities for many learners.

2.2 PROGRAMS

2.2.1 College-Level Examination Program

Since 1965, the College-Level Examination Program (CLEP), conducted by the College Entrance Examination Board, has grown into one of the major national examination services. CLEP has had several major goals since its inception, including the development of a national examination program that could evaluate non-traditional, college level educational experiences. The program has also aimed at demonstrating the need for credit-by-examination programs in the curricula of higher educational institutions and has promoted credit-by-examination on this basis.

In addition, CLEP has provided a means for admission, placement, and evaluation of transfer students moving into four year college and university programs as well as provided a standard by which colleges and universities may evaluate present curricula. Upon occasion the program has served to facilitate the continuing education or occupational advancements of the student learners. (8)

The program both provides and evaluates examinations taken by students. However, CLEP does not grant credit, but only makes the recommendation that a given amount of credit be awarded to the learner.

Presently, approximately 900 institutions award credit for satisfactory CLEP test scores.

The examinations fall into two major categories known as general and subject examinations. The general examinations cover particular fields at a broad level and are intended to assess general knowledge rather than specific ideas within a field. These examinations cover the fields of English composition, humanities, mathematics, and the natural and social sciences. The subject examinations, on the other hand, are more analogous to the final examinations taken at the end of the term to assess the understanding in a particular course. In general, however, the tests are designed to measure the assimilation of factual knowledge, and the recognition and application of the pertinent relationships and principles. (9)

In addition to its primary goals as stated earlier, CLEP has also been used as a means to insure a basic, minimum knowledge in many areas, to provide an alternate means for satisfying specific course requirements, and to certify the continued development of military personnel and prison in-mates in higher education. Furthermore, in some instances, CLEP scores have been used as criteria for acceptance to graduate studies.

To take the examinations, the student registers at the appropriate test center, pays a nominal fee of about $15, and takes the examination at the appointed time and location. The testing centers are distributed throughout the United States in major urban centers. The test scores are then sent to the student and any other institution that the student desires. (10)

2.2.2 College Proficiency Examination Program

In 1963, the Board of Regents of the University of the State of New York acting through the State Education Department created the College Proficiency Examination Program.

This program was charged with the responsibility of certifying the mastery by learners of various subjects, normally part of the curricula of most colleges, but acquired in non-traditional ways. In carrying out its assigned responsibilities, about thirty subject examinations were developed by faculty of New York educational institutions with the aid of State Education Department personnel to test and certify learners who passed the examinations. Standards were based upon administering the tests to regular college students. (11, 12) The program has had the most success in the areas of nursing sciences, health and teacher education, and foreign languages.

Although CPEP does not offer any form of instruction, study guides and reading lists are furnished to students to facilitate their preparation for the examinations. CPEP then recommends a given amount of credit for the examination, but each accepting institution has the right to modify the total credits granted, refuse credit, or review the applicant's examination before deciding. In this fashion, each individual institution can maintain the consistency of its particular standards. (13) Many New York institutions as well as out-of-state colleges and universities award credit for successful completion of the examinations. (12)

2.2.3 The Regents External Degree Program of New York State

The next logical step beyond the College Proficiency Examination Program was the development of a degree program. In 1971, the Board of Regents of New York introduced the Regents External Degree Program. (12, 13) This program is empowered to award degrees for the successful completion of general studies, and studies in nursing or business. The purpose of the program has been to complement the traditional higher education system of New York, while still taking advantage of knowledge and skills obtained outside the educational system. (12)

Upon enrollment a transcript of the student's creditable experiences is developed and maintained. Completion of the necessary requirements and accumulation of the necessary number of credits then leads to the awarding of either the Associate in Arts, Associate in Applied Science in Nursing, Bachelor of Science in Business Administration, or the Bachelor of Arts degree. As the need arises, other degree programs will be developed for learners.

The program sets no age, residence, or completion time requirements or beginning minimum level of educational attainment for its students; neither is any form of instruction offered. The program sets the requirements for each degree, the necessary distribution of credits, and offers study guides to assist the student. It is up to the student to accumulate the necessary number of credits to obtain the degree. (12, 13)

Credit can be earned in a number of ways, which include regular classroom coursework, several recognized proficiency examinations, military service programs, or other means of special assessment. For example, successful scores on CLEP, CPEP, College Board Advance Placement examinations, or U. S. Air Force Institute examinations are translated into credits that are awarded to the student and recorded on the transcript maintained by the Regents External Degree Program. The special assessment of creditable experiences might include evaluation of a program of study at an unaccredited technical or vocational school or a demonstration of skills or knowledge before a panel of faculty or experts in that particular field. (14)

In many ways, the Regents External Degree Program resembles a regional examination and external degree awarding service because part of its enrollment comes from beyond the boundaries of New York state. The program also works in close association with a similar New Jersey program at Thomas A. Edison College. (11) For the most part, there appears to be little use of technology in these programs.

2.2.4 Syracuse University Independent Study Program

Syracuse University has been another New York innovator of external degree programs. The Independent Study Program has enabled students, who must be at least 25 years old, to pursue a four year, non-resident A. B. degree in liberal studies.

An initial three week seminar is conducted at the beginning of the program. Thereafter, the only attendance required on campus is one annual spring weekend when final examinations are administered to the students. However, there are optional one day and weekend sessions occasionally to enable faculty and students to meet each other.

During the rest of the program, students receive materials and suggested assignments from faculty advisors, who also evaluate the assignments and students' progress. The work the students do covers a wide variety of approaches from standard term papers to more innovative assignments that involve the use of audio tapes. (15)

2.2.5 The Rochester Institute of Technology External Degree Program

The Rochester Institute of Technology, located in the industrialized area of Rochester, New York, has offered a semi-structured external degree program leading to the Master of Science in Engineering Technology through the School of Applied Science.

The external degree program, initiated in spring 1972, is designed to prepare graduates for service in many technological fields or teaching at the community college level. Admission requires a baccalaureate degree in an engineering field, mathematics, or related physical science; previous experience in teaching technical materials; and a planned self-directed "curriculum contract."

The program operates on a credit system requiring that at least one quarter of the 48 credit hours needed be taken through the School of Applied Science. However, credit is granted for work done in summer institutes, seminars, through proficiency examination, or work completed at other institutions. The program also arranges for internships as part of a community college faculty.

The Master of Science in Engineering Technology degree can be obtained in anywhere from three to five years depending on the individual circumstances and the ability to meet the requirements of the Evaluation Committee. (16)

2.2.6 External Programs Leading to Degrees in the California State University and Colleges

In 1971, under the direction of Chancellor Glen S. Dumke of the California State University and Colleges, a Commission on External Degree programs was appointed to study the ideas of external degrees through CSUC institutions and then to put forth guidelines for action. (11)

Eventually, the Commission recommended that "external degree programs . . . be programs of instruction and assessment leading to regularly established degrees of California State University and Colleges. (And that these programs) be upper-division and graduate programs designed to serve adult Californians for whom degree and certificate programs are not now available because of their inability to spend extensive periods of time 'in residence' on a college campus." (17)

Further, the decision was made to cautiously and deliberately enter into the non-traditional aspects of higher education and to carefully evaluate each of the programs. For this reason, the majority of programs resemble traditional teaching-learning models for non-traditional audiences. (17)

Since the Commission's role is primarily one of "leadership and facilitation," rather than implementation, each of the nineteen member CSUC institutions has designed its own programs. However, acting upon Commission recommendation, the programs are treated as pilot programs which run over a specific period of time. The earliest that many of the programs will terminate is about 1976. At this time, each program's final evaluation will determine whether the program will be continued or discontinued. However, during the pilot phase, each institution is encouraged to actively pursue various majors and use a diverse number of instructional methods and staffing procedures. (17, 18)

In the academic year 1972-73, six CSUC institutions were conducting ten external programs. Of these programs only California State College-Sonoma used a less structured, internship approach. Students in this program, which has emphasized the clinical aspects of psychology, have met in small groups with psychiatric personnel or psychologists from the community for informal instructional sessions. A masters degree is eventually conferred upon successful assessment of the student by an examination board. The other nine programs have used conventional classroom lecture and discussion approaches.

Six of the ten programs are offered at off-campus locations, and one is used to provide a degree to people in the service area of two other CSUC institutions that do not offer this course of study. Nine of the ten programs are for occupational fields in such areas as business and public administration or criminal justice. Two of the ten programs are limited to a particular employee group. (18) The number of programs is expected to double from ten to twenty in 1973-74.

There has also been consideration of statewide or regional consortia of or within the CSUC system because in some instances there may be a need to insure the consistency of meaning of similar degrees awarded through external programs so that the recipients have comparable skills and knowledge. For example, a business or agency may have regional or statewide offices or distribution centers where consistent skills and levels of knowledge are needed.

Also, within the infrastructure of a CSUC external degree, there has been consideration of a Credit Exchange. The Credit Exchange might be used to maintain a student's record on a CSUC transcript. Upon satisfying degree requirements, the CSUC system might award the degree separately or in conjunction with a particular institution. The Credit Exchange might also investigate and approve a variety of other learning activities such as proficiency examinations and special assessment procedures. It could also provide non-traditional learners information about external programs on a statewide basis. However, the consortium concept and Credit Exchange are at present only possibilities according to correspondence received in July, 1973. (17)

2.2.7 Extended Degrees of the University of California

In 1972, after careful study, the University of California came out in favor of external programs that would lead to regular under-graduate and graduate University of California degrees. (19) In much the same manner as the California State University and College system, UC's approach to providing expanded opportunities that lead to degrees has been cautious and deliberate. Programs are conducted through the present UC system rather than a separate, specially created institution. There is, however, a consortium organization that works in conjunction with individual campus authorities rather than as a representative entity of the total University of California system. Students must be accepted into the university on standards which are applied to the conventional clientele. Degree requirements are stated to be as exacting as those earned through on-campus work, and the regular UC faculty design and implement the external programs. (11, 19)

In 1972-73, eleven programs were either initiating operations or in the planning stages. Of these programs, seven offered or would offer bachelors or masters degrees. Three programs were planned for particular experimental groups. As in the case of the CSUC system, the programs have been designed around pilot phases. UCLA and UC-Berkeley have offered programs leading to the Master of Business Administration degree at off-campus sites. Some programs have opted to admit a number of part-time students and then reschedule courses at a more convenient time for both the part-time and regular students.

In many ways these new programs have appeared to be primarily conventional, but more non-traditional considerations are being employed. In some cases, work experience is taken into consideration for admission to the programs. Other programs are beginning to develop and use programmed instruction or new curricula. In other cases, short courses, seminars, audio tapes and videotapes, closed-circuit television, and inter-campus communications systems are used or will be used in future non-traditional external programs. (11)

2.3 INSTITUTIONS

2.3.1 Community College of Vermont

Through the efforts of the Vermont Regional Community College System, an external associate degree* has been offered to Vermont students. The program is administered from Montpelier, the headquarters for Vermont's community college system, but the Community College of Vermont has a totally external program of instruction. Regional offices and sites at high schools, colleges, and other educational facilities serve as centers for counselling and design of individual programs of study for the students. Each site is staffed with the necessary administrative and advisory personnel. Although the program is designed to provide high access to the rural population, no student is refused admittance to the Community College of Vermont.

Each admitted student receives orientation and counselling and then enters an exploratory stage of studies. During this time, the student is encouraged to follow up areas of personal interest. The duration of this exploratory period continues for as long as each student chooses to follow up particular areas of study. It is also during this time that a record of the student's activities, interests, and progress is developed. Into this record also goes the instructor's evaluation of the student. The next phase consists of developing a learning contract between counselor and student, which must be approved by the regional site's review committee. Upon completion of the

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*An associate degree generally takes two years to complete and is the equivalent of 60 semester credit hours.

program of study agreed upon in the contract, the student is awarded the associate degree. Faculty of CCV include not only the standard kinds of educators, but citizens of the community whose experience and knowledge are valuable educational resources for the students. (11)

2.3.2 Empire State College

Empire State College was founded in 1971 and is the non-traditional institution of the State University of New York system. As a non-traditional institution, it has a liberal arts orientation, and a non-residential student clientele. (20, 21) To be admitted to the college, students need only have a high school diploma or its equivalent and be capable of doing college level work. In mid-1973, Empire State College had an enrollment of about 2,000 students whose median age was about 33 years. (20) The faculty of Empire State College, or the mentors, are full-time or part-time faculty of various educational institutions within the state. (11)

The college provides both individualized programs of study and regional learning centers throughout the state where students and faculty may meet. The emphasis upon individualized studies culminates in a series of learning contracts devised by the student and Empire State College mentors. Each learning contract covers specific goals and the process for achieving these goals. The contracts may be composed of elements or combinations of regular coursework, tutorials, work-study programs, travel, and other proficiency examinations and assessments. No grades or credits are used at Empire State College as a means of evaluation. (11, 20) The degree, which may be either an associate or bachelors in the arts or sciences, is conferred when the faculty has determined the student has completed a specified program of studies at a college level of competency. (11, 20)

Empire State College has not attempted to duplicate the educational facilities of other institutions, but rather encourages the student to take advantage of facilities found on other campuses of the SUNY system and the community at large, such as museums, libraries, theaters, and laboratories. The college uses regional learning centers in metropolitan New York, Albany, Old Westbury, Rochester, and Sarasota Springs, which is the administrative center for Empire State College. More regional learning centers will be established as the need arises. (21)

In order to further assist the student's course of study, Empire State College has worked on developing a catalogue of learning materials for the students. Materials produced by the staff members whether on film, slides, audio cassettes, videotape, programmed instruction, or other materials are then made available to the students for use. (20, 21)

2.3.3 Friend's World College

Friend's World College, a member of the University Without Walls consortium of the Union of Experimenting Colleges and Universities, has been operating seven internationally distributed centers. The centers are located in Latin America, Africa, North America, West Asia, South Asia, and Europe. The centers, which students are rotated through at six month intervals, serve to develop an understanding of different cultures and peoples, which is a major theme of the college.

Seniors, returning to the North American center located in Westbury, New York, from overseas, conduct a senior seminar. The seminar is a collective pooling of the combined knowledge and experiences of the returning group. The faculty serve primarily as resources and advisors. (22)

2.3.4 Minnesota Metropolitan State College

Following the non-traditional approach, Minnesota Metropolitan State College has employed the resources of the Minneapolis-St. Paul twin cities area. Rather than building a campus that is separate from the region; the region is the campus. The libraries, museums, parks, colleges and universities, and laboratories and specialized facilities of industry and the government in the region are the structures of the college. Similarly, a small full-time faculty of conventionally trained and experienced educators is complemented by knowledgeable members of the community serving on the staff.

MMSC admits applicants who have attained two years of college or can demonstrate an equivalence of two years of college level competency on the basis of experience. The ensuing program is aimed at achieving competency rather than accumulating credits. Thus, the learning contract is the primary mode of individual study leading to a degree. (23, 24)

The college has also attempted to serve groups that have been largely passed over by the present system of traditional higher education. Thus, older students, minority groups, the poor, and women are specific target groups which MMSC wishes to serve. About 75% of

Minnesota Metropolitan State College's student clientele is over twenty-five years of age. (11)

The College seeks to develop competency in five major areas: 1) self-directed learning or basic learning and communication; 2) vocational oriented productivity; 3) community responsibility; 4) the ability to understand personal strengths and weaknesses (self-assessment); and 5) fruitful engagement in enriching leisure activities. (23, 24)

Upon completion of the goals expressed in the degree contract, the Final Assessment Committee convenes; the student presents a cumulative history of knowledge, experiences, and work completed. When the committee has decided that the student has demonstrated a college level of competency, the degree is awarded. (11)

2.3.5 Union Graduate School

The Union Graduate School of the Union of Experimenting Colleges and Universities has offered the Ph. D. degree largely on the basis of external work. Candidates average 35 years of age and are admitted on the basis of high intelligence and demonstrated ability to conduct self-directed study. The program does not use the standard credits accumulated or grades, but instead consists of a personally fulfilling study component, an experiential component that is loosely an internship, and a project demonstrating excellence.

Each individual's program begins with a colloquium, which covers a broad field of activities. These activities include independent work, assessment of available resources, and association with peers and advisors during which time a prospective program is worked out. Finally, an examination committee is chosen.

After much preparatory studying, the student with committee approval enters into a period which is similar to the pre-doctoral candidacy stage in a traditional program. The committee, which was chosen by the student, is comprised of two professors, who are specialists in their fields, two Union Graduate student peers, and a Union Graduate School core member. During this time the student assesses where he was, presently is, and chooses to go. The end result is the development of a rigorous contract between individual and committee. The contract or project demonstrating excellence may take many forms from publishing works of art, music, poetry, dance, or film to design and implementation of a socially oriented project. The committee, which keeps up-to-date on the contract's progress, must approve a final terminar (terminating seminar) which means the program is near completion. (25, 26)

2.4 CONSORTIA

2.4.1 The University Without Walls

The University Without Walls, organized in 1964 by the Union of Experimenting Colleges and Universities, consists of approximately thirty institutions of higher education. The consortium has developed alternative forms of non-traditional study with each member institution choosing an individually deemed appropriate course. (27)

The UWW has chosen to abandon such standard practices as a "fixed age group, or set time frame, the classroom as the principal place of instruction, prescribed curriculum, grades, and unit credits." (28)

Available resources to students are the facilities of the individual institution, the member institutions, and the outside world. Programs in the form of contracts individually tailored by the student with the aid of a faculty advisor may include regular classes, independent study, work-study, community service, individual or group projects, internships, travel, short courses, seminars, or any other appropriate learning experience. (29) Presently the close ties between individual and advisor provide the coordination among the student, program, and institution. Consideration has been given to the use of various kinds of technology in future consortium programs of study. (27, 28)

Each UWW member sets its particular standards for admission, and each graduate may choose that institution's degree or opt for the UWW consortium's degree upon completion of the program of studies. The degree is conferred when an assessment board has reviewed the student's achievements and concluded the stated goals have been achieved.

University Without Walls members are the following institutions: Antioch, Bard, Chicago State University, Friend's World College, Goddard, Hofstra University, Loretto Heights, University of Massachusetts, University of Minnesota, New College at Sarasota, Northeastern Illinois University, University of the Pacific, Roger Williams, Staten Island Community College, Stephens, Westminster, University of Wisconsin at Green Bay, University of Alabama, Pitzer, University of Redlands (Johnston College), Kirkland College, Shaw University, College of Racine, Florida International University, Franconia, Morgan State, Skidmore College, University of South Carolina, and Webster College.

Furthermore, there were plans to develop regional centers in several areas of the country according to a 1971 report issued by the UWW consortium.

2.4.2 The National Urban Studies Program

Since 1969 the U. S. Department of Housing and Urban Development has been operating the National Urban Studies Program, or its own version of the "University Without Walls," as it is frequently called. Through the program, many students primarily in the public services sector have been doing college level work and receiving credit. In addition, learners from the military and inner city poor can enroll in the HUD program. The program involves formal instruction in seminars, on-the-job training, and work experience. The system has developed its own "challenge" examinations, similar to the comprehensive, standardized examinations such as College-Level Examination Program tests, which are also accepted for advanced credit. A university-agency liaison ensures that appropriate learning experiences receive certification whether such events occur in the formal education arena or in a less structured situation. There is also complete compatibility between credit earned or granted within the consortial network. In order to compensate for a lack of in-house faculty, a cooperative system with professionals and professional societies helps to steer the course of the program.

Some effort is expended to develop and use learning material packages, tape cassette recorded lectures, tape-slide presentations, and videotapes, and movies. These are to be used either by the individual students or in an agency setting where many of the instructional sessions take place.

The Universities of Tulsa, Oklahoma, Detroit, and Northern Colorado, plus Southern Illinois University at Edwardsville, Central Michigan University, and Shaw College at Detroit are participating members. The largest programs are operated at Colorado, Oklahoma, and Central Michigan. (30, 31)

2.4.3 The Committee on Institutional Cooperation

In 1958, eleven large midwestern universities created the Committee on Institutional Cooperation believing that a coordinated effort would best help these institutions to more closely stay abreast of the rapid growth of knowledge and needed specialized facilities for the students at the various institutions. Since 1963, graduate students enrolled in one university have been given access to the facilities of the other member institutions. (28) Plans call for development of a CIC-sponsored external degree that will be attainable by persons residing in the midwest who can successfully complete a comprehensive examination that demonstrates mastery of a given field.

Group members are the Universities of Illinois, Indiana, Iowa, Michigan, Michigan State University, the University of Minnesota, Northwestern University, Ohio State University, Purdue University, University of Wisconsin, and the University of Chicago. (32)

2.5 TECHNOLOGY-BASED NETWORKS

Technology-based networks have been defined in this investigation as networks which join geographically separate and distant locations to deliver instruction beyond the confines of a single campus by means of communication technology such as instructional television (ITV), broadcast TV, cable television, instructional television fixed service, telephone lines, private microwave, and videotape. TAGER (the Association for Graduate Education and Research) of North Texas, the Stanford Instructional Television Network of California, and the Oklahoma Higher Education Televised Instruction System are examples of networks that link classes in distant cities together by talkback TV. Similarly the telelecture and electrowriter, the "blackboard by wire," is principally used by the Universities of Tennessee and Illinois. The Telenetwork, conference telephone link-up, used by Kansas State University in sixteen cities in the state and the University of Wisconsin's telephone network are also a form of instructional delivery via technology.

In the above cases the linking carrier is of an electronic nature. This, however, is not always the case. At least three systems, Iowa State University, SURGE (Colorado State University Resources in Graduate Education), and the University of Colorado are to some extent involved in producing and distributing through the postal services videotape programs for viewing in their respective regions and states. (33)

Technology-based networks are singled out for particular attention in Chapters 4 through 6 of this thesis.

3. TECHNOLOGY IN NON-TRADITIONAL HIGHER EDUCATION: AN ANALYSIS OF CNTS DATA

3.1 INTRODUCTION

In the previous chapter, examples of several non-traditional programs, institutions, and consortia were presented to provide an overview of the field of non-traditional higher education. Many of these activities may be characterized by an apparent lack of orientation towards technology. In this Chapter, the focus shifts to the role of technology in non-traditional higher education.

The results of this section are derived from both the published results of the study entitled, "Inventory of Institutional Resources for Non-Traditional Study," conducted by Ruyle, Geiselman, and Hefferlin and the Center for Research and Development in Higher Education for the Commission on Non-Traditional Study (CNTS) and Educational Testing Service (ETS) in 1972, and unpublished, raw data from this Ruyle et al study obtained from ETS. At present the study by Ruyle et al appears to be the most comprehensive survey done at a national level in higher education with regard to identifying and describing non-traditional programs.

The definition of "non-traditional" study used by Ruyle et al is as follows:

> "... any specially-designed programs based on new or unconventional forms of education free of the time or place limitations of traditional classroom instruction. They may be unconventional in any of the following ways:
>
> TYPE OF STUDENT ENROLLED--such as working adults, housewives, young and older adults motivated to study independently, or others who cannot easily come to the campus or do not wish to devote full time to classroom work.

LOCATION OF LEARNING EXPERIENCE--such as regional center offerings, field work, home study, or other off-campus programs.

METHOD OF INSTRUCTION--such as nonlectures or nonclassroom teaching and learning methods, distinctive from those common in higher education.

The content of the program may either be different from or the same as conventional courses or programs; but in either case it must be a program offered for nontypical groups of students or at an unusual location or in a novel way...." (3)

Ruyle et al also specifically stated that programs of the following nature need not be included:

"NONCREDIT PROGRAMS--such as one-shot weekend workshops and noncredit lecture or concert series.

CONVENTIONAL PROGRAMS FOR REGULAR STUDENTS--such as interdisciplinary majors, cluster colleges, independent study for full-time students, January intersessions, and remedial or compensatory education.

PROFESSIONAL PROGRAMS AT THE GRADUATE LEVEL--such as medical school innovations or continuing education for the bar." (3)

The Ruyle et al study is more restrictive than the thesis scope in that the emphasis in the former has been placed on the undergraduate level. In Chapters 4, 5, and 6 of this thesis, the emphasis is on technology-based networks which include professional engineering programs at the graduate level.

In this Chapter, emphasis is placed upon comparing selected responses from the overall Ruyle et al survey sample with responses from that subset of the respondent population which employed technology. This subset amounted to 193 institutions of the 1185 eventually analyzed by Ruyle et al which have offered non-traditional educational opportunities. However, the majority of the analyses in the Ruyle et al study was based upon 641 non-traditional programs in 386 institutions.

The degree to which the distribution of respondents among institutional settings in the Ruyle et al study is representative of all institutions of higher education is illustrated in Table 1. Also included for purposes of comparison is the distribution of institutions in the Ruyle et al study reporting some technology utilization.

It can be seen that the percentages in the Ruyle et al sample deviate less than 5% from the percentages for all higher educational institutions, as developed by Ruyle et al, with the exception that two year colleges are 34% of all institutions in the Ruyle et al sample compared with 41% of all higher education institutions. Thus, two year colleges are underrepresented by 7%. Although the sub-sample involving technology also deviated less than 5%, generally, from the overall distribution of higher educational institutions, the exceptions were private four or five year colleges and public two year colleges. These kinds of institutions were respectively underrepresented by 6% and overrepresented by 8% when the differences in percentages are compared.

Upon comparing institutional categories of the technology sub-sample to the Ruyle et al sample indicates four or five year private institutions using technology in non-traditional programs represented a lesser percentage of the total technology category than did this same institutional category of non-traditional category of non-traditional programs as a whole. The opposite was true of two year public institutions.

Table 1: Comparison of Distribution of Institutions among Universities, 4 or 5 year Colleges, and 2 year Colleges for Higher Education, Ruyle et al Non-Traditional Program Sample, Technology-Utilization Sub-Sample.

	Higher Education Population*	Ruyle Sample**	Sub-Sample Utilizing Technology***
Universities	15%	19%	14%
Public	9	12	10
Private	6	7	4
4 or 5 Year Colleges	44%	47%	41%
Public	9	9	12
Private	35	38	29
2 Year Colleges	41%	34%	45%
Public	32	28	40
Private	9	6	5
Total	100%	100%	100%

*Population to which survey questionnaires were sent by Ruyle et al. This population represents institutions from Education Directory, 1971-1972, Higher Education, U. S. Office of Education.

**From study by Ruyle et al. (3) This sample represents respondents to the Ruyle et al questionnaire.

***As derived by author from original ETS survey data. (34)

Less than 20% of the technology-based networks surveyed in this thesis, which form a subset of technology in non-traditional higher education, were mentioned in conjunction with the Ruyle et al sample and study. (See Appendix.)

It should also be pointed out that the Ruyle et al study employed a slightly different definition of technology than does the thesis definition. Ruyle considered the following elements as technologies: tape cassettes, programmed instruction, closed-circuit television with or without talkback capabilities, videotapes, computer-assisted instruction, broadcast radio and television, and talkback instruction based on telephone networks. In the technology utilization sub-sample discussed in this Chapter, programmed instruction with no accompanying communication or information technology such as audio tape cassettes has been excluded from the analysis.

3.2 IDENTIFICATION OF UNCONVENTIONAL FEATURES

In the study by Ruyle et al, respondents were asked to identify unconventional features of non-traditional programs from the following categories: type of student, location of instruction, method of instruction, and content of program. For the sub-sample in which technology was utilized, the type of student and the method of instruction were the most mentioned unconventional or non-traditional features, each being cited by 65% of the respondents. Location of instruction and content of program were mentioned in 62% and 46% of the responses, respectively. (See Table 2.)

The above order of priorities corresponds to those found by Ruyle et al for the overall non-traditional sample with the exception of

Table 2. Comparison of Features between the Ruyle et al Sample and the Sub-Sample Involving Technology*

	Sub-Sample Involving Technology**	Ruyle et al Sample***
<u>All Programs Citing the Following as a Non-Traditional Feature:</u>		
Type of Student	65%	70%
Method of Instruction	65	57
Location of Instruction	62	67
Content of Program	46	48
<u>All Programs Citing the Following Specific Feature or Combination of Features as Non-Traditional:</u>		
Type of Student (only)	5%	9%
Location of Instruction (only)	3	4
Method of Instruction (only)	7	6
Content of Program (only)	2	2
	17%	21%
Student and Location	14%	18%
Student and Method	5	3
Student and Content	3	6
Location and Method	5	5
Location and Content	0	1
Method and Content	5	3
	32%	36%
Student, Location, and Method	9%	7%
Student, Location, and Content	3	3
Student, Method, and Content	5	4
Location, Method, and Content	7	9
	24%	23%
Student, Location, Method, and Content	22%	20%
No Programs Mentioned	7%	-
Total	100%	100%

*Any discrepancy in figure totals are due to rounding off figures to nearest 1%. Also all percentages from the "Sub-Sample Involving Technology" column are based upon 193 responses.

**As derived by author from original ETS survey data. (34)

***From Appendix Table 2 of study by Ruyle et al. (3) The percentages found in the "Ruyle et al Sample" column are based upon three separate figures. Depending on the question, the responses may have been based 1) upon the number of institutions; 2) upon the number of non-traditional programs wherein each institution was requested to briefly describe certain aspects of as many as three of its non-traditional programs; or 3) upon one program which was singled out for more detailed information. The reader is referred to ref. 3 for further details.

method of instruction. (See Table 2.) The greater emphasis for this latter category in the technology-involved group seems reasonable because the technology is primarily used for instructional purposes. As Ruyle et al have pointed out, and as is borne out for the sub-sample involving technology, the tendency has been towards teaching non-traditional students by new methods at unconventional locations the same standard subjects. (3) To a great extent, this has also appeared to be the case with regard to the networks, such as TAGER, and many of the ITFS television systems. (See Chapter 6.)

It can be seen from Table 2 that there is very little difference in the order and approximate magnitudes of the responses to the inquiry for the overall Ruyle et al population and the sub-sample involving technology, when combinations of unconventional features are considered. For the sub-sample involving technology the largest response, 32%, indicates that at least two features were non-traditional. Furthermore, as in the case of the Ruyle et al study, the largest specific category emphasized the features of the new student and unconventional location (14%). (3) Some 24% considered three features of these programs to be non-traditional which was followed by 22% who listed four non-traditional features.

3.3 INTENDED STUDENT LEARNERS

Comparing the Ruyle et al sample and the sub-sample involving technology reveals that there is little difference in the target audiences of the programs. For non-traditional programs that have involved some use of technology, the primary groups served are the students who have been typically the same age as their counterparts in conventional programs, as well as the category "housewives and working adults". These categories are both cited in 50% of the responses. (See Table 3.) Other categories cited to a lesser degree include independent learners, special occupational groups, unemployed or disadvantaged persons, and confined or geographically isolated students.

For the Ruyle et al sample, the major target student categories were typically college-age learners (cited in 50% of the responses), housewives and working adults (45%), and special occupational groups (41%); the latter category includes health workers and governmental employees. Of these categories, two major groups; 1) housewives and working adults and 2) special occupational groups have been relatively non-conventional learners and have traditionally had low access to higher educational opportunities.

For both the total non-traditional program sample and the sub-sample involving technology, among the most cited groups are students the same age as their conventional counterparts (50%). Agewise, this category has traditionally had the greatest access to the traditional campuses of higher education and has also been noted as among the least receptive kinds of students to instruction via technology. (35)

Technology, at the network level at least, has been successful in providing service to occupational and professional learners as in TAGER's case and to geographically separated or confined persons as in the Colorado State University experience. (See section 9.1.1.) On the whole, however, technology-involved, non-traditional programs in higher education have not made these two groups primary targets of their

Table 3. Comparison of Intended Student Learners

	Sub-Sample Utilizing Technology	Ruyle et al Sample**
Same Age Students as in Conventional Programs	50%	50%
Housewives and Working Adults	50	45
Independent Learners of All Ages	36	30
Special Occupational Groups	35	41
Unemployed and Economically Disadvantaged	31	26
People Confined or Beyond Commuting Distance	21	18
Military Personnel	14	14
Other	5	5

*As derived by the author from original ETS survey data. (34)

**From Appendix Table 7 of Ruyle et al study. (3)

programs. For these two collectivities, occupational groups rank only third for the Ruyle et al sample and fourth for the technology sub-sample whereas geographically separated or confined persons rank sixth in both samples.

3.4 TYPES OF DEGREES AND LEVEL OF CERTIFICATION OFFERED

The degrees most offered and available through non-traditional programs that have utilized some form of technology have been the bachelor's degree (cited by 26% of the sub-sample) and the associate degree (22%). (See Table 4.) By comparison, graduate or professional degrees, certificates, and other degree or credit opportunities are cited as being offered less than half as often as the bachelor's degree. This particular pattern coincides with the credit and degree opportunities that have been available in non-traditional programs as a whole.

From Table 4, no direct comparison of degree opportunities is possible for technology-based networks. However, as will be seen in Chapters 4 through 6 these networks are often used to provide professionals, who may also be part-time graduate students with degree and continuing educational avenues. For this reason, professional and graduate degrees are more frequently earned via instructional networks rather than programs utilizing technology in some fashion or non-traditional education as a whole. Many of the technology-based networks were originally intended to serve the working student who most likely possesses at least a bachelor's degree.

Table 4. Comparison of Kinds of Degrees and Level of Certification Offered

	Sub-Sample Involving Technology*	Ruyle et al Sample**
Not a Certificate or Degree Program	11%	12%
Certificate Less Than Degree Level	9	11
Associate Degree	22	21
Bachelor Degree	26	25
Graduate or Professional Degree	5	8
Certificate or Associate Degree and Bachelor's Degree	3	4
Associate or Bachelor's Degree and Graduate or Professional Degree	4	3
Other Combinations (Primarily Certificate and Associate or Graduate Degree)	13	10
Other Recognition	7	6
Total	100%	100%

*As derived by author from original ETS survey data. Based upon 180 responses. (34)

**From Appendix Table 3 of Ruyle et al study. (3)

3.5 TECHNOLOGY AND LEVEL OF UTILIZATION

The technology pointed out as being most frequently used in non-traditional programs has been the audio tape cassette.* Of the total sub-sample indicating technology utilization, tape cassette is cited in 83% of the responses although only 18% of the responses indicated extensive usage. (See Table 5.)

Closed circuit television or videotapes with no immediate talkback capabilities were used by some 37% of those institutions involved with some form of technology. Computer-assisted instruction, broadcast radio or television, live talkback television and telephone-based instruction followed in order of usage.

However, even for institutions that were involved with technology, the second and third most used learning options which were cited by the survey participants were of a non-technological nature. The traditional classroom lecture level of total use was 81%, followed by tutorials at 80%. Field work was rated as the fourth most employed learning option (70%); programmed instruction was the fifth (67%).

Even where technology is used in non-traditional programs at various institutions, technology has not been the principal learning option in a majority of cases. This can be seen from Table 6. In fact, the traditional classroom lecture has been cited as being used more than twice as often as any other principal learning option. Fieldwork, tutorials, and programmed instruction, plus other methods

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*The phrase "tape cassette" appears in the Ruyle et al questionnaire. It is not clear whether this refers just to cassettes or to all forms of audiotape. The cassette, because of its ease of operation, has come into widespread usage.

Table 5. Learning Options Used in Non-Traditional Programs Involving Technology*

	Much Use	Some Use	Total Use
Tape Cassette Instruction	18%	65%	83%
Traditional Classroom Lectures	31	50	81
Tutorial	25	55	80
Fieldwork or Cooperative Work-Study	27	43	70
Programmed Instruction	18	49	67
CCTV or Videotape W/NO Immediate Feedback	4	33	37
Occasional Short-Term Campus Residency	8	24	32
Correspondence	7	20	27
Computer Assisted Instruction	2	21	23
Broadcast Radio or Television	3	17	20
Closed Circuit Live Talkback TV	3	16	19
Talkback Telephone Instruction	2	11	13

*As derived by author from original ETS survey data. (34)

Table 6. Principal Learning Option in Programs Involving Technology*

Traditional Classroom Lecture	31%
Fieldwork or Cooperative Work-Study	12
Tutorial	9
Programmed Instruction	9
Tape Cassette Instruction	5
Correspondence	3
Broadcast Radio or Television	2
Closed Circuit Live Talkback Television	2
Closed Circuit or Videotape With No Immediate Talkback	1
Occasional Short-Term Campus Residency	1
Other	10
No Response	15
	100%

*As derived by author from original ETS survey data. (34)

follow well behind the classroom lecture. Of all institutions involving technology, only 10% utilize any form of technology as the principal mode of learning.

It seems evident from Tables 5 and 6 that audio tape cassettes although extensively used, are not a principal element in non-traditional programs. Ruyle et al have pointed out that tape cassettes and programmed instruction have been used together four times as often as other individual or combinations of learning technologies. (3) This has occurred more frequently at the two year institutional level than the university or four year college level. Ruyle et al also have stated that programs which utilize tape cassettes are more prone to employ a greater number of learning options than do other programs. The particular options involved concern pacing aspects, initiation of studies, use of learning contracts, and acceptance of coursework from a variety of institutions. (See Table 7.)

Where tape cassettes have been used there has been a slightly greater effort to structure or prescribe the curriculum (48%). However, 46% of all programs where technology has been involved structure the curricula, for example by requiring a given course of studies, which is less than a 5% difference from the figure (44%) reported by Ruyle et al for all non-traditional programs. (3) This indicates that non-traditional programs are often not the totally unstructured, time-independent experiences that some conceive of them to be.

3.6 PRINCIPAL LOCATION OF LEARNING ACTIVITIES

Although many locations serve as learning centers, off-campus sites are much less frequently used than is the main campus of the

Table 7. Tape Cassettes and Learning Options in Non-Traditional Programs*

	Programs Using Tape Cassettes (N=160)	Programs Not Using Tape Cassettes (N=176)
Pacing of Program is Determined by Student	64%	43%
Most or All of Curriculum is Prescribed	48	44
Students May Begin Program at Any Time (As Opposed to Start of Term Only)	39	20
Learning Contracts are Devised Between Student and Faculty	38	23
Coursework Allowed at Several Different Campuses	37	32

*From Ruyle et al study. (3)

participating institutions as the principal learning site. For example, only 10% of the technology-involved, non-traditional programs conduct instructional activities principally at a regional or extension site*, whereas 37% of the sub-sample indicate that the main campus is still the major instructional location. (See Table 8.)

Even though the main campus has been the principal learning location, this does not imply that the utilization of technology has also been concentrated there. Ruyle et al have shown that better than 50% of the technology tools have been used at off-campus sites. (See Table 9.)

About 11% of the institutions have no principal location where the instructional activities take place, but have used a variety of sites. Another 9% use the field or outside world as the learning environment. To a lesser extent such sites as the home, community agencies, libraries, or business and industrial locations serve as locations for study.

When this distribution is compared by category to the total Ruyle et al sample, there is little deviation per category. This indicates that while the principal locations of learning are similar, the technology (Ruyle et al's definition) is more likely to be used away from the principal location. In essence, this is largely extending the instruction beyond the confines of the traditional campus.

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*The non-specific "multiple location" category could affect the order and magnitude of the other categories of Table 8 if specific locations were known.

Table 8. Principal Learning Location

	Sub-Sample Involving Technology*	Ruyle et al Sample**
Main Campus	37%	35%
Multiple Locations	11	12
Regional Learning or Extension Center	10	13
In The Field (And Combinations In The Field)	9	13
Home	7	5
Community Center, Agency, or Library	6	6
Business or Industrial Site	4	7
Other	9	9
No Programs	7	-
	100%	100%

*As derived by author from original ETS survey data. (34)

**From Appendix Table 6 of Ruyle et al study. (3)

Table 9. Primary Location of Programs Using Technology*

	% On Campus	% Off-Campus
Tape Cassettes	39%	61%
Closed Circuit TV or Videotape With No Immediate Feedback	37	63
Computer Assisted Instruction	40	60
Closed Circuit Live Talkback TV	34	66
Broadcast Radio or TV	23	77
Talkback Telephone Instruction	20	80

*From Ruyle et al study. (3)

3.7 INTER-INSTITUTIONAL RELATIONSHIPS

A majority (59%) of non-traditional programs using technology have been conducted by one institution. (See Table 10.) In the remaining cases (41%), institutions are involved in some form of cooperation with other educational institutions, business, or both. One in four institutions has interacted with some other educational facility, while only 11% have participated in cooperation with non-educational organizations. Even fewer institutions have cooperated with combinations of both educational and non-educational facilities.

When the technology-involved sub-population is compared to the total Ruyle et al population, the pattern is similar. There is, however, a moderate level of difference between the technology-involved group and the total population with regards to cooperative interaction. The technology-involved institutions have indicated a 7% greater tendency to participate with other educational institutions when compared to the Ruyle et al population. The technology-involved institutions have, also, participated in conjunction with non-educational organizations somewhat less than the overall population although many of the technology-based networks are an exception as can be seen in later Chapters.

3.8 SUBJECT MATTER ORIENTATION OF NON-TRADITIONAL PROGRAMS

Although the majority of students participating in non-traditional programs have tended to be the same age as typical students or housewives and working adults, the majority of programs have focused on occupational and career oriented areas (55%). (See Table 11.)

Table 10. Inter-Institutional Relationships For Non-Traditional Programs

	Sub-Sample Utilizing Technology*	Ruyle et al Sample**
Programs Conducted by Institution Alone	59%	58%
Cooperative Operation With Other Educational Institutions	25	18
Cooperative Operation With Other Non-Educational Institutions	11	16
Cooperative Operation With Both Educational and Non-Educational Institutions	3	3
Combination of First Three Categories	2	1
No Response	0	4
	100%	100%

*As derived by author from original ETS survey data. (34)

**From Appendix Table 16 of Ruyle et al study. (3)

Table 11. Subject Matter Orientation Of Non-Traditional Programs

	Sub-Sample Involving Technology*	Ruyle et al Sample**
Occupational or Career Orientation	55%	62%
General or Liberal Studies	40	38
Traditional Curriculum	39	42
Social Problems	26	28
Recreation or Leisure Activities	11	9
Other	9	8

*As derived by author from original ETS survey data. (34)

**From Appendix Table 5 of Ruyle et al study. (3)

The general or liberal studies area and the traditional curriculum have followed the career oriented programs as the next most frequent focal areas of interest. These are followed by areas which center on social and environmental problems such as ecology; recreation and leisure activities; or other diverse areas.

This pattern has also coincided with the preferences of the larger Ruyle et al population. However, occupational and career oriented themes have been slightly underrepresented (7%) in technology-involved institutions when compared to the larger Ruyle et al group.

3.9 COSTS OF OPERATION

For operating costs of the technology-involved sub-population, 42% of this sample indicate that the costs of non-traditional programs utilizing technology are roughly similar to the costs of conducting conventional programs. The number of institutions that believed the costs of conducting these programs was either more or less expensive was nearly equally divided, 21% and 20% respectively. Another 15% simply did not have the necessary information available to make such a decision. (See Table 12.)

3.10 SOURCES OF FUNDING

For 36% of the institutions using technology, the primary source of program funds has been derived from student fees and student-related grants directly associated with the program. Next, the institution itself has been cited in 29% of the responses as being the primary source of revenue for these non-traditional programs. Outside support, such as foundation grants, has been cited as a primary source of funds in 15% of the cases. The latter percentage is roughly the same as that

Table 12. Comparison of Operating Costs

	Sub-Sample Utilizing Technology*	Ruyle et al Sample**
Costs Similar to Conventional Programs	42%	41%
Costs More Than Conventional Programs	21	17
Costs Less Than Conventional Programs	20	20
Information Unavailable	15	15
No Response	3	7

*As derived by author from original ETS survey data. (34)

**From Appendix Table 31 of Ruyle et al study. (3)

for "other" sources which includes the state, community, or business and industrial concerns. (See Table 13.) Sources of funds from combinations of student fees and institutional subsidies or student fees and outside grants appear to be relatively rare in occurrence.

A comparison of primary funding sources between the non-traditional programs involving technology and the larger Ruyle et al sample indicates there is little difference in the distribution of such sources, with student fees and grants, and institutional subsidies representing the most substantial sources.

3.11 MAJOR PROBLEMS ENCOUNTERED

As in any endeavor, there are problems and obstacles to be overcome, and non-traditional education programs on the whole or those programs which utilize technology are no exception to this rule. The greatest problem encountered by the technology-involved, sub-population has been the lack of funds for program support. This was reported by 54% of these institutions, and it has appeared to be of greater concern (13%) to this group than for the overall non-traditional program population. (See Table 14.) It is interesting to note that the lack of funds is of greater concern to the sub-sample utilizing technology, especially when those surveyed responded that there appears to be relatively little difference between the costs for conducting the non-traditional programs (Table 12) whether the overall non-traditional program population or the sub-sample using technology is considered. It may be possible that greater long range planning and preparation of programs is necessitated where technology is involved thereby requiring that funds be assured over longer periods of time. Another possibility

Table 13. Comparison of Primary Program Funding Source

	Sub-Sample Utilizing Technology*	Ruyle et al Sample**
Self-Sustaining Via Student Fees and Grants	36%	39%
Institutional Subsidy	29	25
Foundation or Other Outside Grant	15	14
Other	16	13
Student Fees and Institutional Subsidy	2	1
Student Fees and Outside Grant	2	2

*As derived by author from original ETS survey data. (34)

**From Appendix Table 30 of Ruyle et al study. (3)

Table 14. Comparison of Problems Encountered by Non-Traditional Programs and the Sub-Sample Utilizing Technology

	Sub-Sample Utilizing Technology*	Ruyle et al Sample**
Lack of Funds	54%	41%
Difficulty in Assessing Non-Classroom Learning	43	40
Problems of Budgets Based on FTE Units	40	25
Faculty Resistance	38	32
Institution's Concern About Academic Standards	33	34
Lack of Approved Examination/Assessment Techniques	25	19
Suspicion of Passing Fad	22	20
Acceptance of Graduates Into Advanced Education or Graduate Schools	22	18
Recruitment of Appropriate Faculty	21	13
Recruitment of Students	18	12
Inadequate Preparation of Students	16	12
Lack of Interest Within Institution	14	21
Licensing and Certification	12	9
Accreditation	10	10
Lack of Interest Among Institution's Constituency	8	12
Employers Concerns About Graduates Qualifications	5	7
No Evident Demand For Such Programs	4	15
Other	4	6

*As derived by author from original ETS survey data. (34)
**From Appendix Table 51 of Ruyle et al study. (3)

is that the technology may be considered a low priority item in some situations and is the first item to be cut from the budget in time of financial exigency. The latter situation is probably less likely to occur in the case of technology-based networks.

Difficulty in assessing the value of non-classroom learning experiences and budgeting monies based upon the distribution of full-time equivalent credits have also been major problems. However, the problem of budgeting on the basis of FTE units appears to be a greater problem (15%) for institutions which indicate some technology utilization. This might be explained by the fact that the use of technology can increase flexibility with regard to instructional contact time thereby introducing the problem of defining exactly what is a "unit of instruction." Or, it may also mean that programs using technology may be less structured.

Faculty resistance was the next most problematic issue, and this issue has been slightly more acute (6%) for institutions that involve applications of technology than for institutions that have not. Also for the institutions that employ some form of technology the ability to recruit appropriate faculty (8%) and students (6%) have been of greater concern than for the overall field of non-traditional study. Conversely, it has appeared as though institutions that have utilized technological aids in non-traditional programs are somewhat more certain that there is a tangible need for non-traditional educational opportunities (11%).

Other problems which have confronted both the technologically-involved group and the total non-traditional field have included accreditation procedures, insuring academic standards both for the student and to others who might wish to evaluate these students, and other forms of institutional apathy or disinterest.

3.12 PLANS FOR TECHNOLOGY-INVOLVED, NON-TRADITIONAL PROGRAMS

Unfortunately, the future plans and activities of the majority of the technology-involved institutions are largely unknown since 60% did not respond to this question as was also the case for the greater population (71% nonresponse). (See Table 15.)

Of the respondents from the technology-involved, non-traditional group, 12% of the programs were in planning stages, and the program's non-traditional character as the term, "non-traditional," has been used by Ruyle et al was yet to be established. Another 10% had indicated plans to expand the present programs, while only 3% of the total Ruyle et al population had made any such plans. Many of the programs were simply too recent to be able to make any decision of future implementation of the present programs (8%). In sum, there does not appear to be enough information to derive a clear picture of future plans for these programs examined in the Ruyle et al study.

Table 15. Future Plans for Programs

	Sub-Sample Involving Technology*	Ruyle et al Sample**
No Response	60%	71%
Program Initiated in 1972-73	8	6
Program for 1972-73, but Probably Not Non-Traditional By Ruyle Standards	5	5
Plans For Credit by Examination	2	2
Program Coded, but Will Begin in 1972-73	1	1
Program in Planning Stages 1972-73 (May or May Not Be Non-Traditional According to Ruyle)	12	10
Plans for Shortened Degree	2	2
Plans for Greater Expansion of Existing Program	10	3
Plans to Grant Credit For Non-Course Work	0	0

*As derived by author from original ETS survey data. (34)
**From Appendix Table 53 of Ruyle et al study. (3)

4. TECHNOLOGY-BASED NETWORKS: REVIEW OF AVAILABLE INFORMATION

4.1 INTRODUCTION

In Chapter 3, an analysis was performed of utilization of technology in higher education using data obtained in connection with the work of the Commission on Non-Traditional Study (CNTS). In this and the following two chapters, the emphasis is upon the use of technology-based networks to link geographically remote locations. These networks, which have been defined in sections 1.2 and 2.5, form but one subset of the overall field of non-traditional programs, and received relatively little emphasis in the CNTS study. Technology-based networks are singled out for particular attention in this thesis because of their rather extensive technology utilization.

Chapter 4 includes a review of the literature and contains descriptive characteristics of the kinds of technologies and the circumstances in which these devices are employed. Information is presented on the cost aspects of the technologies and the manner of technology utilization in the networks. In this Chapter, heavy reliance is placed upon published and unpublished print materials as sources of information.

Next, Chapter 5 presents the results of a survey of technology-based networks conducted by the author. In the survey, particular attention is given to the information that was not readily available in publications or other printed matter. Information sought included intended and actual student groups receiving instruction via the system, promoting and inhibiting factors to technology utilization as experienced by the networks, problems faced by the networks, sources of initial funds and operating costs, and overall predisposition towards the future use of technology in higher education.

Chapter 6 contains an analysis of the technology-based networks, based in part upon the material developed in Chapters 4 and 5. The Appendix contains descriptive information on some twenty-six networks which was compiled in the course of the research. (See Listing, Table 16.)

4.1.1 Research Methodology

The methodology was comprised of three major elements: 1) a literature search, 2) follow-up correspondence with letters or telephone calls, and 3) a survey questionnaire which was developed and distributed several months later. While reviewing the current journals and other literature, it was often possible to obtain the name of institutions and individuals directly connected with or knowledgeable about specific networks. At this point it was possible to follow up the initial literature review with letters or telephone calls seeking further information. Telephone conversations often led to the acquisition of further, useful information by the author. In addition to the standard literature review and telephone conversations, a survey questionnaire (See Appendix 9.10.) provided additional information not found in the literature or obtained through further follow-up activities.

To be sure, the most effective means of compiling a specific dossier for each network would have been to visit each individual location and, while on location, accumulate the necessary information by personal interview as well as literature acquisition. This,

Table 16. Typology and Listing of Technology-Based Networks

Videotape Networks

- Colorado State University including programs SURGE, Co-TIE, and other off-campus activities
- The Iowa State University Videotape Program
- Other Videotape Programs

ITFS Instructional Television Networks

- The Stanford Instructional Television Network (SITN)
- The University of Southern California Instructional Television System
- The University-Industry Television for Education (UNITE) of the University of Minnesota
- Case Western Reserve University Instructional Television Network of Ohio
- Other ITFS Instructional Television Systems

Point-to-Point Microwave Television Systems

- The Association for Graduate Education and Research of North Texas (TAGER)
- The Indiana Higher Education Telecommunications System
- The Oklahoma Higher Education Televised Instruction System
- The Michigan Expanded Resources for Graduate Education of the University of Michigan
- The University of Rhode Island Instructional Television System
- The Ohio State University Instructional Television System
- The University of Connecticut Television System
- The University of California-Davis Instructional Television System
- The University of South Carolina Instructional Television System

Broadcast Television Networks

- The T V College of Chicago
- The Maryland Center for Public Broadcasting
- The Miami Dade Junior College of Florida
- The Kentucky Educational Television Network
- The State University of Nebraska--Project SUN
- Other Broadcast Television Networks

Other Instructional Television Networks

- The City University Mutual Benefit Instructional Network of the City University of New York (CUMBIN)

Educational Telephone Networks

- The University of Wisconsin Educational Telephone Network
- The Kansas Statewide Continuing Education Network
- The Virginia Polytechnic Institute Multi-Media System

Electrowriter Networks

- The University Extension Network (UNIVEX-Net) of the University of Illinois
- The University of Tennessee Electrowriter Network

however, was not practical for a variety of reasons, time and cost being the most noteworthy. Nevertheless, it is hoped the drawing together of information concerning the technology-based networks in the manner employed in this thesis provides a valuable starting point for future study by individuals and groups concerned with the application of technology in higher education.

4.1.2 Problems Associated with the Literature Review

While a literature review is a valuable starting point for any research effort, many problems are encountered particularly in an effort of this kind in which information on programs and costs are being sought for a sizable number of relatively new activities. First, there is the possibility that the literature from a source may become quickly outdated, as well as initially being somewhat out of date. This is particularly true of articles taken from journals. Unpublished printed material obtained from various institutions may also not always be current.

Material that is obtained from specific institutions generally falls into two categories. Some literature is of a highly factual nature designed to assist program administrators in program development and planning. In the other category, much information comes in brochures aimed at "selling" the instructional services to potential buyers.

There is also the problem of completeness of the literature which is often designed for a particular audience, for example, educators in general, educational administrators or planners, engineering educators in particular, design and communication engineers, or educational technologists. This, in turn, often leaves the researcher who seeks to review the literature from a broad perspective with unanswered or only partially answered questions.

It is hoped that the combination of literature search, telephone interviews and survey questionnaire will provide a reasonably accurate and up-to-date picture of the technology-based networks. The survey was completed towards the end of 1973.

4.2 TECHNOLOGY: AN OVERVIEW

4.2.1 Introduction

The choice of a particular kind of technology must vary with the particular environment in which it is desired to develop a technology-based network. Each technology has certain advantages and disadvantages intrinsic to that particular technology, whether it is ITFS television, point-to-point microwave television, television utilizing telephone lines, videotape, telephone networks or the electrowriter. Some characteristics and uses will now be described.

4.2.2 Broadcast Television

Broadcast television of the UHF/VHF variety is capable of covering a broad area (50-75 miles radius) and coming directly into the home. For this reason, UHF/VHF television has the potential of reaching very great numbers of persons. However, because of its one-way, mass communication orientation, any type of real-time, instructor-student interaction has not been practical. (36)

High costs have been a major problem when UHF/VHF has been used in conjunction with college accredited educational programming. First, courses are often produced to be reusable with only minor modification.

But reusability is not enough; relatively high enrollment per course must also be realized. To help maintain the enrollment level, a given course may be aired only once a year or once every two years as Chicago's T V College has done. (37)

There may also be the problem of securing broadcasting hours during which a potential student audience could watch the programs. As the number of courses and programs increase, sufficient broadcast time to carry the full schedule may become difficult to obtain. Martin-Vegue, Jr. et al have pointed out that there have been problems concerning allocation of channels to serve specific groups versus the general public, as well as corresponding problems of convenience associated with fixed-schedule broadcasting. (36)

Because relatively high enrollments per course must be realized and because greater diversification and specialization will occur during the junior-senior and graduate years, the first two years of college which tend to be less specialized may be the academic level when broadcast television can be most successfully employed. From the networks and systems examined in this thesis, this has appeared to have been the case to some extent. T V College* has offered only courses generally taken during the first two years of college, because it operates as a component of the community college system of the City Colleges of Chicago. The Maryland Center for Public Broadcasting also has emphasized general lower division or freshman-sophomore level courses. The SUN project of the State University of Nebraska had

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*Specific programs and networks referred to in this Chapter are described in the Appendix.

**It is reported now that upper level courses will also be developed.

initially planned to offer only the first two years of a total college curriculum that will lead to an associate degree.** (38)

4.2.3 Videotape

Videotape, as pointed out by Martin-Vegue, Jr. et al and Loomis et al, has the advantage of being economic in covering a highly dispersed student population which can not be effectively reached by point-to-point microwave or ITFS television systems. For this reason, a relatively diverse curriculum may be effectively videotaped for student usage in relatively small sections per course. (36)

Because the courses are videotaped and then delivered to the various receiving sites, considerable flexibility in scheduling the videotaped lectures is created for the period of time that the tapes are retained at the local sites. Students who have not been able to attend the regularly scheduled convening of a class can watch the lecture at some other time. This has been an advantageous situation for any student who has wished to review a lesson or portion of a lesson. The course instructor also has the opportunity to critically review personal teaching techniques by watching the recorded lecture. (39)

If a videotaped course is to be presented in successive academic terms, through arrangements with the television instructor a course's videotaped series may be retained for later use. Also because the videotapes are delivered in most instances by courier or the postal service to the receiving sites, problems with channel restrictions or FCC regulations are non-existent.

The greatest disadvantage to the utilization of videotape has been the resultant loss of real-time interaction between instructor and remote student. Frequently, though, pre-scheduled telephone conferences partially off-set this drawback. Nevertheless, loss of spontaneity and informality has been cited. (40)

Compatibility problems may also arise since there is a lack of videotape and related equipment standards. A producer of instructional programs may use tapes and equipment which are incompatible with a user's playback equipment. (36) Nevertheless, Martin-Vegue, Jr. et al have noted that videotape has much in its favor, especially where live instructional television can not be justified. (See section 4.3.10.)

4.2.4 Instructional Television Fixed Service

ITFS systems have been favored where there have been many classes with relatively small enrollment per section in a geographically concentrated area. (41) The broadcasts are normally live and are therefore conducive to live, real-time interaction. This feature has been among one of ITFS distribution systems strongest "selling points." Martin-Vegue, Jr. et al have also noted that ITFS stations may possibly cost much less than a UHF/VHF broadcast television station with fewer basic limitations, such as channel use time. (36)

Courses are broadcast at pre-arranged times and the off-campus students can see, hear, and respond to actual class discourse. When ITFS distribution has been combined with videotaping of the lectures at the receiving end, all the advantages and the flexibility of videotape are accrued albeit at greater expense than for live ITFS program viewing alone. (42)

ITFS television systems have been restricted access networks as have been videotape and point-to-point microwave systems. Only the member that has been willing to interact cooperatively and purchase the service has been allowed to receive the transmission. Morris has gone one step further and stated that where industry is concerned, the cost for the instruction, the capital costs, and the operating costs should be the responsibility of the industry or organizations involved. (43) This has been the situation in many of the ITFS systems, such as those of Stanford, the University of Southern California, and the University of Minnesota, in which industry has carried the main financial burden. As a result, a new source of income, industry, has helped cover the cost of operating and maintaining the networks by these universities. Morris, a leading exponent of ITFS systems, also points out that the student from industry often comes with the financial backing of his organization. (43)

4.2.5 Point-To-Point Microwave Television

Point-to-point microwave systems have been used to service geographic areas that have concentrated groups, but which span distances normally larger than an ITFS system has been able to service. TAGER of North Texas is an example of a system that has utilized a 12 Ghz microwave spine to interconnect distant ITFS area coverage systems. The Oklahoma State Higher Education Televised Instruction System has implemented its microwave link in a similar fashion. (36)

Through point-to-point microwave interconnections, a larger geographic region can be incorporated into a network with multiple origination and reception points via live interactive television, ie. one-way video with talkback. Also, many of the advantages relevant to ITFS systems have been realized by more comprehensive microwave networks.

4.2.6 Television Distributed by Telephone Company Lines

In the case of television systems that depend upon telephone lines for transmission, such as CUMBIN in New York, the primary advantage has been that telephone lines can surpass the problem of the New York skyline. Other forms of distribution, like ITFS and microwave television systems, would have major transmission problems. (44) Although the benefits of talkback television can be realized in this manner, the rental costs of the telephone lines has been a major drawback. (44)

4.2.7 Other Telephone-Based Technologies*

Other telephone-based technologies, such as telephone conferencing networks or electrowriter systems also have certain basic advantages. The University of Wisconsin and the Kansas Statewide Continuing Education programs are primarily dependent on telephone conferencing, whereas the Universities of Illinois and Tennessee systems are dependent upon electrowriter technology. Advantages of such systems include the ability to utilize existing telephone lines. This feature has enabled the networks to serve rurally isolated regions where no other technology would be economically practical. Utilizing existing telephone services, in essence, has provided nearly universal access to a delivery system. Thus it has been possible for many public and private facilities to serve as classrooms periodically for a short time. (45) The presence of telephone service has also allowed for frequent dissemination of limited amounts of instruction whenever it is convenient, rather than restricting the service to fixed schedule

*CAI networks that depend on telephone transmission lines, such as PLATO, are not included in this discussion.

programming which is often an economic necessity of more sophisticated systems. (46)

Unfortunately, telephone-based networks also have major drawbacks. The total lack of visual contact for telephone conferencing and the narrow, highly limited form of visual contact for the electrowriter have been major restrictions. For the electrowriter technology, only the transmission of information written upon a small surface can be accomplished during actual interaction between the instructor and class sections. Any other visual materials must be delivered prior to the class meeting usually by the mail or courier service. This mode of transmission may also require the instructor to teach in a manner that is not accomodating to his natural teaching style. (43)

4.3 COST ASPECTS OF TECHNOLOGY-BASED NETWORKS

4.3.1 Introduction

In the following sections of this Chapter, cost information concerning many of the technologies of the networks is presented. The technologies which are discussed include broadcast television, cable television, ITFS television, videotape, point-to-point microwave television, and telephone-based instructional technologies. Much of the cost information is based upon the work of Martin-Vegue, Jr. et al, which provides an analysis for technologies which have both a visual and audio component. (36) In addition, Morris et al have contributed substantial information on comparing incremental instructional costs of technology-based networks to the traditional on-campus costs of instruction in a study concerning the cost-effectiveness of continuing engineering studies by television. (47) Furthermore, Morris et al demonstrate cost trade-offs of videotape versus radio frequency (RF)* technologies in particular geographical settings and for various levels of programming. The Morris et al analysis is conducted using data from the Colorado State University-SURGE program, the Stanford Instructional Television Network, and TAGER. This latter analysis contains information which is particularly relevant to this study.

4.3.2 Broadcast Television

It has been pointed out by Martin-Vegue, Jr. et al in a 1971 article that UHF/VHF broadcast television systems are relatively high in cost for both initial capital costs as well as annual operations. (See Table 17.) Initial capital funding may cost from $250,000 to upwards of $1,000,000.** Annual funding may range from $120,000-$400,000 for each channel. (36) T V College is reported to have an annual budget in excess of $800,000 for a two channel operation in the years since 1966. (37)

The capital cost of $10,700,000 cited for the Kentucky Educational Television Network has covered the entire cost of developing and constructing a statewide transmission, relay, and receiving system that has been used to service all levels of education in Kentucky. (48) Annual operating costs in 1972, were estimated to be between $1,000,000-$2,000,000. (49) Costs, both of a capital and annual nature, are thus relatively high. It should be pointed out that the capital cost and annual operating cost figures given for the Kentucky Educational

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*By radio frequency (RF) technologies, Morris et al is referring to both ITFS and point-to-point microwave television which are used by Stanford and TAGER, respectively.

**Costs cited are based upon published estimates in past years and do not reflect 1974 costs.

Table 17. System Costs*

TECHNOLOGY	CAPITAL COSTS	ANNUAL OPERATING COSTS
UHF/VHF Broadcast TV	$250,000->$1,000,000 /per channel**	$120,000->$400,000 /per channel**
-TV College	—	$800,000- $900,000 /per 2 channel
-KETN***	$10,700,000 total system construction costs (1968)+	$1,000,000-$2,000,000
ITFS TV	$271,000/per channel-$535,000/per 4 channel	$42,000/per channel-$92,000/4 channel
-Stanford	$625,000 (1969)	$204,000/4 channel****
-University of Southern California	~$825,000 (1968-72)	—
Microwave TV		
-TAGER	$2,500,000 (1966-67)	$516,000****
-OHETIS	$1,700,000 (1970-71)	—
-IHETS	$ 600,000 (1966-68)	—
-Rhode Island	$ 21,000 (1960-61)	—
-Ohio State University	$ 10,000 (1963)	—
TV Distributed via telephone company lines		
-CUMBIN	$170,000 (1966-70)	$250,000
Videotape		
-CSU	$152,000-$180,000 (1967)	$159,000
-ISU	$51,000 (1968-69)	
Telephone Networks		
Electrowriter Networks		

*Costs should not be treated as 1974 dollars, particularly capital costs.

**Martin-Vegue, Jr. et al. (36)

***Not exclusively devoted to higher education and also includes point-to-point microwave television system in addition to broadcast television network.

****Morris et al. (47)

+Approximate year capital costs were incurred.

Television Network include funds which are used to finance and operate a statewide point-to-point microwave television system in addition to the broadcast television network. Not enough information was available to separate the costs for the broadcast television system and the point-to-point microwave system.

On a larger scale, research conducted by Wagner of the Open University in Great Britain has provided evidence that has indicated the Open University in Great Britain can compete with the costs of traditional higher education in that nation. (50) Whether a somewhat similar approach to higher education will prove viable in the United States in view of structural and geographical differences between the two countries which affect higher education remains to be seen. The Open University Project of the State of Nebraska (SUN) which is currently under development is somewhat analogous to the approach used by the Open University in Great Britain. It is likely that the knowledge gained from Project SUN which will use broadcast television and additional instructional support systems, will have a strong influence on future development of large-scale instructional television networks.

4.3.3 Cable Television

With regard to cable television, Martin-Vegue, Jr. et al have compared the costs of cable television and ITFS assuming the following for cable television: 1) the cable system is already in existence, and 2) adequate time and channels for distribution of the programs are available. On the basis of these assumptions, Martin-Vegue, Jr. et al point out that the cost at the receiving site for the necessary equipment plus maintenance for a four classroom receiving facility slightly favor cable TV. Considering the receiving equipment, TV monitors, time-shared talkback facilities and installation charges, the cost for ITFS facilities of approximately $10,750 compare to $9,650 for cable oriented facilities. The main difference is that ITFS facilities require headend receiving equipment, while the cable subscriber or user pays a monthly fee to receive this service. (36)

An analysis by Johnson provides additional information concerning costs and savings to the institution for the instance when a cable TV channel has been made available to a university from a local commercial cable TV system. (51) For Oregon State University, one of the case studies which comprise the Johnson study, the cable TV channel has been utilized extensively, about 40 hours each week in 1971. Also at this time, 1971, some 8,500 students, both on and off the campus were receiving televised lecture instruction over the cable TV channel.

By comparing the cost of the salaries for the faculty that would be needed to provide instruction to these 8,500 students with the instructional costs by cable TV, Johnson demonstrates that cable televised instruction costs may represent less than half the cost of the faculty salaries when instructors are used. (See Table 18.) However, Johnson points out that the extent to which costs may be reduced by cable TV usage rather than using instructors is dependent upon the following factors: 1) the maximum class enrollment allowed in each traditionally taught course, and 2) the proportion of the instructor's work day spent preparing for and meeting with students in a conventional class. While the cost of utilizing the cable TV channel might be less than half the costs incurred by using instructors, the greatest savings by cable TV utilization occur when the class

Table 18: Estimated Annual Cost Savings Generated By Televised Instruction, Oregon State University* (8,500 students total annual enrollment)**

		Number of Students Per Class in Absence of Television		
		25	50	100
Faculty Salaries Without Television		$192,000	$96,000	$48,000
Less Faculty Salaries with Television	$18,000			
Television Center - Annual Operating Expenses	35,000			
Amortization of Capital	11,000			
		64,000	64,000	64,000
Net Savings		$128,000	$32,000	$-16,000

*From study by Johnson. (51)

**Minimum enrollment for a cable televised course is 250 students, while the average for Oregon State University is 350 students.

enrollment of the cable televised course are many times the enrollment allowed in a traditional class.

A basic problem with utilizing cable TV distribution systems has appeared to be the relatively limited geographical scope. Most commercial cable systems are franchised to cover a given city or portion of a metropolitan area. However, an instructional television-based educational network may be required to span a much greater distance than cable systems presently cover in order to provide maximum access to the greatest possible student audience.

A problem encountered upon considering a dedicated educational cable TV system rather than piggybacking on a commercial system is the cost of laying the actual cable, Baer has pointed out that the cost for laying cable above ground may vary from $4,500-$6,500 per mile, while the cost of laying cable underground may range from $8,000-$100,000 per mile depending on the actual circumstances. (52) Thus, the cost of merely laying cable may be a major factor concerning implementation of a dedicated educational cable TV system.

4.3.4 ITFS TV Systems

According to the analysis of Martin-Vegue, Jr. et al,* the most economically viable large scale technologically-based educational systems have been either ITFS TV distribution or videotape networks. Martin-Vegue, Jr. et al state that ITFS TV distribution systems can operate at both capital and annual operations budgets much smaller

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*The authors of this article, "Technical and Economic Factors in University Instructional Television Systems," (ref. 36) are actively involved in marketing ITFS instructional television systems.

than UHF/VHF broadcast television systems. They state that capital costs may be as low as 15% of those for UHF/VHF, and operating costs may favor ITFS over broadcast television by as much as 20 to 1. However, Martin-Vegue, Jr. et al do not explicitly demonstrate how these particular figures are derived.

Using figures provided by Martin-Vegue, Jr. et al, the mid-value capital cost per channel for broadcast TV is roughly $625,000. Likewise, the mid-value annual operating costs are calculated to be about $260,000 per channel. However, T V College costs have indicated this figure may be nearer the upper limit given by Martin-Vegue, Jr. et al of $400,000.

Cost figures, also provided by Martin-Vegue, Jr. et al, indicate that ITFS TV capital costs are $271,000 for a one channel operation and $535,000 for a four channel operation. (See Appendix 9.8.) Annual operating costs vary from $42,000 for a one channel operation to $92,000 for four channels. (See Appendix 9.8.) However, capital cost information from the Stanford and University of Southern California ITFS networks, both four channel systems, indicate that Martin-Vegue, Jr. et al's ITFS figures may be underestimates.

Comparing the mid-value capital cost for a broadcast TV channel to an ITFS channel indicates that the cost for one channel of ITFS represents .43 the cost of a broadcast TV channel. However because the actual range of capital costs for ITFS television overlaps the lower half of the capital cost range for broadcast TV, this figure, .43, may in some instances be higher.

When annual operating costs are compared, a clear advantage is realized with ITFS TV utilization. A broadcast TV annual operations mid-value cost per channel of $260,000 is indicated whereas the ITFS per channel cost is $42,000. Annual ITFS operating costs for one channel may run as little as .16 of the annual costs for one channel of broadcast television. For a four channel operation ITFS compares even more favorably with broadcast TV. For example, the four channel costs of operating the Stanford ITFS network is $120,000 which represents about .12 the cost of a broadcast television operation assuming the cost for one channel is four times the cost for a four channel operation ($260,000 x 4 = $1,040,000).

4.3.5 Videotape

Several of the networks mentioned in this thesis have utilized the videotape technology, and the most prominent of these networks is Colorado State University SURGE program. Baldwin et al point out that this videotape network has helped to reduce the costs per quarter credit for both on and off-campus instruction, as well as being highly productive. First, the Colorado State University investigators note that off and on-campus students are charged the regular residential, part-time tuition fee of $25 per quarter credit. (53) In addition, only the instructors who teach the on-campus classes of the University are used in videotaping programs for the off-campus sections. In short, no new faculty are added for the off-campus program. However, there have been more graduate students employed for increased, non-instructional activities, such as grading assignments. (39)

> According to Baldwin et al: "For the M. S. level SURGE courses which are predominantly in engineering and mathematics,

the CSU direct cost of instruction* on campus has been estimated to be $65 per quarter credit. This figure is viewed as a conservative estimate for graduate instruction which averages 16 students per course. Any effective, non-traditional instructional system would generally be expected to compete with $65 per quarter credit if introduced on-campus."

In Table 19 total costs are presented for the Colorado State University SURGE program. The costs were determined by adding the individual costs of the following items: 1) amortization of equipment, recording space and tape; 2) operating cost of production, delivery and program administration; and 3) incremental direct instructional costs of adding off-campus students to existing classes.

After considering the number of hours and tapes required, the number of students per section, and sections per course, a cost per quarter credit hour is found to be $52**. (39) The behavior of the cost per credit hour (F) is shown in Figure 1 as a function of the number of students per section (S) using the average number of sections per course (N) as a parameter. From Figure 1 it can be seen that as the number of students per section and number of sections increase, the costs continue to decline until a theoretical limit of $13 is reached.

Thus, Baldwin et al state the case for productivity of the SURGE program as follows:

"However, in view of the present costs it should be noted that the on-campus instruction in these courses has a direct instructional cost of $65 per quarter credit for an average

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*According to Baldwin et al: "The 'direct cost of instruction' on-campus in the traditional mode is defined here as the instruction cost (faculty salaries) divided by the total number of student quarter credit hours associated with that instruction." (39)

**Appendix 9.9 provides further details.

Table 19: Total Cost of SURGE Instruction*

	Dollars per Recording Hour	Dollars per Delivered Tape
Equipment, Space and Tape	7.10	0.50
Office of Ed. Media Operating Expenses	25.15**	3.00
Instructional Operating Expenses	--	1.25+1.30 S
Total	$32.25	$4.75+1.30 S

S=students per section

*From Baldwin et al. (39)

**Based on ability to operate at current CSU level of 80 courses/year. This value becomes about $18.35 for enlarged program of 160 courses/year.

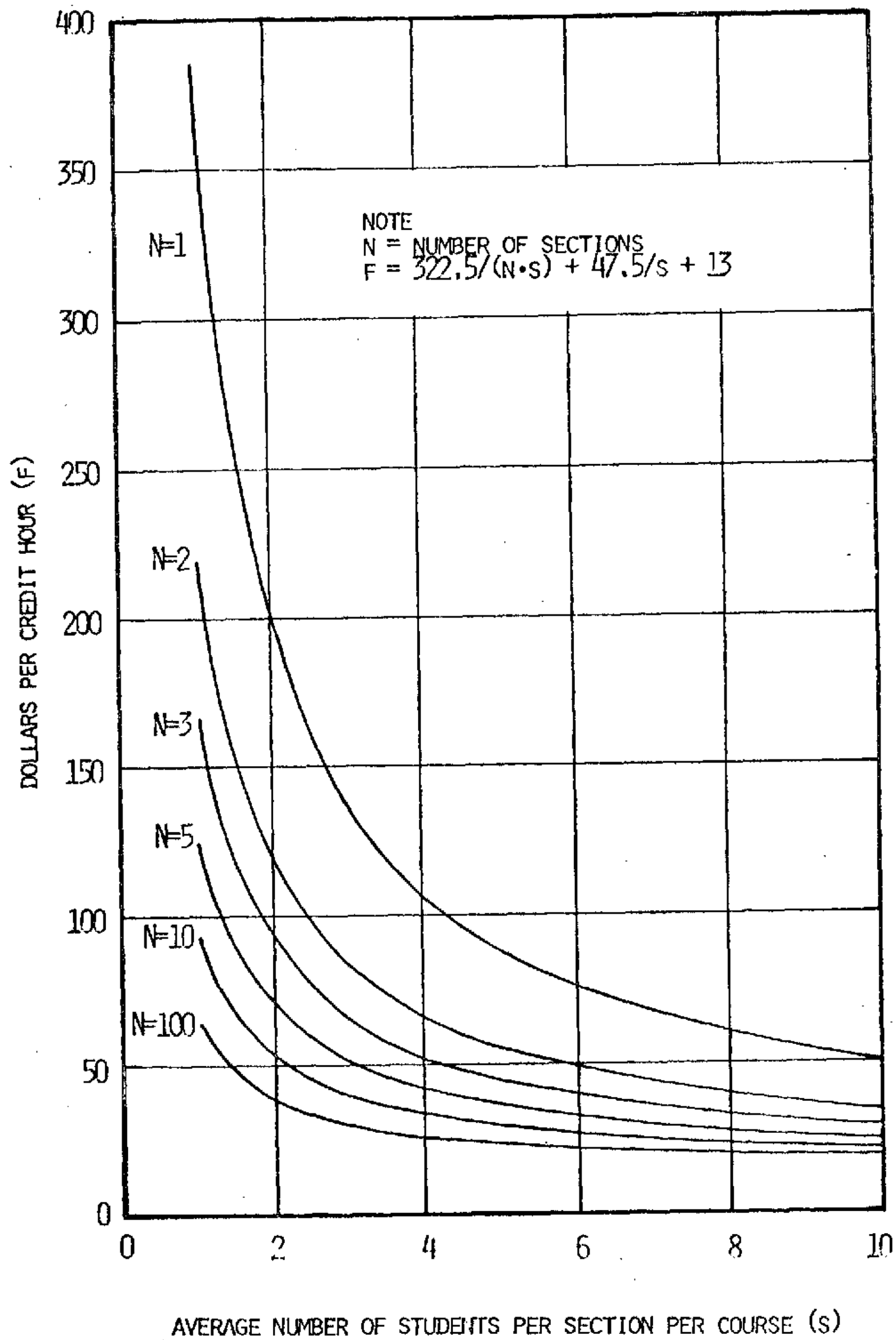

FIG. 1 CSU OFF-CAMPUS TV COST ANALYSIS

From Baldwin et al. (39)

course enrollment in 1971-72 of 15.6 students. The average cost of instruction for <u>both</u> on-campus and off-campus instruction is:

$$F_{average} = \frac{15.6\ (\$65) + 12.9\ (\$52)}{15.6 + 12.9}$$
$$= \$59 \text{ per quarter credit."}$$

"Clearly, the program lowers the instructional cost from the point of view of the university and also increases faculty productivity." (39)

Section 4.3.10 presents a detailed comparison of costs of videotape versus ITFS systems for differing user populations and differing levels of programming.

4.3.6 Point-to-Point Microwave Television

For point-to-point microwave systems, the capital costs vary greatly with the scale of the operation. Small one-hop video with two-way audio systems may cost less than 10% of the costs for an ITFS system. The larger scale operations as in TAGER, the Oklahoma Higher Education Televised Instruction System, or the Indiana Higher Education Telecommunications System cases may cost several times the capital outlay for an ITFS system. However, point-to-point microwave allows for more directionally specific, distant coverage, especially when used to interconnect points over wide areas such as the previously mentioned networks (Oklahoma's and TAGER) do.

The capital costs for a point-to-point microwave system may be several times less than the cost for a statewide educational television system such as the Kentucky Educational Television Network which incorporates both microwave and broadcast television distribution within the system. However, in either case, the number of relay and reception points in the system greatly affect the costs.

Point-to-point microwave television applications may be desirable when the following conditions apply: the number of reception points is to be restricted or specific locations are to be accessed, talkback is to be utilized, and more extensive distances than are feasible with ITFS must be achieved. In addition to possible cost advantages under certain conditions, point-to-point microwave may also be more advantageous than UHF/VHF broadcast television for the previously cited reasons of limiting access by non-paying users and utilizing talkback.

4.3.7 Telephone-Based Technologies

Where television distributed by telephone company lines is concerned as in CUMBIN's case, the capital costs are reasonably lower ($170,000) than the other television and videotape-based technologies, but the annual costs of operation (for CUMBIN approximately $250,000 in 1973-74) are far in excess of those indicated by ITFS or videotape networks.

Other technologies, not mentioned by Martin-Vegue, Jr. et al, such as the electrowriter and the telephone conference hook-up are less capital intensive, and also less costly operationwise than TV systems. Kriegel has pointed out that for electrowriter set ups, the first link between origination and reception locations will cost about $6,000 for a total investment. For each additional receiving location an investment of $3,000 is then needed. To this investment are the costs incurred for rental and use of the interconnecting telephone lines. This rental cost is a recurring cost, and it varies so that any single cost figure would only be accurate in specific instances. (33)

Kriegel also has pointed out that the cost of a telephone conferencing network is less than the cost of telephone line rental for a similar electrowriter network simply because the electrowriter must utilize two lines for video and audio transmission. The electrowriter and telephone conferencing networks are most practical for sparse, low density use where funds are relatively less than those required for the more sophisticated technologies. (33)

4.3.8 Talkback

According to Martin-Vegue, Jr. et al, there have been three primary methods of developing talkback capabilities, ie. the capability for real-time interaction between the separated class sections of a course. These methods are telephone, standard microwave facilities, and the ITFS audio-allocated spectrum. Costwise, Martin-Vegue, Jr. et al have estimated that for a ten year period servicing 27 different locations, ITFS response costs .49 the cost of leasing telephone lines for four channels. This factor, .49, becomes smaller if a time-shared talkback transmitter is used to serve the four channels rather than having each channel with its separate response capabilities. The comparison has been made with regard to telephone lines considered to be the necessary minimum to preserve voice quality by Stanford University. The actual dollar cost for utilizing telephone lines for this same ten year interval are approximately $1,050,000, while ITFS audio response costs are approximately $530,000. The latter falls to $170,000 when a time-shared talkback transmitter is used. (36)

4.3.9 Cost-Effectiveness of Technology-Based Networks

Morris et al in their study concerning instructional television networks for continuing engineering education provide much information concerning the cost-effectiveness of three technology-based networks. These networks are the Colorado State University SURGE program, the Stanford Instructional Television Network, and TAGER. (47) In their analysis of the cost-effectiveness of these three systems, Morris et al compare the on-campus instruction costs per student-contact-hour to the TV instructional costs per student-contact-hour of the network. The instructional cost per student-contact-hour is defined by Morris et al as the Instruction Cost Index (ICI) and is determined for both the on-campus case and the network case. It is the comparison of these indices for the on-campus situation and the network which then are used to characterize the cost-effectiveness of the network. In addition, only the incremental cost of instruction is used to determine the cost of instruction for the network, ie. faculty salaries are wholly allocated to on-campus costs rather than distributing the instructional cost between the network and institution on the basis of number of off-campus students and on-campus students. (47)

From the results of their study, Morris et al indicate that 1) CSU-SURGE instructional costs per student-contact-hour are not more than 64% of the on-campus cost of graduate instruction, 2) SITN costs of instruction are 50% of the on-campus instruction costs per student-contact-hour, and 3) TAGER instructional costs compare favorably with on-campus costs. Thus, it is concluded that these networks are cost-effective. (47)

Morris et al, however, have cautioned that in order to maximize the income from instructional TV network programming, fee considerations must be taken into account for special participants.

Morris et al make this point with particular regard to the Stanford system by the following statement:

> "Many organizations are participating primarily because of the auditor, NRO (non-registered option) and ACE (Association for Continuing Education)* related features of the ITV system. If these features did not exist, a significantly different (financial) picture would be apparent. For example, of the 4,199 student course registrations in 1972-1973, only 562 or 13% are matriculated Stanford students. One can conclude therefore that the Stanford School of Engineering ITV Network is economically viable as a direct result of the totality of its educational services to industry, not just those related to degree seeking students." (47)

4.3.10 Cost Comparison of Radio Frequency Delivery versus Videotape Delivery

Morris et al point out that networks based on either the videotape, ITFS TV, or point-to-point microwave technologies have many similar costs in common such as classroom facilities. However, it is the costs of delivering the instruction that should most concern the institution.** The delivery costs of instruction have in the CSU-SURGE, SITN, and TAGER cases been shown to be dependent upon factors such as the geographical distribution and number of participants. It is these factors which may influence the choice to utilize either Radio Frequency (RF) delivery or videotape delivery.

To demonstrate the effects of geographical distribution and the number of participants on the choice of technology, Morris et al use actual information from these three networks in hypothetical situations

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*See Stanford Instructional Television Network (section 9.2.1) for further details concerning the NRO and ACE features of the system. Words and phrases in parentheses have been inserted by the author.

**In these cases, the receiving sites for these three networks are business and industrial locations that provide for their individual receiving facilities.

to do the following: 1) compare the cost of Stanford's present RF delivery system to one using videotape delivery to serve Stanford participants with the same level of programming, 2) compare the cost of TAGER's present RF delivery system to one using videotape delivery, 3) compare the cost to Stanford for using RF delivery rather than videotape delivery when the large geographical distribution of the TAGER system exists, and 4) finally, compare the cost of RF delivery to RF delivery at half the present Stanford programming level for only one off-campus section per course. In cases 1) through 3), certain cost aspects of videotape delivery are based upon the results of the analysis of Colorado State University's SURGE program, such as the cost per delivered videotape. Also in Morris et al's hypothetical transformation from RF delivery to videotape delivery, it is assumed that the number of receiving locations per course is the same as that found for CSU-SURGE in cases 1) through 3). (47)

Stanford is an example of an RF delivery system that serves a concentrated geographical area, while TAGER is a case of RF delivery that is used to serve a more widely distributed clientele. Although CSU-SURGE was not directly examined, SURGE data was needed in order for Morris et al to transform the RF-oriented networks to the hypothetical videotape networks, and this data would be characteristic of a large scale, videotape network serving a statewide audience.

For case 1), presented above, Morris et al determine Stanford's cost of using RF delivery to be .29 the cost of videotape delivery. In other words, it costs Stanford $44,820 annually to use RF delivery to distribute 200 courses (6,000 hours of broadcasting) to 30 participating companies whereas videotape delivery would cost $155,641. For case

2), TAGER's cost for using RF delivery is 1.27 times the cost of the videotape delivery. Or, it costs TAGER $236,414 to use RF delivery rather than $186,769 to use videotape. For the case of 3), Stanford's cost of using RF delivery to provide instruction to the 30 companies participating in SITN, but spread over the area which TAGER services would be 1.53 times the cost of videotape delivery. Dollarwise, it would cost Stanford $1,740,000 to use RF when videotape delivery would cost only $1,138,000. For the case of 4), Morris et al indicate that if Stanford was broadcasting 100 courses (3,000 hours) each year rather than 200 courses (6,000 hours) and there was only one off-campus section per course, the RF delivery costs would be 1.66 greater than the cost of videotape.

As Morris et al point out, cases 1) and 2) demonstrate RF delivery is more feasible when a concentrated area is to be served ($\leq$ 40 mile radius). Case 3) points out that distances ranging beyond a 40 mile radius and reaching about 44 classrooms dramatically change the choice of either RF delivery or videotape delivery. For case 4), Morris et al demonstrate that if the initial level of programming and number of participants are not adequately evaluated, the incorrect choice of RF delivery or videotape delivery can be costly to the network. (47)

> In summation, Morris et al state, "the choice between a videotape delivery system and an rf delivery system can be made by comparing only costs of delivery and ignoring on-campus or off-campus classrooms costs.... If the number of participating organizations is small or if the number is large but is widely dispersed geographically, the choice will tend towards videotape. Conversely, if the number of organizations is large and within potential line of sight of a broadcast system, the choice will tend towards an rf system." (47)

To this Morris et al also suggest that each individual situation in which a technology-based network is a possibility is unique and that the particular circumstances require careful analysis. (47)

5. TECHNOLOGY-BASED NETWORKS: SURVEY RESULTS

5.1 INTRODUCTION

From the list of technology-based networks presented in Chapter 4, a survey questionnaire was developed and sent by the author to 27 networks.* Some 20 networks responded. Initially, telephone contact was established with the majority of participants who were subsequently mailed the questionnaire, "Survey of the Role of Technology in Higher Education," several months later. Appendix 9.10 contains a copy of the questionnaire, which employed an open-ended format. In general, the sample was representative of the various types of networks. (See Figure 2). No network on the basis of kind of technology utilized was overrepresented by more than 10%. Unfortunately no respondents employing electrowriter technology replied to the questionnaire.

The purpose of the questionnaire was to obtain information, from the viewpoint of those responsible for or involved in technology-based networks, concerning the present and future role of technology in higher education.

Questions were asked concerning the kinds of student users initially intended to be served and the kinds of users actually served by the networks. In addition, the respondents were questioned concerning the extent to which these students were receptive to instruction via

*Only 27 questionnaires were distributed although a few more networks are briefly identified in the Appendix. Of the 20 respondents, two are not included in the list of Table 16 or the Appendix. One of these networks was discontinued, and the second was not yet at the stage of development that the literature had indicated.

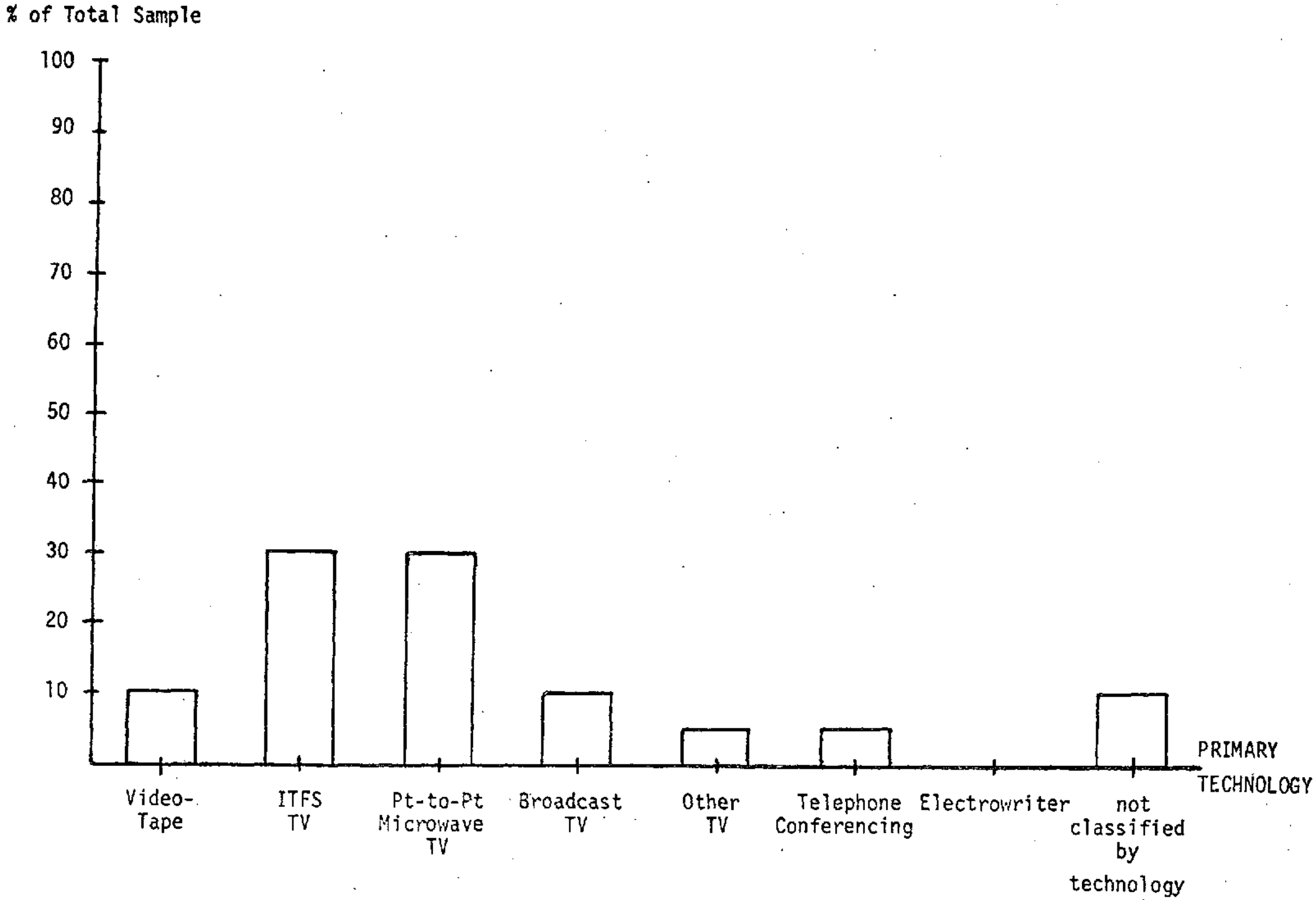

Figure 2. Network Survey Sample Response by Technology.

telecommunications. The sample was also asked about additional interest by groups that might want to receive instruction via their network. Other questions posed concerned conditions needed to effectively use telecommunications for instructional purposes and opinions about the future impact of technology in higher education. The sample population was also asked to briefly discuss the status quo of their network with regard to stability, expansion or contraction and their willingness to enter into a more extensive telecommunications network along with the reasoning for this position. Finally, information concerning costs and sources of funds for the development and operations of the networks was also sought.

The respondents held various positions within the networks, varying from directors to instructors. System directors or directors of divisions through which the networks operated represented the largest group (60%). Deans of colleges or divisions (15%), professors (15%), coordinators of programming (10%), and a departmental chairman (5%) comprised the remainder of the respondents. Some of these respondents served in a dual role, for example as both a professor and a director.

5.2 INITIAL DATE OF NETWORK OPERATIONS

In response to the question, "In what year did your system become fully operational (technically)?," the sample indicated that of the twenty networks, 75% have been operating less than a decade, and slightly more than 30% have become functional since 1970.

On the average, the systems were proposed slightly more than two years before the networks became operational. Most responses indicated that it was less than a year after the system became fully operational that fully accredited college level courses were taught over the system.

5.3 INTENDED AND ACTUAL STUDENT GROUPS SERVED

In response to the question, "Which groups was your system intended to serve when the system was under development?,"* professional persons (90%) and part-time graduate students (75%) were the most frequently cited categories. To a lesser extent, full-time and part-time undergraduates, full-time graduates, semi-skilled workers, and the general population were target groups for the instructional networks. (See Table 20.) When queried about specific occupations, the engineering profession was singled out as the most significant target group with business and teaching occupations next in order. None of these specific categories is a clear-cut majority (> 50%), however.

Responding to "Which groups have turned out to be the principal users of your system generally?," the same pattern that was apparent for the intended student users held for the principal students actually served by the network. "Professional persons" (75%) and "part-time graduates" (60%) were the outstanding categories followed by full-time and part-time undergraduates, full-time graduate students, semi-skilled workers, and others. (See Table 20.) Likewise, the engineering occupation, followed by business and teaching were the specific professions most often cited.

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*For brevity, many of the questions have been paraphrased.

Table 20: Intended and Actual Student Groups Served in Survey of Technology-Based Networks*

	Intended	Actual
Full-Time Undergraduate Students	35%	35%
Part-Time Undergraduate Students	35	20
Full-Time Graduate Students	25	20
Part-Time Graduate Students	75	60
Professional Persons	90	75
Semi-Skilled Persons	25	20
General Population	20	15
No Group in Particular	0	5
Others	25	25

Specific Categories	Intended	Actual
scientists	20%	10%
engineers	45	40
business	20	25
nursing	5	10
medicine	5	15
teachers	15	25
vocation/technical oriented persons	10	5
law	5	5
kindergarten through senior high school students	5	5
prison in-mates	5	5
housewives	5	5
handicapped persons	5	5
governmental groups	0	5
technicians	0	5
secretaries	5	5
religious groups	0	5
adult groups	0	10

*Per cent figures refer to the number of institutions in the sample indicating the particular category.

5.4 ADDITIONAL STUDENT GROUP INTEREST IN INSTRUCTION

To the question, "Have any student groups other than those now served or expected to be served shown any interest in receiving instruction by your system?," 40% of the sample responded that additional interest had shown, 35% of the sample indicated that no additional outside interest had been shown, while 25% did not know or respond to this question.

From the 40% indicating additional interest, half noted that the groups expressing this interest had the same orientation as the present clientele. For example, more business or engineering organizations were interested in having an opportunity to receive courses, in addition to the present groups served. The other half which noted interest and which had an orientation that was not presently being served were of a continuing education nature. Although these latter respondents considered these additional groups different from their present clientele, many of the other respondents had been serving just such persons; businessmen, teachers, employees of state agencies, housewives, plus gifted high school students and medical students.

To the inquiry concerning "encountering any potential student group that was unreceptive or uninterested in the idea of receiving instruction via the system," some 65% of the sample responded that only a receptive clientele had been the recipient of instructional services. Of the 25% that did indicate encountering a nonresponsive group, specific mention of these groups included traditional on-campus students or students with easy access to the traditional campus. Also mentioned were students attending a private university or generally anti-technology oriented students, plus one professional group of sales clerks that was not responsive to a prepared education series. Only 10% did not respond to this question.

5.5 NECESSARY CONDITIONS FOR THE EFFECTIVE USE OF TECHNOLOGY

Responding to the question, "What conditions do you feel have to exist for telecommunications to be beneficial for providing instruction?," the two most noted conditions were an overall positive attitude on the part of all parties involved (70%) and a clear need for the services which a telecommunications system could best perform (35%). Positive attitudes, motivation, and a willingness to cooperate on the part of faculty, policymakers, administrators, and students were considered to be beneficial for effective utilization of telecommunication systems.

Other conditions cited less frequently included procurement and use of a system that is relatively free from major difficulties. This also included understanding the limitations of the technology itself, and developing and utilizing the necessary support systems, of which interaction or response capabilities were mentioned. Also, the need for quality materials with adequate mechanisms for program development such as released time and tenure opportunities for faculty involved with teaching via technology were considered necessary. In addition responses included the need for a healthy financial atmosphere, leadership, and demonstrations which prove the feasibility of technology as a viable medium for instructional purposes.

Conversely, in answer to the question, "Under what circumstances do you feel that telecommunications media are <u>not</u> beneficial in providing instruction?," the respondents (50%) considered the improper use of telecommunications as the most adverse factor.

With respect to this issue, it was pointed out that lack of adequate planning, coordination, and implementation of the network would result in less effective instructional services. In addition using technological delivery when it was not necessary often resulted in poor attitudes by the students to using it. Cited in this question were the lack of adequate support systems, irrelevant content or an unsuitable method of presentation of the broadcasts resulting in less effective use of technology. Other pertinent factors were poor viewing conditions, unjustifiable expectations from a given application of technology, lack of committment on the part of the parties involved, and a lack of quality materials.

5.6 CONSIDERATION OF LARGER REGIONAL OR NATIONAL NETWORKING

To an inquiry concerning "possibilities of the technology-based networks becoming involved in a more extensive regional or national resource sharing network," the majority of the sample (55%) looked favorably upon considering possible participation in a larger regional or national network. Only 15% ot the sample was not willing to consider greater network participation. In these particular instances, reasons cited were the lack of need and the fact that in one instance the present network was being discontinued. Another 20% were not willing to indicate one way or the other. The primary reasons for uncertainty in participating in a larger network included the need to show the benefits of such an arrangement for the participants, to demonstrate that the quality of instruction could be maintained, and finally, to insure that the salient features of the present system would not be lost. Only 10% did not respond to this question.

Concerning the advantages or disadvantages of more extensive network involvement many possible advantages were cited. These included the ability to diversify present offerings (35%), better use of resources (35%), and possible cost savings (20%). With regard to diversification, broader courses of study could be more easily offered with better programming and higher quality products. Possibilities for more diverse learning options were also considered as an advantage that might be derived from a larger, regional or national network.

Possible utilization through cooperation and sharing of other network members' strong points and expertise were mentioned in conjunction with overall better use of resources. Through such cooperation more students might be served at less expense and with possibly better distribution of educational services. Use of a larger network distribution system was also considered a source of energy savings (primarily gasoline).

The greatest drawback seen to participation in a larger network was the possibility of the loss of control (35%) of such aspects as scheduling of courses, quality of courses, and the caliber of instructors. General problems concerned with loss of flexibility and complexities of administration were also cited as disadvantages resulting from greater networking than was presently implemented. Other drawbacks, less often cited, included possible cost barriers of interconnection, working out acceptable tuition rates among the participants, and other accounting matters, and transmission or broadcast limitations and time delays in dissemination and retrieval of materials distributed throughout the system.

5.7 COST FACTORS AND SYSTEM FUNDING

In answer to the question, "Have system costs been a constraining factor or have you been relatively free to develop the system as it was envisioned?," 50% of the sample indicated cost limitations in the development of their particular system, while only 20% indicated relative freedom from cost constraints in the implementation of their network.

When questioned concerning "the percentage of total aid received for initial development by several sources (federal government, in-house funds, etc.)," the greatest percentage of developmental monies were stated to come from in-house funds (39%), when averaged over the twenty systems that responded. (See Table 21.) Funds from "other" sources, of which business and industry comprised a sizable component, financed 22% of the initial costs. The state government and private gifts were responsible for providing 17% and 14% of the funds, respectively, while the federal government and private foundations provided very little support.

A majority of the twenty systems surveyed (11 networks) indicated that some in-house funds were received for initial development. Of these eleven networks, seven cited in-house funds as the primary source of support with the range varying from 10% to 100% of total funding and averaging about 74%. Whereas some federal government grants were indicated as a source of initial financing by six systems, a number second only to in-house funds, no system received more than 33% of its total funds from federal grants. The average funding for these six systems indicating some federal support was about 20% of total funds.

TABLE 21. Relative Levels of Funding for Initial Development and Operation of Technology-Based Networks

Source	% of Total Initial Development Funds**	% of Total Operating Funds***
Federal Govt. Grant	7	2
State Govt. Grant	17	18
Private Foundation Grant	2	0
In-House Funds	39	36
Private Endowment or Gift	14	2
Student Fees*	—	19
Other	22	23
TOTAL	101	100

*Student fees not applicable as a source of initial development funds.

**Derived on the basis of 14 usable responses.

***Derived on the basis of 16 usable responses.

Four networks have received support from private endowments or gifts for initial start-up, of which half indicated this was a primary source of funding. For these four networks, the range of financing from private endowments or gifts varied from 33% to 90% of total funding, and averaged 63%.

Private foundation grants, state government, and other sources (business, industry, etc.) were each cited by not more than four systems as having provided support. However, when funding was made available from these sources, in several instances the amount was sizable.

Responding to "What percentage of your total aid helps to provide for the present operation of your system?," the greatest source of funds came from within the institution (36%). The second greatest source of total operating funds came from the "other" category (23%) of which corporate and industrial monies, again, provided a sizable portion. Student fees and state government grants on the average provided 19% and 18%, respectively, of the total annual costs of operation.

For the support of network operation, in-house funds and student fees were cited most frequently as sources of monies. Some eleven networks indicated using in-house funds, and over half of these systems indicated this money was the primary source of support. The range of support varied from 30% to 100% averaging 79% for all systems using in-house funds.

While six systems in the sample indicated using student fees as a source of support for operational costs, only two considered this a primary source of funds. The range of funding, however, for all six systems using student fees to finance operation varied from 25% to 100%.

Four or fewer networks indicated receiving funds from each of the following individual categories: the federal government, the state government, private foundations, private gifts, or "others".

With regard to the "cost-effectiveness of their system," 60% of the respondents considered their system to be cost-effective. However, the criteria upon which this response was made did not necessarily involve actual dollar criteria. While a variety of reasons were stated, the most prominent criteria cited for cost-effectiveness was the qualitative one of providing a valuable educational service. Of the twelve networks, 25% used this criteria. Other reasons cited by individual networks included; the income from the system programs was greater than the costs of providing the service; low costs; the programs were self-sustaining on tuition fees; and the continued purchase of the service by the recipient. The remainder of the sample (40%) was equally divided over whether their particular instance was not cost-effective or simply that the situation was not known.

5.8 GROWTH ORIENTATION

In response to the question, "Do you feel your system will continue to grow, or has reached stability, or perhaps will be reducing its scope presently or in the near future?," the majority of the sample (65%) indicated that expansion was in their plans. Growth, in this instance, referred to an increase in the number of students served and/or an increase in the number of locations reached. From the remainder of the response, 20% of the systems were stable with respect to growth and service, while only one of the twenty systems (5%) indicated any cutback.

The changes as a result of growth that were occurring involved a more diversified means of reaching many of the kinds of students presently served. For example, there were instances of employing industrially-located, regional classrooms (USC), incorporating more institutions into the system (TAGER, IHETS, CUMBIN), including more services such as computer information and instruction, plus library materials (T V College). These kinds of changes as a result of expansion were indicated by about 25% of the sample. To a lesser extent, an increase in the number of locations, and the reaching of different or more of the same clientele were indicated as factors of change.

In response to the question, "If growth is anticipated, what kinds of audiences do you plan to reach?," some 75% of the sample planned to reach the same kind of student audience that was presently being served. These were primarily engineers, workers in industry, businessmen, medically-oriented groups, and traditional students. For the 40%, which indicated probable future service to different groups, the areas of business, state agencies, industrial and supervisory personnel, high school teachers, adult and continuing education students, home learners, and exceptional high school students were cited. These groups appear to belong to the continuing education group of learners, and while many networks are servicing these kinds of students, others are beginning to do so. In general, these learners have not been of traditional college age, nor have these individuals had traditional daytime access to the conventional campus.

5.9 FUTURE IMPACT OF TECHNOLOGY ON HIGHER EDUCATION

In response to the question, "Do you believe the utilization of technology will have a major impact in higher education for providing instruction off-campus or between campuses in the future?," the majority of respondents (75%) did believe that telecommunications would have a major impact on higher education. The reasons cited included the tightening budgets for traditional higher education and the growing importance of educational opportunities that are not obtained in the conventional ways.

Responding to "What major influencing factors would promote more widespread future technology usage?," foremost mentioned was the need for adequate funding (50%), followed by more positive faculty and administrative attitudes towards committment, receptivity, and understanding, and finally the need for better hardware and software and its proper utilization (35%). Many of these same problems were mentioned in conjunction with the sub-sample utilizing technology in non-traditional higher education from the Ruyle et al study.

In answer to "What major influencing factors would inhibit more widespread future technology usage?," 55% of the respondents mentioned lack of financial support, 35% mentioned unfavorable faculty attitudes, and 30% mentioned inadequate instructional programming. Poor administrative attitudes and general rejection of technology were also cited as inhibiting factors.

6. ANALYSIS: TECHNOLOGY-BASED NETWORKS

6.1 INTRODUCTION

In this Chapter several aspects of technology-based networks are analyzed. The rationale for networks based upon increased educational opportunities for students, sharing of resources, etc. is presented. Other characteristics of the networks are examined including the kinds of students served, institutional relationships, instructional characteristics, and cost aspects. The analysis is based upon the results of the survey of the networks presented in Chapter 5 as well as published and unpublished literature developed in Chapter 4 and the Appendix. This Chapter concludes with a comparative analysis of technology-based networks vis-a-vis the technology utilization in Ruyle et al's study of non-traditional opportunities and programs. Selected results based upon raw data from the Ruyle et al study performed in conjunction with the work of the Commission on Non-Traditional Study (CNTS) were presented in Chapter 3.

6.2 TECHNOLOGY-BASED NETWORKS: RATIONALE

6.2.1 Benefits to Industry

Industry has been one group that has gained significant benefits from the increased access to higher education. Engineers and business personnel have been able to pursue graduate degrees because the networks have been able to overcome several obstacles. The time required for commuting to and from campus has largely been eliminated for either the student or instructor. As a result, problems such as excessive time off the job, travel fatigue, and energy consumption in transportation can be minimized. (54, 55)

Through networking, the actual geographical separation of location of learning and origin of instruction have become less of a hurdle. For example, via SURGE, Colorado State University involves industry throughout the state of Colorado. The MERGE television system of the University of Michigan has provided an educational service to the Detroit area where 60% of the state's engineers are situated, but which is over 40 miles from the origin of instruction at Ann Arbor.*

6.2.2 Benefits to Other Professions and Students

Not only have industry, business, and other organizations benefited but also many other groups. Other professionals, like in-service teachers, have been able to pursue graduate studies or receive certification via instructional technology, while remaining on the job. For example, the videotape network of Colorado State University, Bradley's ITFS system, Rhode Island's point-to-point microwave television, and the Kentucky Educational Television Network have offered courses for members of the teaching profession.

Handicapped, sick, or confined persons have also benefited through college level work delivered primarily by a technology-based network. The Indiana Higher Education Telecommunications System and T V College of Chicago have served prison in-mates. T V College has also served the confined home learner. Many hospital personnel have also had the opportunity to receive instructional programs via technology as in the case of the University of Wisconsin Telephone system.

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*Specific programs and networks referred to in this Chapter are described in the Appendix.

Technology has aided community college students in successfully making the transition into four year colleges and universities and graduating on schedule rather than being delayed because many necessary prerequisite courses could not be easily taught at the two year institutional level. The CO-TIE program is a case in point for students who take engineering courses, usually only available at four year institutions, while still at community colleges. The University of Southern California's ITFS system and Project HI-TIE of Colorado State University have provided a means whereby many high school students could begin college much sooner than otherwise possible.

6.2.3 Resource Sharing

Many students presently in the "mainstream" of higher education have benefited from courses transmitted by technology-oriented networks. TAGER of North Texas, the Indiana Higher Education Telecommunications System, T V College, the Maryland Center for Public Broadcasting, and the University of Connecticut have made the educational resources and instructors at one location available to many institutions or campuses in their region. T V College and the Maryland Center for Public Broadcasting have primarily done so at the freshman and sophomore levels.

This sharing of resources such as faculty time and expertise has demonstrated a potential capability for inter-institutional cooperation whereby the student has the opportunity to choose from a broader variety of courses and curricula. This has been nowhere as apparent as in industry. Many industrial locations in San Francisco and Los Angeles in California, Colorado, Fort Worth and Dallas in Texas now are able to share in the instruction carried on at college campuses in their respective cities. Until recently, those campuses had been the only instructional sites.

Some evidence also indicates that using educational resources to reach many distant and dispersed groups enables the institutions involved to increase their educational productivity, for example, by increasing enrollments. In some cases, the instructor can handle the additional remote students with few problems or little extra aid. In other instances, the addition of remote students has created adequate enrollment for a course that otherwise could not have been justified, or might have been presented in smaller sections using more personnel.

In addition, the full utilization of the resources or services of the network can contribute to its successful financial operation. One of the ITV systems in the Morris et al study was cited as recovering the incremental cost of instruction via the network services to the participants. Several reasons were cited for this favorable situation. One major reason involved using all channels, 8 hours each day, five days a week during the academic year plus summer programming also for providing instruction to the participants. Another reason was the inclusion of not only college accredited programming but other non-accredited programming that was appealing to the industrial participants. It was also this non-accredited participant option which also attracted many participants which greatly contributed to the favorable financial status of the system. (47)

6.2.4 Creating Off-Campus Learning Sites

Through the outreach of the various networks, many sites and locations have become centers of learning. Industrial classrooms and conference rooms have served as congregation points where students may participate in courses. Regional classrooms, in the case of the University of Southern California Instructional Television System or the learning centers of Chicago's T V College provide educational settings. Locations such as state agencies, high schools, court houses, penal institutions, hospitals, libraries, and the home may also serve as learning sites in addition to the traditional campuses of two and four year institutions.

Under certain conditions, these technology-based networks can be expanded with relatively little difficulty by taking advantage of existing buildings. When the proposed point of reception is already situated within the range or line of sight of instructional television broadcasts, then only the receiving hardware need be installed. (55)

6.3 STUDENTS SERVED BY TECHNOLOGY-BASED NETWORKS

From sections 5.3 and 5.4, it becomes evident that professional persons are the largest student group served by the technology-based networks surveyed in this investigation. These professional persons in large part are from the business and industrial community. The engineering profession is most heavily represented. Many part-time graduate students are engineers in business and industry. The next most frequently cited professions are business and teaching.

What might be characteristic of these students is their need to have access to the most up-to-date information and skills. For many of these professionals and skilled workers, their occupational fields are rapidly changing and advancing. As a result, there is a constant need to renew skills, understanding, and knowledge. Thus, if instruction via the extended instructional networks is the most convenient and quickest route to acquiring needed information, it is utilized. Since the instruction can come to the learner, it need not greatly obstruct the student's working day. Evidence also indicates that other would-be learners not now served are interested in instructional delivery via instructional networks. These learners tend to fall into the same professional and formal continuing education categories as those now served.

6.4 INTEREST IN RESOURCE SHARING AND EXPANDED NETWORKING

Many of the respondents from the technology-based network sample were in favor of possible participation in a more extensive network. (See section 5.6.) Possible cost savings, better use of educational resources, and opportunities to diversify course offerings via more extensive networking were cited as possible advantages.

Networking has often made it possible to have large enough class enrollments so that it is possible to justify offering certain courses particularly at the graduate level. However, the sample also acknowledged corresponding problems related to setting policy for and administering a more extensive system.

6.5 NETWORK INITIATION AND MISSION ORIENTATION

Based upon the responses from the survey, the definition of goals and the preparation and organization required in the planning of a technology-based network have appeared to be carried out well in advance of actual operation. (See section 5.2.) Interaction between the particular educational institution and non-educational organizations such as business and industry also appears to have been well coordinated and harmoniously conducted. Furthermore, cooperative interaction among educational institutions has seemed to be well conceived and instituted.

With regard to this latter situation, several interesting organizational and administrative arrangements can be perceived. First, there is the instance in which one academic institution primarily administers and organizes the network and programming (CSU: CO-TIE). Then, there is the case where a private organization conducts much of the organization, administration, and maintenance of the network (TAGER). Finally, there is the case of a state government agency organizing and providing the educational services through networking (IHETS). Each of these particular situations offers relative advantages to the participating institutions, whether public or private.

When the state government is backing a network, necessary funds for development and operation may be assured. Also, the state government could serve as the authority which may encourage or require that other state educational institutions participate or cooperate in network activities. When a private organization coordinates the activities of the educational institutions participating in the network, then the institutions may only have to concern themselves primarily with developing programs. In addition, the fact that the participating educational institutions operate through a private organization rather than having one of the institutions coordinating the others may avoid problems associated with academic institutional pride. When many two year colleges are involved in a network, it may be advantageous for a larger four year institution to coordinate the activities. In this case a larger four year college or university may be able to draw upon needed expertise and resources from within that institution which may be less readily available at the two year college level.

The technology-based networks appear to have a specific mission to serve a particular student population or populations. (See sections 5.3 and 5.4.) The systems have indicated a tendency to be serving those elements of the student population which were originally targeted. Thus, it appears that the networks are meeting their intended mission to serve specific groups. Survey results revealed that generally, there is not more than a 10% discrepancy between intended and actual users on a per category basis, except for the part-time graduate students and professional workers whose actual participation was somewhat less than expected. However, for the professional students who also include many part-time graduate students, this might be explained by the fact that these are the most mentioned and also the most likely to fluctuate. Since few networks cited serving unreceptive learners, this would seem to lend further credibility to the possibility that technology-based networks are utilized where the need is clearly present.

6.6 INSTRUCTIONAL DELIVERY FORMAT

6.6.1 Importance of the Traditional College Lecture Teaching Style

A trend that can be perceived from the description of the technology-based networks indicates that instruction via these systems has emphasized the delivery of the conventional college lecture format. A majority of the cases surveyed indicate that an instructor delivers a lecture which is then transmitted to a class or classes. In the remainder of the cases, little was specifically stated about the manner of instruction. However, few if any networks indicated any form of instruction other than the lecture method. This has been the case whether the delivery system has been based upon videotape, ITFS television, other forms of instructional television, telephone conferencing, or electrowriter technology.

The general procedure for the videotape, ITFS, and point-to-point microwave systems has been to broadcast or videotape actual classroom sections. This is accomplished by modifying a classroom and equipping it with the necessary cameras and microphones. Between one and three cameras are typically used to broadcast or tape the classroom session. One camera follows the course instructor from the rear of the room, essentially providing the same view a student would have while sitting in class. This camera is generally equipped to pan, tilt, or zoom in when necessary as are the other cameras. The cameras are usually controlled by an operator at a control booth at the back of the classroom or at some other remote location.

Other cameras are normally used to pick up two particular kinds of situations. One situation involves the use of an overhead camera focusing on the instructor's desk. From this vantage point, problems or exercises worked out on a desk writing pad or desktop demonstrations can be picked up by the cameras for transmission to the distant sites. Usually, the on-campus students have television monitors where the desktop activity can be seen. The other situation involves the use of a camera to picture the local students in class.

Microphones, strategically located in the classroom, then pick up the lecture and any ensuing discussion for taping or broadcasting. When the classes are live and interactive, return speakers are mounted at all sections so that all lecture and discussion can be heard by the students at the various sites.

In the cases of videotape, ITFS, and other, non-UHF/VHF broadcast forms of instructional delivery, little innovative production technique or format has been used. The basic philosophy has apparently been to attempt to simulate the environment of the on-campus section of each course and/or to maintain the lecture format. Zigerell of Chicago's T V College, where courses have involved the lecture format over broadcast television, has pointed out that this institution's personnel have not used television to remake the instructional process. (37) Gill has also pointed out that users of the television medium have not endeavored to use the medium to its greatest potential. (56)

6.6.2 Advantages and Disadvantages of the Lecture Format

The lecture format, a style that has not required the more sophisticated production methods of commercial television, seems to provide certain advantages to the technology-based networks. (See Appendix.) When a live class is either videotaped or televised, all students, on campus and off campus, frequently benefit from a better prepared lecture and a better organized course than if the television were absent. In many cases, the dependence on a lecture format and lack of dependence on sophisticated production techniques has helped to keep the costs of instructional delivery within the means of the network. Furthermore, as has been pointed out by one network respondent, it "beats not having any instruction."

The use of the lecture style also has its disadvantages. Although the optimal method of learning varies with the individual, there is little doubt that although the lecture approach is most used, its orderly pacing through the material may not be the preferred method of learning for many. Slower learners may be at a disadvantage, as may the learner whose preference has been to pursue a subject on a more individualized basis. Also the removal of actual face-to-face contact and the substitution of a televised lecture or a voice coming from a loudspeaker dispensing information, such as in an audio telephone network, may have caused some students to shun instruction via these technology-based systems when possible.

For the instances where there is live, real-time interaction between the instructor and on-campus section with the remote sections, some of the respondents from the networks would consider it a loss to the students, especially the remote groups, to replace interaction with "canned programs." The interactive capability of many of the networks, particularly the ITFS systems and the point-to-point microwave distribution systems, as pointed out by a respondent, have been a strong selling point of the network from an educational point of view. However, this issue appears to be somewhat controversial since Stanford University is reported to have made the talkback capability an option rather than a requirement for its participants.

For the particular case of SURGE, a videotape network, while live, real-time interaction is absent during the videotape viewing sessions, greater flexibility is often present. Many different courses and the subsequent number of needed tapes are produced directly from the on-campus lecture session, reportedly with little loss of time between the actual lecture and the distribution of the videotapes and at low production expense. Furthermore, the scheduled time for viewing can be chosen at the receiving site so that it is the most convenient for a majority of the students. Also, since the taping of any actual classroom session incorporates not only the instructor's lecture but the discourse between instructor and students in the form of question and comments, a significant number of the questions that may arise from the off-campus sections are answered.

In instances where a student must often miss a scheduled videotaped lecture, arrangements are often made to show the tape to that individual at a later time. In fact, many of the ITFS and point-to-point microwave networks mentioned in the Appendix allow the receiving sites to videotape the incoming broadcasts to take advantage of the flexibility of videotapes. However, there may be limits in videotape operations to the period of time during which tapes can be retained. CSU requires the tapes to be returned within one week in order to be erased and reused.

Sometimes, a taped series may be retained for use during consecutive terms with the instructor's consent. This procedure saves time and reduces production costs. Prescheduled telephone conversations also have helped to compensate for the lack of real-time interaction. (39)

In the cases of the electrowriter and telephone conferencing networks, each medium offers a correspondingly less complete visual element than television, although the real-time interaction is maintained. In the instance of broadcast television, although the visual component is clearly present, the interactive element is largely absent.

6.6.3 Need for Instructional Support Systems

What becomes apparent after examining twenty-six cases of networking is that as either the visual and/or the interactive elements become more removed from the actual eye-to-eye interplay, there develops a correspondingly greater need for instructional support. This may include film slides, film strips, graphics, textbooks, and may include more sophisticated study guides and assignments. However, this does not imply that the need for such materials is totally absent when visual and/or interactive audio elements are present.

In the case of T V College, an over-the-air broadcast television network, the learner is provided with the necessary study materials, assignments, and other facilities before the course has actually begun. Although opportunities for interaction are limited, students can telephone the course instructor and discuss the materials. In addition, there are four centers located in the greater Chicago area which students can attend to meet fellow students or participate in conferences. To a great extent these elements have served as instructional support. The SUN project which has certain features in common with the British Open University will also follow a similar format according to present planning.

The Miami Dade Junior College program also has utilized additional instructional support with study kits, and regional panel discussions involving a phone-in "hot line" for listeners. There have been frequent and periodic assignments designed to keep the student in step with the material delivered over the television network.

6.7 PACING OF STUDENT PROGRESS

At present, a strong effort is made in most technology-based network courses to set a pace for most students, remote and otherwise. However, recent developments such as T V College's new "Study Unlimited" program provide an indication that there may be efforts forthcoming to develop options other than the deliberate, orderly progress through a course. At present, for the most part, students are required to follow very nearly the same pace. All sections must complete the same assignments and frequently a courier or mail service picks up and delivers course assignments and materials. This has typically been the case for Colorado State University's SURGE program, the ITFS systems, such as the Stanford Instructional Television Network, the University of Southern California's television network, the University of Tennessee's electrowriter system, and point-to-point microwave systems, such as TAGER.

6.8 FACTORS AFFECTING THE USE OF TECHNOLOGY

In sections 5.5 and 5.9, the respondents from the surveyed networks pointed out the need for a positive attitude on the part of all parties involved for the successful functioning of an instructional network. Positive attitude meant the willingness to work and interact with network related personnel, becoming involved in network associated problems and activities, and contributing assistance and expertise when it was needed.

Respondents from the surveyed networks also indicated a need for quality materials to successfully employ technology. This included adequate means for program development such as released time and tenure opportunities for faculty involved with teaching via technology. These have also been cited as important factors by the Commission on Non-Traditional Study. (57)

Another factor mentioned for the effective use of telecommunications was the clearly defined need for such a service. This factor has been emphasized previously by the Carnegie Commission's Fourth Revolution report which pointed out that technology should be implemented only where it can do a better job than other means and not merely be a decorative frill. (58)

Other factors mentioned by the respondents from the networks were the need for adequate financing, proper leadership, and demonstrations that prove the feasibility for technology as a viable medium for instructional purposes. These are issues to which the National Academy of Engineering's Commission on Education has addressed itself. The NAE commission has recommended that leadership be instilled, developed, and nurtured via public mechanisms, such as councils and commissions with adequate authority and responsibility to influence action. (59)

In a study of factors affecting utilization of electronic instructional aids into four separate colleges, Demerath and Daniels* have pointed out that administrators in higher educational institutions may occupy a key role in determining the extent of technology

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*It should be emphasized that while Demerath and Daniels examined factors affecting technology utilization in several different types of institutions of higher education, they did not study technology-based networks.

utilization, serving as the "gatekeepers" although the faculty and students can not be disregarded. (35) The Carnegie Commission's <u>Fourth Revolution</u> report concurs with the need to involve administrators of the institutions at the highest level. (60) The need to have the active involvement by the faculty has been emphasized in a Ford Foundation report. (61)

Demerath and Daniels also have pointed out the need for new organizations and institutional forms to affect and alter the traditional, established ways of accomplishing tasks and goals, such as the instruction of students. Organizations such as the Joint Council for Educational Telecommunications, and other associations which have gone on record as favoring technology have the power to influence and inform administrators and other personnel of higher educational institutions who look to these organizations for information, assistance, and expertise.

Finally, Demerath and Daniels point out that many of the new non-traditional academic programs may provide a foothold for technology utilization. (35) Many of these programs have deliberately left behind many of the traditional ideas and ways of administering and conducting educational and instructional processes. Furthermore, the newness of the programs may mean that institutional relationships and ways of accomplishing tasks and goals have not yet become traditionalized so that different approaches such as the use of technology for instruction may encounter less resistance. However, the results of Chapter 3 concerning the use of technology in non-traditional higher education indicate that technology does not appear to be a major factor in this overall field.

6.9 INSTITUTIONAL RELATIONSHIPS; ECONOMIC FACTORS

In many cases, educational and non-educational institutions, such as business and industry, have cooperatively interacted in order to develop or expand their particular systems. In turn, the networks have transmitted courses particularly suited and needed by the workers of these organizations. In addition to undergraduate and graduate college accredited courses, additional programming is often delivered by the networks and purchased by the participating industrial organizations and business. These programs may be short courses, formal continuing education courses, special topics courses for credit or not-for-credit and may be specifically requested by the participants.

In many instances, the continuing success of the network is associated with the economic well-being of participating organizations. One respondent to the survey questionnaire for technology-based networks pointed out that in some cases (TAGER, SURGE) where the ties between industry and the network are strong, the number of students participating in off-campus programs varies with the economic state of affairs of the organizations. For example, when the industrial activity or need for engineering personnel is relatively low the number of enrolled students from these organizations also falls. (39, 62)

6.10 COST ASPECTS

6.10.1 Funding for Initial Development and Operations

From the survey, responses indicated that for initial system development, in-house monies provided on the average the greatest percentage of total support and were the most cited source of funds.

(See section 5.7) "Other" sources of support which includes business and industrial organizations, government, private foundations, philanthropic personal gifts, etc., provided a lesser amount of total support than in-house monies and were less often cited by the respondents as sources of initial development funding.

Similarly with respect to sources of operating funds, the sample respondents pointed out that, on the average, in-house monies provided the greatest percentage of total operating funds. (See section 5.7.) In addition, this source was also cited by the most networks. The "other" category, which includes business and corporate funds, provided the second greatest percentage of total operating funds. Although student fees, the second most cited source of funds were mentioned by six networks, these fees provided only 19% of the total operating funds. The state governments and the federal government each provided a lesser amount of the total operational funds. More funds are needed from these sources that are more widely accessible to all involved in or considering technology instructional systems. Lack of funds was the most prominent problem mentioned by the surveyed networks.

6.10.2 Fees Paid By Non-Educational Organizations

From the examination of the networks described in the Appendix, it can be seen that many industries have financed part or all of the capital costs of some technology-based networks, particularly ITFS systems. However the costs to these non-educational participants does not appear to have stopped there. In some instances, these organizations pay a television surcharge and a tuition matching fee for each credit hour taken per student. For example, the SITN television surcharge of $20 per credit hour per student, and the matching fee are used to help cover the operating expenses of the network and the costs for providing the instruction by the individual college or departments of the University. (63)

6.10.3 Additional Income from Non-Degree Seeking Students

While funds from the sources in section 6.10.1 have appeared to be limited, Morris et al have pointed out that the fees which can be solicited from network participants and students in non-accredited or non-degree seeking options can provide a substantial source of income. Morris et al point out that the Stanford ITV system serves many times the number of students who fall into a non-matriculated student category than are matriculated into the University. The income from these businesses and industries whose students participate in a non-matriculated fashion and the fees from these students has helped the Stanford network achieve a favorable financial situation. (47)

6.10.4 Network Cost Factors

Morris et al indicated that the costs of televised instruction via videotape or radio frequency (ie. ITFS or point-to-point microwave) are sensitive to the number and geographical distribution of the students and that the amount of programming can also significantly affect the costs of instruction. A comparison of actual RF delivery costs of the Stanford and TAGER networks to their hypothetical videotape delivery costs for the same geography and student population as are now served by the Stanford and TAGER networks has demonstrated dollarwise that RF delivery is more economical over a range that has a radius of not greater than about 40 miles. Videotape is favored when geographical dispersion of the receiving sites is present.

If inaccurate estimates of programming levels are made it is possible that the technology which is not the most economical may be chosen. For example, Morris et al have demonstrated that if Stanford were only broadcasting half their present programs or approximately 3,000 hours per year then videotape would have been the economically preferred technology. This would have been the case in spite of the geographical concentration of SITN participants. (47)

The extent to which already existing facilities, such as broadcasting towers, can be utilized, the greater or lesser will be the costs to the network. In general, the greater the scale of operations, the greater the costs for the system. As an example of this latter situation, the capital cost for the Ohio State University microwave network which has one off-campus location was $10,000, while the capital cost for the Indiana Higher Education Telecommunications System which is a more extensive network was $600,000.

6.10.5 Cost-Effectiveness

Three networks, CSU-SURGE, SITN, and TAGER have been shown to be cost-effective based on a measure developed and utilized by Morris et al, which compared the incremental cost of instruction for the network to the cost of on-campus instruction. In the Morris et al case, the "incremental cost of instruction" primarily referred to the costs of paying for and operating the network. Based on this measure the cost of off-campus instruction may be as little as 50% of the on-campus costs (SITN). In the other instances, the off-campus instructional costs were less than on-campus costs but not as notably as was the case for SITN. (47)

However, there appears to be some question concerning the validity of using the incremental cost of instruction as an element of Morris et al's measure of cost-effectiveness. The primary justification for using the incremental cost of instruction for the network has been that the on-campus class must be taught regardless of the presence of the off-campus students. Considering the work load of the instructor and other teaching assistants involved, there seems to be two sides to this issue. On one side, if the cumulative number of off-campus students is small and the on-campus course has a typical class enrollment, then the increase in work output required by the instructor and other assistants may be small. In this instance, Morris et al's definition of cost-effectiveness may be acceptable. However, if the cumulative number of off-campus students is comparable or larger than the on-campus class, then the increased work output required by the instructor and teaching assistants may be substantial. In this instance it may be less valid to assume that the instructor's salary, a major component of on-campus instructional costs, should be fully attributable to on-campus instructional costs.

The issue of cost-effectiveness may also have to take into consideration other factors in addition to on-campus versus off-campus instructional costs although this latter comparison can not be discounted. This was indicated by the sample from the surveyed networks whose interpretation of cost-effectiveness was much broader and more qualitative than the measure used by Morris et al. (See section 5.7.) These respondents defined cost-effectiveness in terms such as 1) providing an educational service that would not otherwise be available, 2) continued purchase of the educational service by the recipients, and 3) lower network instructional costs as compared to using traditional instructional methods.

6.11 FUTURE OF TECHNOLOGY IN HIGHER EDUCATION

Considering the growing nature of most of the networks surveyed, it is not unusual that the respondents have an optimistic outlook on the future of technology in higher education. (See sections 5.8 and 5.9.) For the systems surveyed, it appears that the fact that many of the networks have established cooperative relationships with other non-educational organizations, such as business and industry, has and will most likely continue to contribute to the success of many of the technology-based networks. In these cases many of the industries and organizations have required increasingly more skills and knowledge on the part of their working force, and the instructional networks can contribute to this educational need.

6.12 COMPARISON BETWEEN THE NON-TRADITIONAL INSTITUTIONS USING TECHNOLOGY (CNTS STUDY) AND THE TECHNOLOGY-BASED NETWORKS

6.12.1 Dependence on Technology

In the case of the non-traditional institutions using technology surveyed in conjunction with the CNTS study, the Ruyle et al "sub-sample" of Chapter 3, technology has served a less primary position in the delivery of instruction than has been the case for the technology-based networks. For the Ruyle et al sub-sample, most of the institutions using technology place strong emphasis on other non-technologically oriented options, such as the traditional classroom lecture, fieldwork, and tutorials. The tape cassette, a low-cost, highly individual and flexible unit, has been the most used technological device. In short, technology for the sub-sample from

Ruyle et al's study has been only one of many elements which have included the more traditional and non-technological oriented approaches to education and not necessarily the dominant element. (See Table 6.)

In contrast, the networks have heavily relied upon the technology to deliver instruction to their students. Where there is live, real-time interaction, the technology has helped to create a class of students who can hear each other's questions and comments to the instructor where there would otherwise be fragmented, widely distributed groups of learners. Furthermore the networks have utilized more sophisticated, larger scale, costlier technologies such as ITFS television, point-to-point microwave, and videotape more frequently than have the institutions of the sub-sample using technology.

6.12.2 Structure and Flexibility

For the case of the technology-based networks generally, the televised lecture or lecture format has been most evident, and with this format an effort has usually been made to present the material and pace the student in a manner similar to the traditional, on-campus classroom. The sub-sample using technology, as has been the case for the overall non-traditional field as surveyed by Ruyle et al, has generally structured or prescribed their curricula and programs in spite of the general mystique surrounding non-traditional programs concerning their open or unstructured nature. However, for the sub-sample there has appeared to be more flexibility with regard to such aspects as entry into the program of studies and extent of pacing than was evident for the networks.

6.12.3 Locations of Learning

The use of technology in non-traditional higher education has added a new dimension to the locations of learning, and these sites are primarily off campus. The technology-based networks have established instructional sites in many industries, business organizations, state agencies, and other educational institutions. Many community facilities such as courthouses, libraries, and public school facilities have periodically been used to receive non-locally originated instruction. For the Ruyle et al sub-sample, technology has also been used mainly away from the principal learning location, the main campus, and so has taken some aspects of the instruction off of the traditional campus.

6.12.4 Learners and Degree Opportunities

The networks have served many learners from business and industry, as well as traditionally, college-age students. Many students from these business organizations have been engineers or businessmen seeking formal continuing education and advanced degrees in engineering and other related fields of science and business.

In the overall field of technology in non-traditional higher education, technology has been used usually to serve learners approximately the same age as conventional students as well as housewives and working adults. Programs conducted through these particular institutions focus on, firstly, occupational and career development, followed by general or liberal studies and then by the traditional curricula. Through these programs, students are given access to bachelor's or associate degree programs.

With regards to the students served by the sub-sample using technology, some basic issues become apparent. First, several of the kinds of targeted students may in many ways be similar to the "New Student"* described by Cross from which a large pool of potential students may come in the future as higher education becomes more egalitarian. If this is the case, the use of instructional technology may have to adapt to their particular educational outlook in order to be acceptable. Many of these students would consider televised instruction as entertainment rather than education and would feel "cheated" by instruction delivered via technology rather than by an instructor who was present in the classroom. These students may also need the presence of an instructor who can reward accomplishments and provide assistance and guidance when it is required. These students may also be among the most suspicious of educational innovations. (35, 64) Furthermore, technology, as pointed out by the Commission on Non-Traditional Study, may be one of the least accepted and least preferred learning options on the whole. (65) However, the preference may change when the alternative is no educational access or opportunity. Technology may also be more preferable when it provides the most clearly convenient access route by coming directly to the working site of the student as has been the case for many of the students participating in the networks.

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*Students scoring in the lowest third on the traditional academic achievement tests and on the whole motivated by avoiding failure rather than achievement.

6.12.5 Inter-Institutional Relationships

For many of the technology-based networks, the participation of non-educational and other educational institutions has been considerable. (See Appendix.) The participants have included two year and four year colleges and universities as well as business, industry, and other organizations. This involvement of other groups has in most instances been mutually beneficial for the parties concerned in that the participants have greater access to educational opportunities in addition to more diverse programming, while the networks have benefited from economies of scale. In contrast, the sub-sample utilizing technology has conducted their programs for the most part on an individual basis showing little involvement with other educational or non-educational groups.

6.12.6 Sources of Funds

The respondents from the surveyed networks have indicated that in-house funds have supplied the greatest percentage of total development and annual operating funds followed by an unspecified "other" category which includes business, industry, and other sources. The Ruyle et al sub-sample has reported the primary funding source to be institutional subsidies and student fees. In addition, both the networks and the Ruyle et al sub-sample pointed out that the lack of funds has been their major problem. The Ruyle et al sub-sample using technology indicated that this was of much more concern to them than for the overall non-traditional field as surveyed by Ruyle et al.

6.12.7 Future Outlook

Technology-based network survey respondents have an optimistic outlook concerning the future of their networks and the future of technology in higher education. For the Ruyle et al sub-sample using technology, as well as for non-traditional higher education as a whole as examined by Ruyle et al, less information is available to clearly discern their outlook on the future.

7. SUMMARY AND CONCLUSIONS

7.1 INTRODUCTION

In the preceding chapters, non-traditional higher education has been examined with particular emphasis on technology-based networks. First, an overview was developed of non-traditional higher education by characterizing many prominent non-traditional programs, institutions, and consortia. Next, technology as it has been introduced and utilized in many non-traditional programs was examined and compared to the overall non-traditional field using data collected by Ruyle et al in conjunction with the work of the Commission on Non-Traditional Study.

A central concern of this thesis was the use of technology-based networks, which are defined as networks which join geographically separate and distant locations to deliver instruction beyond the confines of a single campus by means of communications technology. Data on these networks were collected by way of literature review, correspondence, conversations with individuals directly involved with networking activities, and a survey questionnaire directed at this latter group. Information was gathered on various characteristics of the networks, such as cost aspects, manner of networking and technology utilization, kinds of student participants, problems encountered, and future plans and prospects. This information was presented and analyzed in Chapters 4, 5, and 6, and the Appendix contains descriptive information on some twenty-six networks. In this Chapter, overall results of this investigation are summarized and major conclusions presented.

7.2 LACK OF TECHNOLOGY UTILIZATION IN MANY PROMINENT NON-TRADITIONAL PROGRAMS

With the emergence of non-traditional education, much effort has gone into seeking and employing new ways of learning. Many non-traditional ventures have opted more for individual learning contracts, or other "learn by doing" or "experiencing" kinds of approaches as has been the cases for the University Without Walls, Empire State College, and Minnesota Metropolitan State College. Some of these programs have utilized final comprehensive examinations such as CLEP, CPEP, or the Regents External Degree Program. Others have offered traditional programs at new locations such as the University of California or California State University and Colleges programs but have maintained the traditional classroom lecture approach. In these latter cases, videotape or the live television technologies, such as ITFS and/or point-to-point microwave, may be practical although there has been little evidence of usage.

Many of the notable examples of non-traditional higher education programs, institutions, and consortia do not appear to be using technology extensively or oriented towards using it. Furthermore, due to the individual pacing character of many of these programs for their students, it appears that if technology utilization were to be initiated or to increase, more flexible technological tools would be favored, such as audiotape cassettes, videotape, slides, or films. This appears to be the pattern, based upon current technology utilization in institutions surveyed by the Commission on Non-Traditional

Study*. Individualized access to computers or computer resource sharing might also be feasible.

7.3 TECHNOLOGY UTILIZATION IN NON-TRADITIONAL PROGRAMS

Technology as it has been used in non-traditional programs surveyed by Ruyle et al in connection with the work of the Commission on Non-Traditional Study, has had little impact. Of the Ruyle et al sample, half of the 386 institutions indicated using some form of technology. However, in many ways the characteristics of the sub-sample employing technology did not differ greatly from those of the broader non-traditional field as studied by Ruyle et al.

Both the sub-sample utilizing technology and the larger Ruyle et al sample had in their respective programs similar kinds of students, similar methods of instruction, similar principal off-campus learning sites, and similar program content. Both the technology sub-sample and the Ruyle et al overall sample designed their particular programs mainly for traditional college-age learners, housewives, or working adults with the programs having an occupational or career orientation which lead to either the associate or bachelor's degree in most cases. In addition, both the programs of the sub-sample involved with technology and the Ruyle et al sample have not used an off-campus locale as their principal learning location. The main campus has still been the principal instructional site.

Both samples also indicate little inter-institutional interaction or cooperation and uncertainty concerning future plans for their respective programs. Furthermore, the costs of the programs

*The obstacles to technology utilization in four different types of institutions have been examined in detail by Demerath and Daniels.(35)

in the sub-sample and the overall Ruyle et al sample are similar, and both samples have the same primary funding sources, namely the institution itself and student fees. Finally, both the sub-sample and the overall sample have experienced many of the same problems, lack of funds being the most prominent.

The institutions and programs of the Ruyle et al study were primarily aimed at undergraduates. The principal technology employed in these institutions is the audio tape cassette, although some use of televised instruction is also present. The relatively low impact of technology in these institutions is in marked contrast to the picture that emerges for the technology-based networks.

7.4 TECHNOLOGY-BASED NETWORKS

7.4.1 Introduction

Technology-based networks are beginning to emerge as a major factor in higher education. Of the approximately 25 networks for which information was gathered for this investigation, the most prominent networking uses were by large state university systems delivering televised college level instruction to distant campus sites or by universities delivering graduate and continuing professional programs or courses to industrial locations. Although graduate and continuing educational programs were excluded from Ruyle et al's consideration of non-traditional programs, these programs appear to be very important from the point of view of technology utilization.

7.4.2 Instructional Technologies of the Networks

Several alternative technologies have been used in technology-based networks. Each technology has offered certain advantages and disadvantages which must be considered. In this investigation, computer-based technologies and computer networking have not been examined.

Broadcast television has provided a means for mass coverage, but high costs and lack of interaction must be contended with. Instructional Television Fixed Service (ITFS) has been most useful where there have been many learning sites within a concentrated geographic area. Small classes and interaction have also been practical with ITFS. Point-to-point microwave television systems have been used to interconnect origination points and receiving locations over distances that are beyond the range of a single ITFS system but have ITFS favored distribution at each of the interconnected areas. In addition, point-to-point microwave systems have been used to interconnect locations where there has been only one origination point and one receiving site. Talkback in these cases has also been employed.

Videotape systems have their greatest use for connecting many small classes over a wide geographical area, but immediate talkback has not been possible. Nevertheless, videotape networks have provided a great deal of flexibility from an access and time-scheduling point of view. Most areas that can be reached by courier or mail service could also be instructional sites for videotape systems. Videotaped lectures can be scheduled and reshown at convenient times, provided that suitable arrangements are made with the program suppliers and/or instructors.

Television systems that have utilized telephone lines have been able to circumvent obstacles that radiating systems sometimes suffer from, such as the skyline of a metropolitan center. However, the costs of line rental are often high. Other telephone-based technologies, such as the electrowriter and telephone conference systems, can employ a near universal access system and are often useful in low density rural areas. However, the telephone conferencing system lacks visual contact, which is also highly restricted for the electrowriter systems.

7.4.3 Impact on Educational Opportunities

The technology-based networks are having an impact on the educational opportunities of professional workers, primarily engineers and businessmen in industry and business. Through the networks these non-traditional learners have obtained increased access to instruction that has previously been confined to the campus classroom. Many of these learners have been pursuing graduate degrees, primarily at the master's level, on a part-time basis in engineering and related sciences, and business. In September, 1973, Baldwin estimated there were 15,000 students in engineering graduate programs taking approximately 700 courses each year by way of off-campus technology-based networks. (53)

Many undergraduate students have also been served by technology-based networks, which have provided increased educational opportunities and access to higher education. These students have often been able to live at home and attend nearby community colleges, thereby reducing the costs of a college education and still choose courses that have been offered in a larger, more diversified, four year institution via the networks. The capability to choose from a wider selection of courses made possible by a network has also enabled many students to fulfill lower division, prerequisite course requirements and then complete their curricula at a larger four year institution on schedule.

Furthermore, being able to take courses offered over a network as well as those offered on campus has often helped a student work out a more convenient time schedule for classes. As a result, the students benefit from a greater diversity of programs that often provide greater flexibility of scheduling and use of time, as well as cost savings.

7.4.4 Dependence on the Lecture Approach

Although many non-traditional student groups have been served, the use of the traditional classroom lecture approach has been predominant. In many cases, the actual classroom lecture session on campus has been broadcast or videotaped and delivered to the off-campus or remote sections. The ITFS and point-to-point microwave networks are prime examples of technologies used to deliver live, televised classes, while Colorado State University's SURGE network is a notable example of television-based classroom instruction via videotape.

7.4.5 Concern for the Instructional Process

The networks have relied primarily upon an instructional process that is similar to the approach used in the traditional college classroom. Off-campus students in addition to their on-campus counterparts in the originating classrooms are expected to do the same work and progress at a steady, even rate along with their fellow students. These students have for all practical purposes been completing specific traditional courses or programs within the various departments of the respective institutions, but doing so at remote locations.

7.4.6 Need for Instructional Support Systems

Although technology is used to disseminate information presented by the traditional classroom lecture format, it appears that additional instructional support has been needed. Even the live, interactive television networks such as the ITFS and point-to-point microwave systems have used instructional support. For instance, off-campus students have frequently been required to complete and submit class-work to the on-campus instructors. For the Chicago T V College, a broadcast television-based system, students have received study guides and additional materials to further aid their studies, besides having to complete homework assignments. Furthermore there are also regional study centers where T V College students can receive assistance. The videotape-based networks have scheduled telephone conferences with the off-campus students so that these students have the opportunity to discuss and clarify the material which is presented by the instructor. Electrowriter and telephone conferencing systems have often sent visual and other needed materials to the remote sections prior to the time when the class meets.

7.4.7 Beneficial Relationships with Business and Industry

Technology-based networks have been effectively used in cooperative ventures between educational and non-educational business and industrial concerns. Prominent factors for success appear to be that the effort between these parties be coordinated and well defined, and that the needs of the organization and its students be explicitly defined. In many of the ITFS television systems, a substantial portion if not all of the costs have been paid by business or industry, while the educational institution has provided the service.

7.4.8 The Question of Cost-Effectiveness

For many of the networks surveyed, little information was obtained concerning actual incomes and expenditures. Most respondents from the surveyed networks considered their networks cost-effective, but often the criteria upon which this conclusion was arrived at depended only partially upon dollars and cents. In many instances, it was based upon the perceived value of providing the service to the participants apart from the costs of providing the service. Morris et al have performed an analysis which indicates that at least three networks, Colorado State University - SURGE, the Stanford Instructional Television Network, and TAGER, are cost-effective, based upon the incremental instructional costs of providing the educational service. For these networks, the per student cost of televised instruction was estimated to be less than the traditional on-campus costs. In addition, one of these networks was reported to be fully recovering the incremental costs of its television delivery system.

7.4.9 Developmental Needs

The foremost problem facing the technology-based networks is lack of funds. Without proper resolution of this problem, the further utilization of technology may falter. To a greater extent than for technology utilization in non-traditional programs in general, the networks have benefited from the financial participation of industry. This, however, has not solved the monetary issue. Many of the networks have received outside funding from sources such as business, industry, the state governments, and foundations, but the greatest percentage of total funds has come from within the institution. To a large extent other sources of support have been less substantial.

Furthermore for the networks to develop, other conditions must also be met. Faculty and administrators need to be convinced and made more receptive to the use of technology-based instruction. In addition, channels of communication that provide for adequate interaction, cooperation, and exchange of ideas must also be initiated for the groups concerned.

7.4.10 Long Term Needs

While there are developmental needs for technology-based networks, this must also be followed up by other long term developments to sustain the networks. First, there may be the need in the long run to obtain enough student users to keep instructional costs per student comparable to or less than traditional costs. This appears to be an important consideration in planning for Project SUN of the State University of Nebraska. According to a recent article, consideration has been given to increasing the user base by including residents of midwestern states other than Nebraska.* (38)

It may also be desirable to develop a diversified user base so that the network can be generating income from as many sources as possible. This diverse user base can be built by making arrangements for several institutions to present programs over a given network, as is the case for the Association of Continuing Education on the Stanford Instructional Television Network as well as by expanding the student clientele. Student users may be seeking degrees, college credit, or may only be auditors and other continuing education learners.

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*As this report was being finalized, the formation of the University of Mid-America was announced. (133)

Development of a diverse user base may also mean that the network would be less dependent upon fees from any one particular user group.

7.4.11 Positive Future Outlook

The future for the technology-based networks based on the sample response appears secure. Better than half of the surveyed networks have indicated future growth and expansion. The networks also appeared interested in the educational opportunities increased networking and resource sharing could offer. The networks as a whole believe telecommunications has a future in higher education and will have a major impact. The technology-based networks in their present capacity of service appear to have secured a niche in the field of non-traditional higher education.

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9. APPENDICES

9. APPENDICES

Sections 9.1 through 9.7 of the Appendices contain a description of twenty-six technology-based networks compiled during the course of the thesis investigation. In addition, several other networks are briefly mentioned. The networks are categorized as follows: videotape, ITFS, point-to-point microwave, broadcast television, television distributed by telephone lines, electrowriter, and other telephone-based technologies. It is believed that the descriptions are reasonably accurate and up-to-date through early 1974. Appendix 9.8 contains information on ITFS costs per channel, while Appendix 9.9 is the cost determination per quarter credit hour for the Colorado State University SURGE program. Finally, Appendix 9.10 contains a copy of the survey questionnaire, "Survey of the Role of Technology in Higher Education," and a partial list of respondents.

APPENDIX 9.1

VIDEOTAPE NETWORKS

9.1.1 Colorado State University*

Since 1967, Colorado State University has been instrumental in developing and maintaining innovative programs utilizing various technologies to provide instruction to many educational and industrial locations. These educational programs under the acronyms SURGE, CO-TIE, BIOCO-TIE, HI-TIE, and other lesser non-traditional educational projects have been funded in part by the National Science Foundation. The videotape technology is the medium most often identified with CSU programs. The videotapes are prepared and shipped by courier service to the off-campus locations.

SURGE: Initiated in 1967 the SURGE (State University Resources in Graduate Education) program was intended to serve the technologically based industries on the eastern slope of Colorado's Rocky Mountains. SURGE offers graduate level instruction in the fields of engineering, mathematics, physics, statistics, atmospheric science, watershed science, psychology, and business. A complete Master of Science degree program is offered in Mechanical, Civil, and Electrical engineering, as well as a Master's degree in Business Administration, which has recently (1972-73) been incorporated into the program.

The SURGE program is oriented towards serving the employees of industries in Colorado or its near vicinity. Furthermore, sites located in California, Montana, New Mexico, South Dakota, and Wyoming

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*The information from this section was taken from Innovative Educational Programs of Colorado State University. (39)

have been added to the SURGE network on an experimental basis. Table 9.1.1.1 lists participating industrial firms and agencies; Figure 9.1.1.1 geographically locates those sites. The students at the various off-campus locales receive videotapes of actual classroom lectures along with the discussion that occurs during each lecture between the students and instructor. Off-campus students are required to complete the same assignments, laboratory experiments and examinations as on-campus students. Laboratory experiments and the needed equipment, most notably in the field of electrical engineering, are conducted with each industry's or agency's own stock of supplies. However, there is usually a two day difference between the time an on-campus student and an off-campus student receives the same material. This is primarily due to the time required for transmitting the packaged videotapes and accompanying assignments through the courier service.

Since fall 1967-spring 1968, SURGE has grown from a system offering seven courses per quarter at about eight locations to 644 off-campus students yearly, into one that has offered 31 courses per quarter at 27 different locations to 1,127 students during fall 1972-spring 1973.

The system that is primarily responsible for this increase in productivity is dependent upon a videotape network. The videotaping process begins with a specially equipped classroom on campus where an instructor delivers his lecture to a classroom of students in face-to-face, interactive fashion. Further, there are no specially taught SURGE courses; the courses taped are simply regularly scheduled courses taken by the traditional college student.

Table 9.1.1.1

Industrial Firms and Agencies

Participating in SURGE Program

Academic Year 1972-73

Company or Agency	
Adolph Coors Brewery	Golden, Colorado
*Ball Brothers Corporation	Boulder, Colorado
Bell Telephone Laboratories	Denver, Colorado
Canal Zone Society of Professional Engineers	Balboa Heights, Canal Zone
C. F. & I. Steel Corporation	Pueblo, Colorado
Cobe Laboratories	Lakewood, Colorado
Colorado Department of Health	Denver, Colorado
Colorado State Penitentiary	Canon City, Colorado
*Dow Chemical Company	Golden, Colorado
Eastman Kodak Company	Windsor, Colorado
First National Bank of Denver	Denver, Colorado
Hewlett-Packard Company	Colorado Springs, Colorado
*Hewlett-Packard Company	Loveland, Colorado
*Honeywell, Inc., Test Instrument Division	Denver, Colorado
*I. B. M. Corporation	Boulder, Colorado
Lamar Community College	Lamar, Colorado
Lowry Air Force Base	Denver, Colorado
Marathon Oil Company	Littleton, Colorado
*Martin-Marietta Corporation	Denver, Colorado
Mesa College	Grand Junction, Colorado
M & I Incorporated	Fort Collins, Colorado
Mountain States Bell Telephone	Denver, Colorado
*National Center for Atmospheric Research	Boulder, Colorado
Nelson, Haley, Patterson & Quirk Inc.	Greeley, Colorado
Northeastern Junior College	Sterling, Colorado
Stearns-Roger Company	Denver, Colorado
U. S. Air Force Academy	Colorado Springs, Colorado
U. S. Bureau of Reclamation	Denver, Colorado
U. S. Bureau of Reclamation	Billings, Montana
U. S. Geological Survey	Denver, Colorado
U. S. Geological Survey	Cheyenne, Wyoming
White Sands Missile Range	White Sands Missile Range, New Mexico
Woodward Governor	Fort Collins, Colorado
Wyoming Highway Department	Cheyenne, Wyoming

*Original locations for initiation of program, Fall 1967.

**From Baldwin et al. (39)

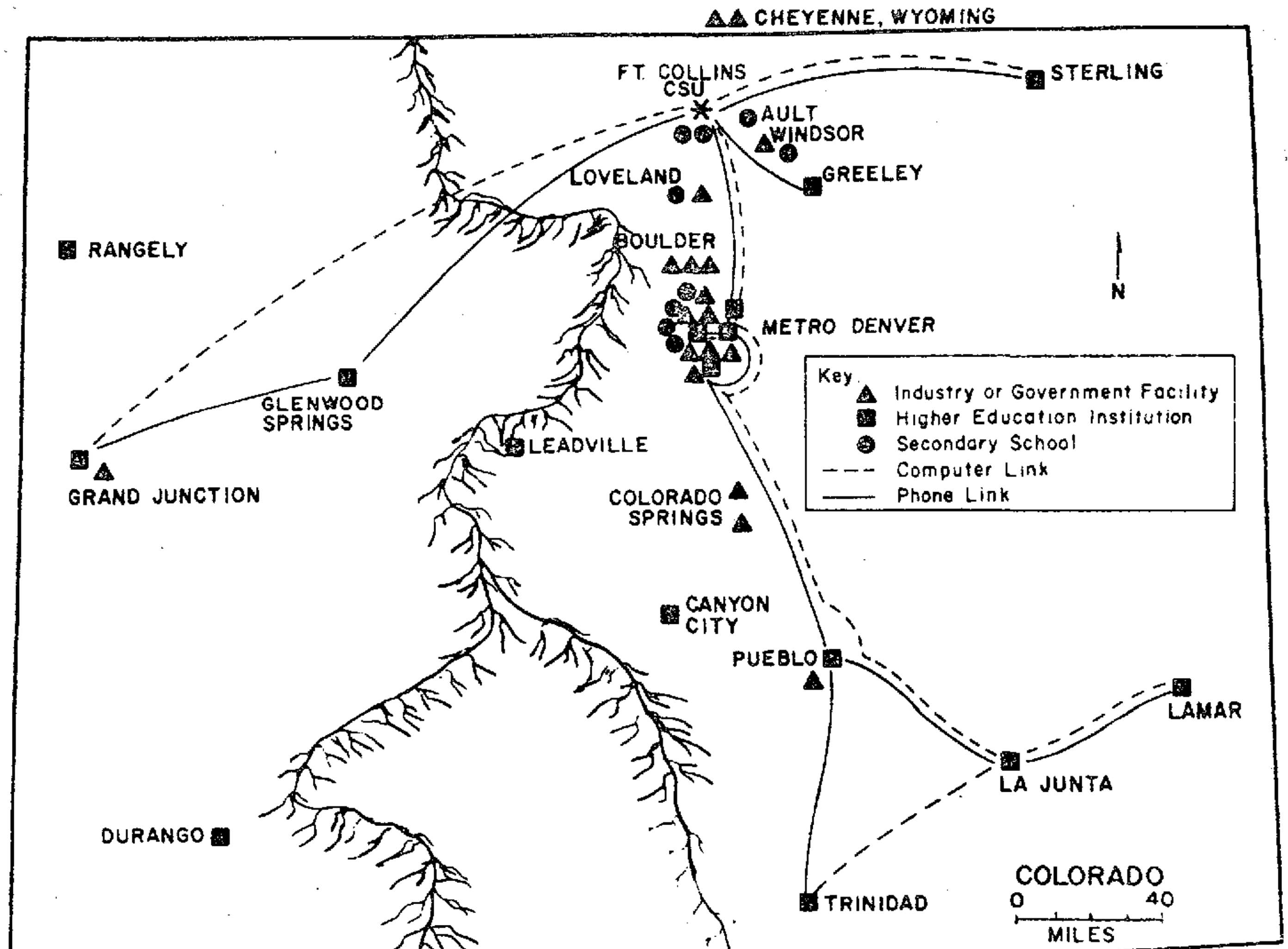

Figure 9.1.1.1. Locations of Innovative, Off-Campus Educational Programs of Colorado State University*

*From Baldwin et al. (39)

SURGE utilizes four on-campus classrooms for taping purposes. These four classrooms serve three slightly different functions. Two classrooms accommodate approximately thirty students, a normal sized class; one classroom accommodates sixteen students to provide greater interaction; and the fourth is a small, wedge-shaped auditorium holding 125 students for larger lectures.

The camera arrangement for the three smaller classrooms consists of three strategically located cameras. One camera, controlled by the instructor, is situated over the instructor's desk. This camera enables any writing on a desk pad or other activity that might occur on the desk to be seen via the studio classroom monitors or be recorded for off-campus students. A second camera, located in the rear of the studio classroom, is controlled by a technician at the central recording facility. The technician may remotely pan-tilt-zoom and focus this camera to follow movements of the instructor at the front of the room or at the blackboard. The third camera is positioned in the front of the classroom to pick up a portion of the students in the class. It is up to the course instructor, who selects the viewing camera from his desk, as to which camera is activated.

The audio portion of the videotape is picked up through the instructor's lapel microphone or by overhead microphones which can be activated either by the instructor, student(s), or technician. The technician, situated at the central recording control console, listens to the lecture being taped and accepts cues verbally so that the best possible picture can then be recorded from any one of the cameras. It is also possible to present a split screen picture when it is desirable. This procedure is important since little rehearsing is done before the actual recording of programs.

The audio and video signals are used to produce the necessary number of tapes needed for each course. As many as 32 original copies can be provided for distribution to the off-campus instruction sites. The recording function takes place within the central recording facility. About 400 videotapes each week are prepared, numbered, catalogued, and delivered by United Parcel Service to the instructional sites.

At the firm or agency receiving sites, the videotaped courses are played back on the necessary equipment in classrooms that are provided by that particular firm or agency. Although videotape is the primary communications medium used by the students, course instructors are encouraged to visit each receiving site at least twice a quarter to provide face-to-face interaction. Occasional telephone conversations provide supplementary live, real-time contact.

The videotapes, once viewed, are returned to the SURGE facility at Colorado State University for erasing and reuse to tape other course lectures. If a student should miss the regularly scheduled videotape playback time, it is possible to retain the tape for several days for later viewing by that student.

From 1967-73, a six year period, some 16,000 quarter credits have been granted to professionals studying at their respective work sites.

CO-TIE: Another non-traditional educational project of Colorado State University, CO-TIE (Cooperation via Televised Instruction in Education), has as an objective facilitating the transfer of primarily community college students in pre-professional programs to four year institutions without undue time losses. Loss of time and progress are often the result of a deficiency in necessary background courses which are needed but are not conveniently taught at the community college level. The time required to develop the proper background and enter a particular curriculum on schedule can mean the loss of an academic year to some students. According to Baldwin et al (39), CO-TIE also serves to enrich and extend the curricula at the participating institutions through resource sharing of expertise, facilities, and ideas.

As indicated by Baldwin et al by a strong cooperative educational effort, CO-TIE has crossed institutional boundaries and broadened academic programs in the areas of engineering, mathematics, avian sciences, and biological sciences. Table 9.1.1.2 lists the participating institutions, their participation in the many aspects of CO-TIE, and audio and computer network facilities. Classes are being taught by instructors who are remote in time and space from the students receiving the instruction. Classes, primarily in the avian and biological sciences, are further being supported, embellished, and enriched by a team venture that has produced illustrative and demonstrative programs in both the field and laboratory.

In the fall of 1968, CO-TIE took the first of several steps that would influence higher education in Colorado colleges. First, the sophomore engineering curricula at many community colleges were broadened to facilitate the smooth transition of transfer students into continuing programs at four year institutions. Courses in electrical network analysis and fluid mechanics in the electrical and civil engineering areas were and continue to be videotaped at CSU and distributed to the colleges.

Table 9.1.1.2. Colorado State University Cooperation with Higher Educational Institutions*

	AVIAN SCIENCE	BIOCO-TIE	ENGINEERING	MATHEMATICS	COMPUTER NETWORK	AUDIO NETWORK
Aims Community College, Greeley		●		●		●
Arapahoe Community College, Littleton		●	●	●	●	●
Colorado Mountain College (East), Leadville		●				
Colorado Mountain College (West), Glenwood Springs		●				●
Community College of Denver (Auraria)		●		●	●	●
Community College of Denver (North)		●		●	●	●
Community College of Denver (West)		●		●	●	●
El Paso Junior College, Colorado Springs				●		
Fort Lewis College, Durango			●			
Lamar Community College, Lamar		●			●	●
Mesa College, Grand Junction		●	●	●		●
Northeastern Junior College, Sterling	●	●	●	●	●	●
Otero Junior College, La Junta	●	●	●	●	●	●
Rangely College, Rangely		●		●		
Trinidad State Junior College, Trinidad		●	●	●	●	●

● Indicates program activity on campus

*From Baldwin et al. (39)

The manner of course preparation and taping is similar to that employed in the SURGE program. In fact, the same equipment and facilities that are used in the SURGE program are also used for CO-TIE. In addition to the videotape and playback facilities is a dedicated audio network which enables live, real-time interaction between students and instructor twice a week. Remote electronic blackboards, or blackboards-by-wire, are also employed to facilitate the instructor-student interplay.

Since credit for the videotaped courses is granted by the institution where the playback takes place, rather than through CSU, faculty at those community colleges oversee the progress and examination of the students. Many of these faculty, however, exchange ideas on progress and testing concerning the taped courses with the CSU faculty.

Because many community colleges are limited in what can be offered at their institutions, courses such as the avian sciences may be overlooked. This was the situation until project CO-TIE was initiated. Now, for example, two community colleges offer autotutorial courses in the poultry sciences. Each course is accompanied by videotaped lectures, texts and laboratory manuals that are used in conjunction with the taped lectures. Laboratory work, along with supporting audiotapes and color slides complete the course.

The program known by the acronym BIOCO-TIE (Biology Core via Televised Instruction and Experimentation) produces visually supportive, biology-oriented videotapes to supplement regular course lectures. Thirteen community colleges, as well as Colorado State University and the University of Colorado, participate in BIOCO-TIE by using the materials. The color videotapes, no longer than 20 minutes in duration, may be made in the field by way of a mobile unit, in the laboratory, in CSU studios where special production techniques may be used, or other locations. More conventional audiovisual materials, such as transparencies, slides, films, and audiotapes, are also made and distributed to the institutions of BIOCO-TIE.

Underlying the educational aspects of the CO-TIE effort are the utilization of an audio network and a computer network. Although these capabilities do not reach every institution in the CO-TIE program and are not as extensive as the videotape network, many colleges are served. (See Table 9.1.1.2.)

The audio network, which also served the HI-TIE program (discussed later), consists of 1000 miles of Rocky Mountain Bell Telephone, voice-grade line linking the colleges and CSU. (See Figure 9.1.1.1.) The audio network enables real-time interaction between distant individuals and transmits information to the electronic blackboards and to some slow-scan television monitors that are used on an experimental basis.

The computer network also utilizes another 1000 miles of voice-grade line, which allows nine outlying campuses to take advantage of the computer facilities at Colorado State University. (See Figure 9.1.1.1.) Until 1971 such a computer service had been nearly nonexistent for many two year colleges, but was clearly needed by many students whose plans required computer-related skills.

CO-TIE has also proven beneficial to many mathematics faculty throughout the community college system, in addition to the student bodies of these institutions. Presently, two courses in mathematics are offered each term so that the mathematics faculty have the opportunity to increase their proficiency. This is accomplished while these faculty remain at their respective campuses.

HI-TIE and other off-campus activities: HI-TIE is somewhat similar to the CO-TIE project. The use of studio classrooms and dependence on the videotape technology characterize both programs. However, the educational objective of HI-TIE is to provide accredited college-level instruction to high school instructors and students. HI-TIE enables teachers to complete in-service training, improve competency, and obtain full-credit for work done in a variety of fields. This work may also serve to fulfill certification requirements.

HI-TIE also allows high school seniors who have completed graduation requirements early to begin their college careers sooner than might otherwise be possible. Furthermore, HI-TIE permits high school students who have outdistanced their fellow learners to take college-level courses as electives while concurrently finishing high school. Although HI-TIE is still considered experimental in nature, the response to bringing the college to the high school has been encouraging to the faculty and administrators of all parties alike, according to Baldwin et al. (39)

Finally, in spring, 1972, Colorado State University in cooperation with Colorado State Penitentiary in Canon City offered a first year college mathematics course to the inmates. The course was taught via videotape and further supported by the electronic blackboard. Successful completion of the course results in full credit being granted to the student at CSU. A more varied academic program is reported to be soon developed for the Colorado prison system.

9.1.2 The Iowa State University Videotape Program

In 1968, the growing awareness of educational needs for Iowa's engineering profession led to the pilot phase of a program that was later to become the Iowa State University Videotape Program. Through the ISU engineering college administration, the decision was made to offer a full-credit statistics course to four industrial locations by videotape technology. A communications technology was chosen because, like in many regions, the engineering professional is found throughout the state. Because of the professional statewide distribution, it is inconvenient and time consuming for the engineering professionals to come to ISU, or for ISU to go to the engineer by way of faculty frequently travelling to lecture sites. (40)

The success of the pilot phase resulted in an expansion plan whereby more students could receive programs, more locations could be reached by prepared videotape programs, and more courses could be presented. Over a three year period, from 1969-1972, some 106 sections of sixty different courses have been taught at many locations by 49 different instructors of ISU to classes with a minimum of five students through the videotape program.

The off-campus students follow the same registration procedures and pay the same tuition as their conventional counterparts. However, off-campus students are advised to register as non-degree seeking students until at least nine credit hours have been accumulated. At this time the student, who so desires, may seek regular graduate student status by application to the Graduate College. Both procedures help to minimize the administrative and secretarial work required for off-campus students.

Industry incurs the expenses for mail delivery of videotapes, class materials, references, and exams. The University covers the costs of occasional instructor travel to and from each off-campus site. By policy, it is expected that each instructor will visit each site at least twice per term. Furthermore, the additional off-campus sections are considered to be part of any instructor's regular work load, and so no time allowances are made for dealing with off-campus sections. (40)

Courses that will be videotaped each term are selected from a general list that is circulated to the instruction receiving sites. The local site coordinator, who takes charge of scheduling, playing, and return of the tapes, and other essential activities, determines the interest in the courses offered and applies for those particular courses. In time, each location receives a list of the videotaped courses it will receive and a notice of any other possible courses that have not been filled. This procedure allows for the most appropriate resolution of conflicts since it is possible to be shut out of a course according to the first-come-first-serve stipulation and the restriction that there can only be two off-campus videotape sections per course. (40)

Each of three classrooms at Iowa State University is equipped with videotaping facilities which include one camera, two recording units, a television monitor, and microphones for the instructor and class. (33, 40, 66) A student cameraman tapes each course lecture and is expected to turn in one or two tapes by the following day. Enough time is then allotted so that a tape can be remade if necessary.

Otherwise, the tape and any other materials are shipped to the industrial receiving site. After being played, the videotape is returned to ISU for erasing and reuse. If, however, a course is to be given two consecutive terms, by mutual agreement of the instructor and departmental chairman it may be possible to save the tapes for reuse in the following term.

The receiving site then plays the tapes on equipment either purchased or rented by the industry. It takes approximately two days from the time of taping for the tapes to be delivered and seen. Ordinarily, the off-campus classes meet the same number of times for the same amount of time as their on-campus counterparts. Instructor visits, plus prearranged telephone discussions provide the only other communication links between ISU and the instruction sites. (40)

After several years of operation it appears as though the present videotape system compares favorably to the cost of conventional instruction on the Iowa State University campus. An investment of $51,000 has purchased the necessary capital equipment such as the cameras, recorders, tapes, and other related equipment. According to Townsend and Lamp, "[Through] ten quarters of operation the receipts to the University as a per cent of total annual costs come to 44.2%. This cost figure has been arrived at by including administrative and secretarial salaries, all travel expenses, depreciation of [the] equipment and tapes, and miscellaneous equipment repair costs. Costs associated with offices and classrooms are not included in [these costs]." (40)

9.1.3 Other Videotape Systems

Since approximately 1969, the University of Colorado has been operating the Audiovisual Continuing Education (ACE) program, which incorporates a videotape network. Although the author was not able to obtain much information about the ACE system, it presently serves a three-fold purpose. First, it provides accredited courses, off-campus. Secondly, it provides for the interchange or exchange of courses between three University of Colorado campuses at Boulder, Denver, and Colorado Springs. Third, since the Denver and Colorado Springs campuses are basically night campuses with part-time clientele, the taped courses allow courses taught in the day to be easily presented during the evening. (33, 67)

According to Baldwin (53), the University of Arizona and Cornell University are operating videotape networks also. The Cornell network, however, utilizes the videocassettes rather than the videotapes. (47) To these systems Morris et al add that the University of West Virginia and Rochester Institute of Technology* have been operating off-campus videotape programs and also point out that the University of Wisconsin is initiating a videotape program. (47)

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*The Rochester Institute of Technology off-campus videotape program is distinct from the RIT external degree program mentioned in Chapter 2.

APPENDIX 9.2

ITFS INSTRUCTIONAL TELEVISION NETWORKS

9.2.1 The Stanford Instructional Television Network

In order to explain why Stanford University chose to develop an Instructional Television Fixed Service (ITFS) system, which has become the Stanford Instructional Television Network (SITN), it is necessary to look briefly into the history of the Honors Cooperative Program. The Honors Cooperative Program was the first program to have courses broadcast over SITN.

The Honors Cooperative Program (HCP) was set up in 1953 and allowed scientists and engineers pursuing advanced engineering degrees to take courses at Stanford on a part-time basis. In cooperation with the employers, the students were released from their work duties to attend classes part-time on the Stanford campus, while still earning a full-time salary. (54, 63)

However, there were serious drawbacks to this approach, such as the limited number of students that could be served due to travel limitations. In fact, some students were spending as much as twice the amount of time driving and parking as compared to the time actually spent in class. Also, students were often pressured into taking two courses that were offered consecutively, one directly after the other, rather than courses most pertinent to their academic goals, in order to take the recommended 5 to 6 credits per term. These problems were not singular to Stanford University alone, but were common to the many other educational institutions in the San Francisco Bay area. As a result, this particular daytime release program for Stanford, and many other colleges and universities in the area with similar programs had only limited success. (54)

In order to serve the growing number of industries in the San Francisco Bay area and the educational needs of the area's employees, serious consideration was given to taking the Stanford campus classroom out into the surrounding work community. Finally, in 1969 knowing that the industries and organizations presently participating in HCP would assist in the capital investment of a network and that the present program's fees would not increase more than 25%, a four channel, one-way video, two-way audio ITFS delivery system was initiated. (54, 63)

The first real courses to be offered over the air by Stanford to network members were associated with the Honors Cooperative Program. Since HCP is oriented towards engineering graduate students, mainly at the master's degree level (although some doctoral work may be done also), the curriculum primarily reflects the graduate course offerings of Stanford's ten departments in the School of Engineering. (54) However, courses from the School of Humanities and Sciences are also offered in the areas of natural and computer sciences, statistics, business, and political science. (63) Creditwise, because the master's degree does not involve a thesis, it is possible to earn a degree entirely through off-campus television courses, but this is rarely done. Probably the most limiting factor is the diversity of courses needed to meet the interests of any graduate student are not entirely available through the television curriculum. In fact, Stanford could add several additional channels to the network without fully meeting the needs of the students in industry. Secondly, each student is encouraged to spend time on campus to attend seminars, to receive counselling, to become acquainted with faculty instructors wherever possible, and to use the campus facilities, such as the libraries.

Nevertheless, all off-campus students can see the instructor and studio classroom via the video system and can hear and take part in all class discussions since the audio system enables any student at any site to hear the questions or comments from all the other sites. (54, 63)

Admission to the HCP program depends upon having a bachelor's degree, having good academic standing previously, and recommendations for acceptance by the student's employers. As of late, there were between 400-500 graduate engineering students in the Honors Cooperative Program, or about one-third of the graduate engineering enrollment. (54, 63)

These part-time students are advised to take about six credits per quarter for eight consecutive terms. In this manner, it is possible to complete the master's requirements in two calendar years.

For part-time, non-degree seeking students, such as those who have graduate degrees already or do not wish to complete the entire program, or for students only marginally qualified to do graduate work, there is a non-registered option. This option enables students to take televised courses and be evaluated with the other HCP members without HCP standards being affected by the non-registered option students' performance. This option can also be an entry route to the Honors Cooperative Program for the marginal student who does well in coursework. In addition to the non-registered option, it is possible to merely audit a course. (54, 63)

Association for Continuing Education: There is another program that takes advantage of the Stanford Instructional Television Network, and this is the Association for Continuing Education (ACE)*. ACE, a non-profit corporation, is operated under the auspices of a charter by the state of California. The continuing education association televises a diverse range of courses to the members of the Stanford Instructional Television Network in the Bay area. (See Table 9.2.1.1.) The courses televised through ACE are taught by instructors from Golden State University, California State University - San Jose, and the College of Notre Dame in Belmont, who use the Stanford studio classrooms.

Golden State University offers a Master's degree in Business Administration and cooperates in part with the College of Notre Dame, which televises a foundation business administration series for those who do not yet qualify for the Master's program. Notre Dame College also presents a short course leading to a certificate in supervisory management for persons recently given supervising responsibilities or for those who simply want to update their management practices.

California State University at San Jose is broadcasting courses for a cybernetic systems program and in the near future will televise all the necessary courses required to obtain a Master of Science Degree in Cybernetic Systems.

There is also a series of special and general topic courses that are developed by ACE institutions for the educational needs of employees

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*For the case of the Stanford Instructional Television Network, ACE refers to the Association for Continuing Education and should not be confused with the University of Colorado's Audiovisual Continuing Education Program.

Table 9.2.1.1. Members of the Association for Continuing Education.*

Ampex Corporation	GTE-Sylvania
Avantek, Incorporated	Hewlett-Packard Corporation
Barry Research	International Business Machines
Bechtel Corporation	Kennedy Engineers
John Blume and Associates	Lockheed Missiles and Space Company
California State University, San Jose	NASA/Ames Research Center
College of Notre Dame	Pacific Gas and Electric Company
Diversified Electronics	Philco-Ford Corporation
Electro-Magnetic Systems Laboratories (ESL)	Singer-Link Division
Fairchild Camera and Instrument Corporation	Stanford Oil of California
Fairchild Research and Development Laboratories	Stanford Research Institute
Fluor-Utah	Systems Control, Incorporated
Genesys Systems, Inc.	Vidar Corporation
Golden Gate University	Watkins-Johnson
	Xerox, Palo Alto Research Center

*Stanford Instructional Television Network packet. (63)

at a particular industry or organization. By way of mutual agreement, many of these special and general interest courses can then be used at local colleges and universities for full credit in degree programs by the students. (63)

The Association for Continuing Education is governed by a nine member industrial board and a Stanford representative. Members serve staggered two year terms, with three members each from groupings of the smallest, mid-range, and largest industries and organizations. A manager, working full-time with a curriculum committee, finds the proper instructors to teach the courses which are to be offered.

ACE, being non-profit in nature, charges only the necessary tuition fee that permits the program to recover the costs of operation. (54, 63)

The ITFS Network: The technical system that has helped make the Honors Cooperative Program and the Association for Continuing Education a success is an Instructional Television Fixed Service network.

The transmission process begins in the studio classroom on the Stanford campus. In rooms designed to give the atmosphere of a classroom rather than a broadcasting studio, the instructor meets the on-campus section of the class in traditional student-teacher lecture fashion.

Either of two cameras can pick up the activity in the classroom. One camera, set into the ceiling, picks up any material written on the instructor's desk pad, or graphs, slides, or materials the instructor may want to display on television monitors. A second camera in the rear of the classroom can view the class and instructor, who may move to and from the blackboard. Both cameras are remotely controlled for pan-tilt-zoom response by a student controller. The student operator in a control booth at the rear of the room also regulates the audio levels and the talkback capabilities. This booth also contains monitors which enable the operator to see the picture and control its quality. The camera signals, upon going through the booth, are carried to the centrally located master control center by coaxial cable. (See Figure 9.2.1.1).

From the master control center, an engineer gives information and instructions to the operator of the studio classroom. Incoming signals from the cameras are then modulated and relayed back to the monitors in the studio classroom and to a secondary monitor room should the studio classroom be too small to handle the on-campus section. In the studio classroom there is one small television monitor for every two students. The monitors are also provided with the necessary microphone facilities so that all sections of the class can hear any comment or question.

Each of the four studio classrooms is handled in the above manner by an operator and master control. From master control it is possible to switch and/or connect any of the four channels to any of the rooms on campus.

In addition to overseeing the on-campus facilities, the master control center is also responsible for the outgoing broadcast. With regard to this aspect of the control center's duties, there are monitors which allow the engineer to see and adjust the quality of the picture that is beamed at 12 GHz to the Black Mountain transmitter site about seven miles away for broadcasting. The control center can also pick up the broadcast signal off the air with a receiving antenna and display the picture on monitors. This enables the center to be sure a

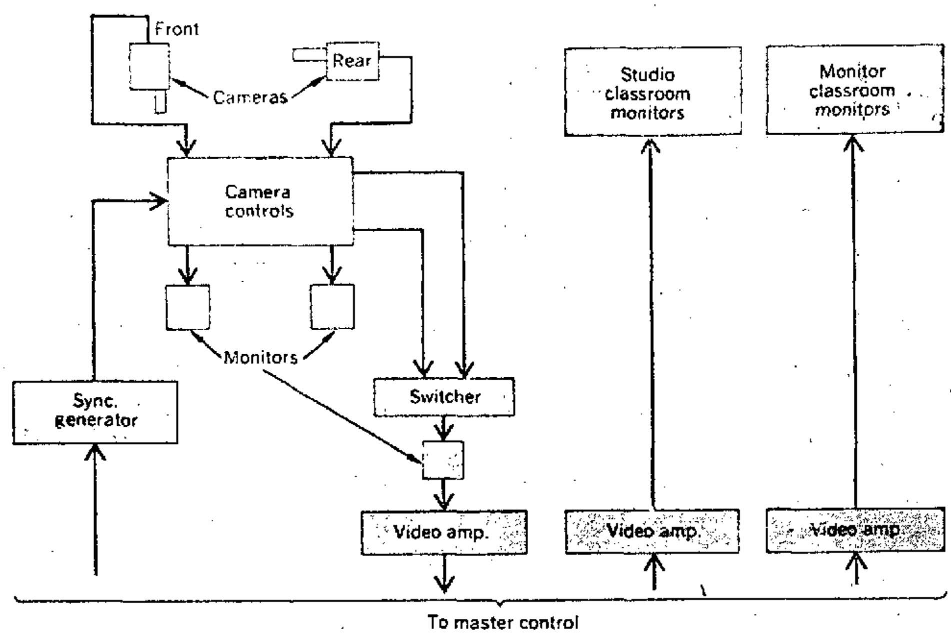

Figure 9.2.1.1. Simplified video block diagram of studio classroom. Pettit and Grace. (54)

properly controlled signal is being beamed out of the Stanford facilities and is received by the off-campus classes. (See Figure 9.2.1.2).

The 12 GHz signal transmitted to Black Mountain is then converted back to the ITFS frequency which is between 2.5 GHz - 2.686 GHz. In order to efficiently use the broadcast power allotted by the FCC, 70% of the power is channeled to an omnidirectional antenna which broadcasts over a 160° arc for a distance of twenty-five miles to the lower San Francisco Bay area. The rest of the power is divided between two directionally aimed dish antennas that transmit to San Francisco, thirty-four miles distant (36, 63) (See Figure 9.2.1.3.)

The receiving sites pick up the broadcast signal, convert it down to the standard VHF frequency band for displaying on television monitors. The audio element of the system is transmitted between the studio classrooms and receiving sites through the Black Mountain transmitter between 2.686 - 2.690 GHz.*

Each organization or industry is generally allowed to design and implement its own receiving classroom(s) as long as the equipment characteristics and specifications are compatible with SITN's own equipment. Most typical receiving sites have a classroom for each of the four channels so that courses broadcast simultaneously do not distract other students. Each classroom is equipped with the necessary number of television monitors and talkback facilities.

Figure 9.2.1.4 is a summary diagram of the entire transmission process from studio classroom to receiving site. At the receiving sites,

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*Stanford has recently made talkback an option, rather than a requirement for participants.

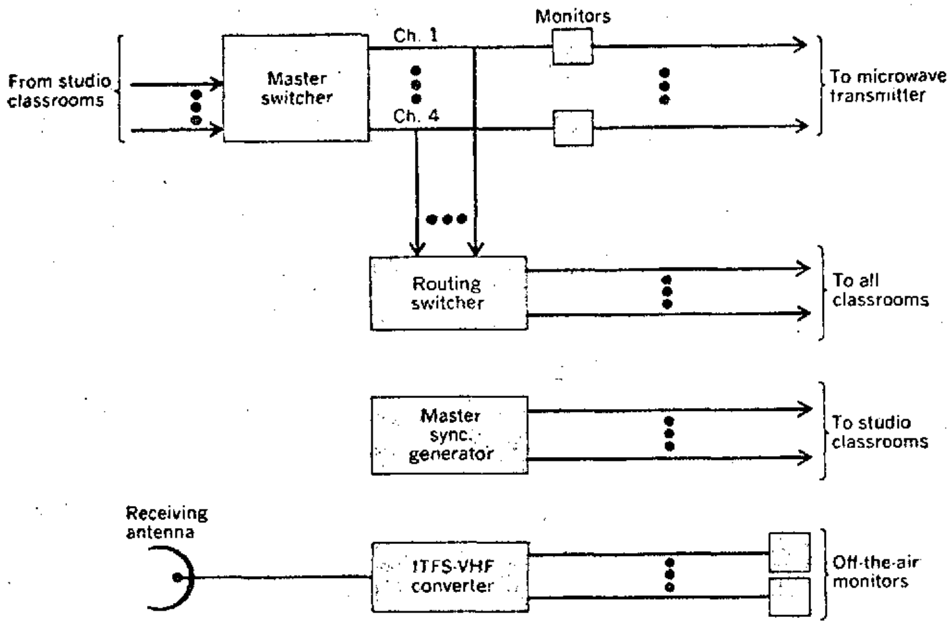

Figure 9.2.1.2. Simplified video block diagram of master control room. Pettit and Grace. (54)

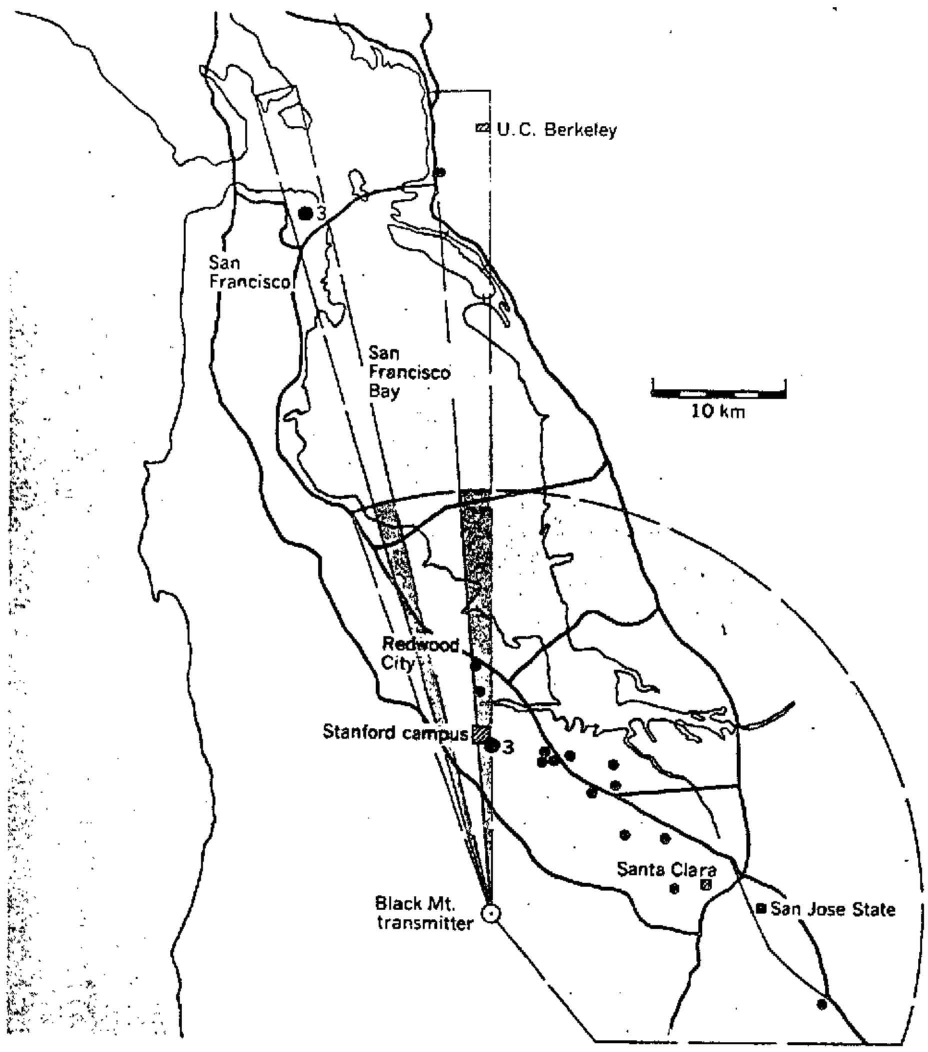

Figure 9.2.1.3. Geographic distribution of San Francisco Bay area participants in Stanford Instructional Television Network. Pettit and Grace. (54)

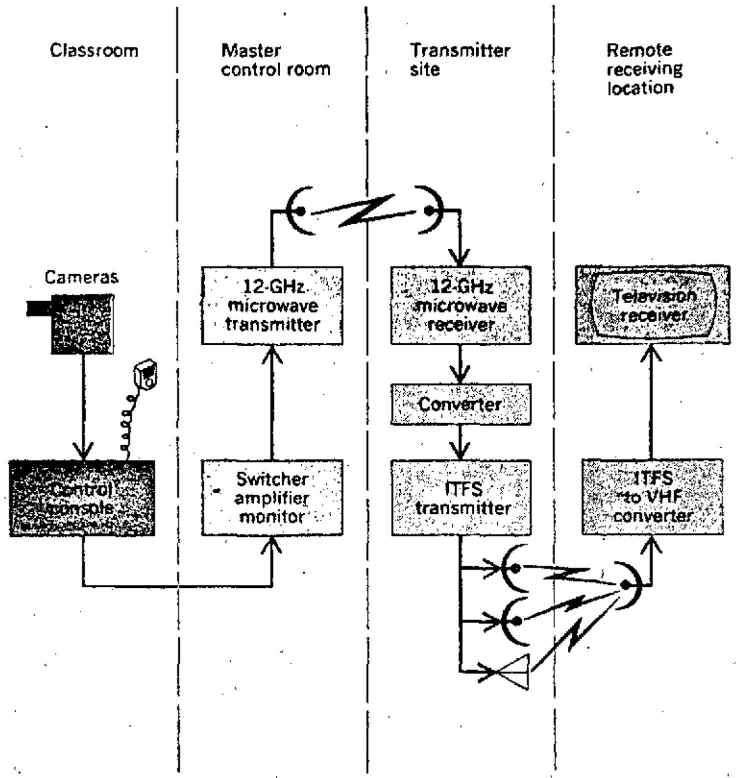

Figure 9.2.1.4. Summary diagram of SITN transmission process. Pettit and Grace. (54)

it is possible to videotape courses from the incoming signal. This enables students to see all the lectures even though it may not be possible to attend all the interactive lecture sessions because of business obligations. By agreement, however, all tapes must be erased within two weeks of the date the course is finished. Occasional visits to the receiving sites by the instructor are the extent of student-instructor interaction at the outlying classrooms. Other than that all assignments and examinations, which are done on an honor system at the receiving site, are picked up and delivered by a daily courier. (54, 63)

As of late Stanford University is broadcasting some 180 credited courses each calendar year to 30 participating industries and organizations. This totals more than 5000 lecture hours each year. ACE, transmitting during the off hours from Stanford, adds some 3,000 hours of lecture to Stanford's total to bring the annual broadcasting time to more than 8,000 hours each year. (54, 63)

Stanford uses the network weekdays from 8:00 am until noon and from 1:00 pm until 4:00 pm. ACE then broadcasts from 7:00 am until 8:00 am, noon until 1:00 pm, and from 5:00 to 7:00 pm evenings. According to Pettit and Grace, the system's broadcast schedule could be extended so that it would be possible to transmit 14,000 hours each year. (54, 63)

SITN Related Costs: The initial capital investment that made the Stanford Instructional Television Network broadcast and transmission facilities possible totals $625,000.* Each of the industries and

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*Appendix 9.8 provides per channel breakdown costs for ITFS systems in general.

organizations participating in HCP pays a share of the capital yearly income. Table 9.2.1.2 indicates the various industrial categories and the membership fee that covers the firm's proportion of the capital investment. In addition to helping in covering the capital investment costs, these same organizations are a source of funds for future capital expenditures. (54, 63)

From Table 9.2.1.2, it can be seen that the smallest organization pays only $2,200, while the largest organization pays $39,600. Furthermore, it is possible to participate in SITN on a trial basis for a year for a fee that is less than 15% of the membership fee. (63)

In addition to contributing to the capital investment, each HCP industry or organization purchases or rents the necessary equipment for its own receiving classrooms. Not considering the audio capabilities, a single classroom that can receive any of the four channels costs approximately $2,100. The more elaborate four classroom set-up with each room capable of receiving any of the four channels costs about $4,500. (63) (See Table 9.2.1.3).

The cost of adding the talkback capabilities to the receiving site system for one classroom facility is about $5,000 and for the four classroom design about $6,500. (See Table 9.2.1.4) (63) Since the talkback element of SITN is an option left to the organization, the cost of hardware equipment varies between $2,100 at the minimum and slightly more than $11,000 at the maximum.

The final responsibility and cost to industry is the registration of the students. Students pay a tuition fee on a per unit basis in HCP, which is not greater than one-fifteenth of a full-time student's tuition per quarter term at Stanford. During 1973-74, the HCP tuition

Table 9.2.1.2. Participant Fees for SITN Members.*

Annual Gross Sales	or	Number of Employees	Membership Fee	Trial Year	Nine More* Annual Payments
$ < 5 million		<200	$ 2,200	$ 200	$ 314
5- 20		200- 800	8,800	1,200	1,223
21- 50		800-2,000	17,600	2,300	2,341
51-100		2,000-4,000	26,400	3,400	3,606
>100					

or an alternate plan providing equivalent payback, interest to be computed at 7 1/2% per annum.

*SITN information packet. (63)

Table 9.2.1.3. Cost of Classroom Receiving Equipment as given by SITN +

	Single classroom switchable to any one of four channels	Two classrooms each independently switchable to any one of four channels	Three classrooms each independently switchable to any one of four channels	Four classrooms each independently switchable to any one of four channels
PURCHASE OPTION				
A. Head-end receiving equipment including 10' mast, 2' parabolic antenna, down-converter, VHF amplifier, power supply, cable (installed)	$1,350.	$1,350.	$1,350.	$1,350.
B. TV receiver and mount, RF outlet, cable (installed)	795.	1,590.	2,385.	3,180.
Purchase Price	$2,145.	$2,940.	$3,735.	$4,530.
LEASE OPTION* - Total Cost per month for:				
a. One year	$ 207.	$ 283.	$ 360.	$ 436.
b. Two years	113.	154.	196.	238.
c. Three years	81.	111.	142.	172.
RENTAL OPTION**				
a. Monthly rental	75.	105.	137.	168.
b. Connect charge	500.	600.	700.	800.
c. Disconnect charge	100.	120.	140.	160.
d. Reconnect charge	100.	120.	140.	160.

*Lease includes 5% sales tax, - it does not include maintenance.

**Rental includes 5% sales tax and all maintenance. Connect, disconnect and reconnect charges are extra.

NOTE: Credit will be given towards purchase at the rate of 66 2/3% of monthly lease or rental payments made during first year.

ESTIMATED COST OF ITV EQUIPMENT AND SERVICES REQUIRED BY COMPANIES
(RECEIVE ONLY - NO TALKBACK)

+SITN Information packet. (63)

Table 9.2.1.4. Costs of Talkback Facilities as Given by SITN +

	Single classroom switchable to any one of four channels	Two classrooms each independently switchable to any one of four channels	Three classrooms each independently switchable to any one of four channels	Four classrooms each independently switchable to any one of four channels
PURCHASE OPTION				
A. Adding talk-back antenna and matching cable	$ 200.	$ 200.	$ 200.	$ 200.
B. Receiver modified for talk-back switching, muting, master panel, line drop, microphone, etc.	530.	1,060.	1,590.	2,120.
C. Automatic time-shared talk-back transmitter with cables (installed)	4,200.	4,200	4,200.	4,200.
Purchase Price	$4,930.	$5,460.	$5,990.	$6,520.
LEASE OPTION* - Total cost per month for:				
a. One year	$ 475.	$ 526.	$ 577.	$ 628.
b. Two years	259.	287.	314.	342.
c. Three years	187.	207.	227.	247.
RENTAL OPTION**				
a. Monthly rental	193.	212.	231.	251.
b. Incremental connect charge	650.	750.	850.	950.
c. Incremental disconnect charge	100.	100.	100.	100.
d. Incremental reconnect charge	100.	100.	100.	100.

*Lease includes 5% sales tax, - it does not include maintenance

**Rental includes 5% sales tax and all maintenance. Connect, disconnect and reconnect charges are extra.

Credit will be given towards purchase at the rate of 66 2/3% of monthly lease or rental payments

INCREMENTAL COST OF ADDING 4 CHANNEL AUTOMATIC TIME SHARED TALK-BACK TO RECEIVE ONLY SYSTEM

+SITN information packet. (63)

has been \$67 per credit although there is a minimum tuition fee of \$245. Students taking the non-registered option pay no tuition fee. However, industry must pay a matching fee of \$67 for both the HCP student and the student in the non-registered option (NRO). The matching fee goes to the department in which the student is registered and helps cover the part-time student educational costs. Finally, a \$20 per credit television surcharge is added to tuition and matching fees to cover daily operation expenses of the network. Auditors' fees are handled in a slightly different manner, and the fee varies depending on the number of individuals sitting in a course. The minimum payable auditor fee as of 1973-74 has been \$75 for a single person, and the fee could rise in excess of \$3,000 for more than 150 persons auditing a course. (54, 63) (See Table 9.2.1.5.)

9.2.2 The University of Southern California Instructional Television System

In 1972, the University of Southern California Interactive Instructional Television System began televising courses to business and industry in the greater Los Angeles area. The USC network may be the most technically sophisticated and most highly developed of the ITFS systems. The network is a four channel one-way video, two-way audio ITFS system with an FM radio link allowing talkback.

Through the interactive television system, students can work on undergraduate or advanced degrees, take part in continuing education studies, and receive short seminars or other information services while remaining on or near their place of work.

The system is centered around the Norman Topping Instructional Television Center on the campus of USC. In this building, which was

Table 9.2.1.5. Student-Related Fees and Auditor Fees for SITN Participants *

The following schedule indicates fees for the 1973-1974 academic year.

	HCP	NRO	AUDITOR	SEMINAR
Tuition	$ 67	$ 0		$ 0
Matching Fee	67	67		0
TV Surcharge	20	20		0
Per Unit	$154	$87		$ 0

Number of Auditors	Fee for Each	Maximum Payable
1 - 20	$75.00	
21 - 40	0.00	$1,500
41 - 80	37.50	
81 - 150	0.00	$1,500
Up to 150		$3,000
Above 150	$20.00	

*SITN information packet. (63)

constructed with an $825,000 gift from the Olin Foundation, are located four studio classrooms with their respective operators' boothes at the rear of each room and the master control room, which is the coordination center for all the classrooms and the entire delivery system. The on-campus studio classrooms and control facilities, plus the master control center function in essentially the same way as the Stanford Instructional Television Network. The major difference is that the USC system uses three cameras, rather than two as in Stanford's case. The front camera which focuses in on the students is the additional camera. (68)

From the control booth an operator can choose the picture from the overhead camera, which is employed when the instructor uses the desk pad rather than the blackboard; the rear camera, which pictures the instructor before his class; or the front camera. Or, two pictures may be presented simultaneously to show a split screen image. As in the case of the Stanford classrooms, every two students share a TV monitor with appropriate talkback facilities. The network can also broadcast from an auditorium, which is equipped like the studio classroom. Thus, larger conferences or seminars may be televised to the off-campus classrooms.

Master control also functions to provide guidance to each of the studio classroom operators, insure the quality of the signal to both the studio classroom and to the receiving sites off the campus, and channel the four different courses being televised to the correct satellite rooms on campus or to the Seaver Conference Center. (See Figure 9.2.2.1.) The signal from the studio classrooms is beamed to the Mount Lee transmitter where the signal is rebroadcast over the Los Angeles community for thirty miles in all directions. Receiving sites in the

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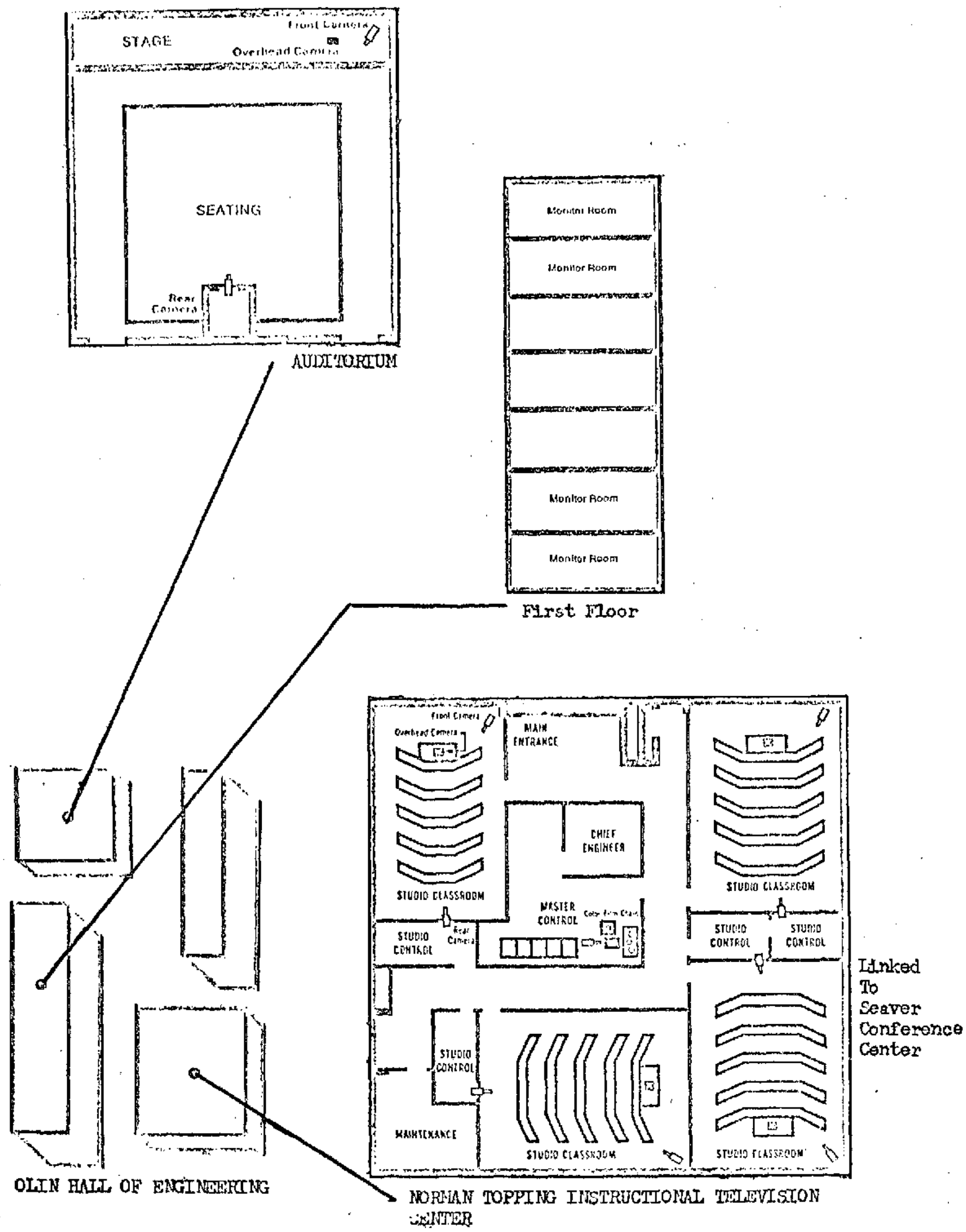

Figure 9.2.2.1. University of Southern California on-campus network facilities. University of Southern California information packet. (68)

reception area pick up the signal and convert it to the VHF-UHF band where the picture can then be displayed on television monitors. The necessary receiving and talkback equipment, plus classroom(s) are furnished by the individual company or firm.

As of 1973, many companies and firms have receiving sites. There is also a receiving location at Rolling Hills High School, which is used on an experimental basis and another regional receiving site located in the heavily industrialized El Segundo area. The Information Science Institute at Marina del Rey will be added to the network in the very near future, also.

The Hughes Aircraft Company, Aerospace Corporation and Burroughs located respectively at Culver City, El Segundo, and East Pasadena are equipped with receiving classrooms to pick up broadcasts. The present two classroom facility at Hughes Aircraft will soon be expanded to bring live lectures to several classrooms and also enable videotaped programs to be patched into five separate study carrels for students who have missed a lecture. Aerospace Corporation with its four receiving classrooms and wired auditorium shares its facilities with the Air Force Space and Missile System Organization in receiving broadcasts. The Burroughs Company has a two classroom facility that is shared with the Bell and Howell Company. In February 1974, Jet Propulsion Laboratory in Pasadena and Van Nuys' ITT-Gilfillian were to be added to the USC system. (68, 69)

With the aid of a $99,500 National Science Foundation grant, USC has established a regional four classroom receiving site in the El Segundo area. The purpose of the regional site is to enable companies that would like to participate in the network the opportunity to do so at a reduced cost. Students attending the regional sites must travel a short distance to the receiving location, but it is a much shorter distance than driving to the campus of the University of Southern California. In the near future, a second site will also be chosen for locating another regional classroom facility. Although the regional classroom application has yet to be evaluated, its success or failure may influence the future development of the overall network. (68)

The Rolling Hills High School receiving site is involved in an experimental program concerned with high school and university interaction. The system is primarily used to teach computer programming to high school students and is infrequently used for supplementary lectures from USC instructors to students. (68)

The Information Science Institute which serves as a research branch of the engineering school in computer science will also be equipped with receiving classrooms and originating facilities. Staff members and students working at the Institute will be able to originate televised courses. Students in the near proximity of Marina del Rey will also be able to take televised courses from the ISI facilities. In time, the USC medical campus and the Marine Science Center at Santa Catalina Island will be added to the network. (68)

Presently, the USC system is offering only about thirty courses a semester, including a non-credit calculus refresher course for high school teachers. If the system were used from 7:00 am until 8:00 pm weekdays, it would be possible to televise at least 80 three credit courses each semester. (68)

It is possible to become a member of the USC network in either of two capacities. In one capacity, the organization is simply allowed to take part in short seminars or participate in USC televised courses on an "audit only" basis. In the other capacity, a company or firm takes part as a fully participating member.

The complete participation option's membership fee, like the Stanford network, varies with regard to the gross annual sales of the company or its number of employees. In USC's case, the smallest company pays only $15 per month, while the largest pays $475 per month, or approximately $180 and $5,700, respectively, on an annual basis. (68)

Each company pays for its own receiving equipment and facilities, which costs in the range of $6,450 for a single classroom with talkback facilities to about $9,700 for the four classrooms with talkback equipment. For companies that merely participate as an auditor, rather than as a full member, no talkback equipment is required, and costs for the classroom may be as low as $1,500. It is also possible for a company taking either option to lease the necessary facilities on a monthly basis. (68)

What the off-campus student and company pay tuitionwise varies with the student's status. A degree seeking student pays the same tuition as a traditional student plus an additional $20 television charge. A non-degree seeking student pays about one-fourth the tuition that a degree seeker does and the $20 television charge. An auditor merely pays the non-degree students tuition and no television fee. In most cases the television fee is paid by the company. Although the limit was not stated, there is a ceiling limit which the total television fee of $20 per student may not exceed. During the second semester of operation, some 150 students were registered in television courses. (68)

Although the network has been in operation since 1972, the future goals for the USC Interactive Instructional Television System are to incorporate more industries, organizations, and agencies into the system. Junior colleges and high schools will also be brought into the system where USC can meaningfully contribute to the educational goals of those institutions. (68)

The USC system plans to increase the programming schedule and develop more programs in the science and engineering areas and broaden the scope of the televised courses to include the business and management fields. (68)

9.2.3 The University of Minnesota University-Industry Television for Education Program

After a brief history of employing closed circuit television in conjunction with an electrowriter to teach graduate courses to IBM employees in Rochester, Minnesota, the University of Minnesota initiated the UNITE program. The UNITE (University-Industry Television for Education) program, which began operating in the fall of 1971, was developed through the joint effort of the University of Minnesota's Institute of Technology and the General Extension Division. The program uses a two channel, one-way video, two-way audio ITFS system to broadcast graduate and upper level undergraduate courses to the Twin Cities and Rochester areas of Minnesota. The program is primarily intended to benefit engineers and scientists in the industries and governmental agencies in these regions. (70)

As has been the case with the development of many of the ITFS systems, a continuing need for professional engineers and scientists to undergo mid-career retraining with minimal travelling inconvenience led eventually to the development of UNITE. Through the UNITE delivery system, professionals in industry and other agencies are able to actively participate in the University's on-campus day programs. It is during the day that the majority of the courses needed by the employees of organizations are taught. (70)

The courses that are televised are regularly offered classes which are attended by on-campus students. The modified classrooms on the campus, however, double as the origination studios for the broadcasts. Either of two cameras that are controlled by an operator may be used for transmitting the picture. An overhead camera is used for desktop demonstrations, slides, or when the instructor wishes to use the writing pad rather than the blackboard. The camera at the back of the room provides a general view of the class and instructor. Both cameras be tilted, panned, or zoomed, which is often done when the instructor is speaking or working at the blackboard. (70)

The picture is displayed in the on-campus classroom, in addition to being transmitted to the downtown Minneapolis broadcast tower. The students see and hear the same thing that off-campus students would see and hear over a television monitor which every two students share. Each monitor is equipped with the necessary microphone facilities so that any question or comment may be heard by all students. Because the on and off-campus students alike can see and hear the same lecture through the same medium, the course instructor is required to develop only a single format for lecturing to all sections. (70)

Presently, the system has two studio classrooms. One studio classroom seats thirty students, and the other seats fifty students.

But if the classrooms are filled to capacity, each class has a satellite room that is equipped with the necessary monitors and talkback facilities to handle the overflow. (70)

To reach the off-campus classrooms, the Foshay Tower in Minneapolis broadcasts an omnidirectional signal for a 25 mile range, and this covers the Minneapolis area. In order to reach the Rochester area about 80 miles from the Minneapolis area, dish antennas beam the signal to a relay station, which in turn transmits the broadcast to the Rochester area. The talkback portion of the signal returns by the same route to the Foshay Tower where special grade telephone lines carry the audio signal to the studio classrooms where the class and instructor may hear the question or comment.

Presently, the following organizations are equipped with receiving facilities although it appears that many other groups are interested: IBM laboratories in Rochester, two separate plants of the Univac Corporation, Honeywell's three plants, the Northern States Power Company, 3M Company, and the U.S. Bureau of Mines Research Center. (70)

Each of the receiving sites picks up the transmitted signal off the air with their own antennas and converts the signal to VHF-UHF bandwidths for display on TV monitors. All of the receiving sites are fully equipped with talkback facilities, also. Videotaping of the lectures is permitted for as many lectures as necessary. This allows students to see lectures that might have otherwise been missed because of other obligations. In addition, videotaping allows students to review past lectures. All tapes must be erased at the end of each academic term according to mutually agreed upon policy. (70)

It is possible for students to earn the Bachelor of Science degree, which provides study in engineering and related sciences, the Master of

Science degree for engineers, and finally the Master of Engineering degree, which emphasizes a design project. The courses are all taught during the regular day session in the program section denoted UNITE A. In the UNITE A group, graduate and advanced undergraduate courses are taught and televised in mechanical, electrical, and geological engineering, engineering mechanics, computer science, mathematics, physics, and operations research. (70)

Courses taught through the UNITE B section are usually requested by the network members. These courses are usually taught through the General Extension Division of the University. The UNITE B courses, in contrast to UNITE A section courses which are televised during the day, are broadcast in the evening hours.

The UNITE C section is composed of experimental courses, short lectures, or seminars which may be of interest to the participating members. UNITE C courses are televised during the slots when regular classes do not use the system. (70)

The UNITE advisory committee is responsible for the administration of the educational goals of the member groups. The committee is composed of members of the University and the participating organizations. Based on the membership's academic needs, a series of courses which appear to be most appropriate are selected for televising to the off-campus students. (70) Off-campus students are registered into the courses by a team which comes to the premises of each receiving location. The students then follow the customary procedures of completing course-work and assignments, which are picked up and delivered by courier. Examinations are also done at the receiving sites under the supervision of a company administrator.

UNITE's present costs of operation are financed primarily by industry through special fees and partly by students' tuition. The initial development was primarily financed by the participating industries. (70) The future of UNITE appears to be aimed at reaching a greater number of organizations within the present area of broadcast coverage. (71)

9.2.4 Case Western Reserve University Instructional Television Network

Since fall of 1972, Case Western Reserve University has been operating the Instructional Television Network which is used to reach many off-campus learning centers located at industrial sites in the Cleveland, Ohio, area. Case Western Reserve University's network relies heavily upon an ITFS system used in connection with videocassette technology. Although it appears that the ITFS system is used in a manner similar to the University of Southern California's or the University of Minnesota's ITFS system, not much was readily available concerning the specifics involved. The same is true for videocassettes, although it is known that the cassettes are used to bring on-campus courses to industrial extension centers. (68, 72)

The philosophy of the Instructional Television Network is oriented towards the "open university without walls" concept. The premise of the ITN is that industrial growth depends upon the continued growth of its workers. The growth of these workers depends upon the periodic updating or upgrading of the skills and knowledge of the employees, which extends beyond the traditional college years and continues throughout every individual's working life. Thus, it is the function of the University to provide the opportunities for growth through continuing professional education. In addition learning options must be made accessible at a pace controlled by the learner whenever possible. (72)

This philosophy has exerted a major influence upon the development and form of the Case Western Reserve University Instructional Television Network. The ITFS system is capable of delivering the instruction to the learner, and the videocassette can, in part, help the individual to learn at his own pace and convenience. Approximately 70% of the learning centers (about 12) depend upon the videocassette method of instruction, while the remaining 5 learning centers depend primarily on the live TV broadcasts. (72)

Presently, it is possible to earn the Master's degree in Business Administration or the Master of Science degree in the fields of engineering, applied statistics, or operations research, and it is also possible to earn the Bachelor of Arts degree. The courses offered for the bachelor level are generally of a junior-senior category that are designed to allow the community college graduate to attain a four year degree. The coursework for the master's level may be completed entirely through the ITN if the student so chooses. In fact some doctoral work may be taken over the network even though it is not possible to complete a doctorate by the ITN. (72)

Students may be admitted to the ITN programs in either of three categories. In one category, the student is admitted with the intention of obtaining a degree in the near future. This is the regular student status. The second category is reserved for special students who generally intend to do only limited coursework in certain areas and are not degree seekers. This may include students who already have advanced degrees, but wish to further develop their present skills, or students who simply wish to develop other skills. The special student status is also used for students who wish to enter the graduate programs as regular students but have not yet proven their competency to do graduate level work. After successfully participating in ITN courses as special students, it is possible to petition the University to be admitted as regular degree seekers. The third category is used for students who merely wish to audit courses.

Regular and special students who take courses over the ITN pay $109 per semester credit hour, which is based on the on-campus, part-time student tuition fee. Auditors pay $60 a semester credit hour for the right to sit in on a course. (72)

Figure 9.2.4.1 lists the organizations presently participating in the Instructional Television Network, the number of learning centers at each location, and their geographical location. The network was initially designed and implemented with a George Gund Foundation grant in early 1972. At that time only three organizations were committed to participating in the network, namely NASA, the General Electric Company, and the Bailey Meter Company. Since that time the system has grown to include thirteen organizations having seventeen learning centers in the fall of 1973. During the fall 1973 semester, twenty-five courses were taught to 321 students via the network. From fall 1972 up to and including fall 1973, 51 courses have been taught through the Instructional Television Network. (72)

Figure 9.2.4.2 depicts the growth of the network from its inception until fall 1973, in terms of the number of students and organizations, plus learning centers. As can be seen from the figure, the ITN has experienced general growth. It is expected that as long

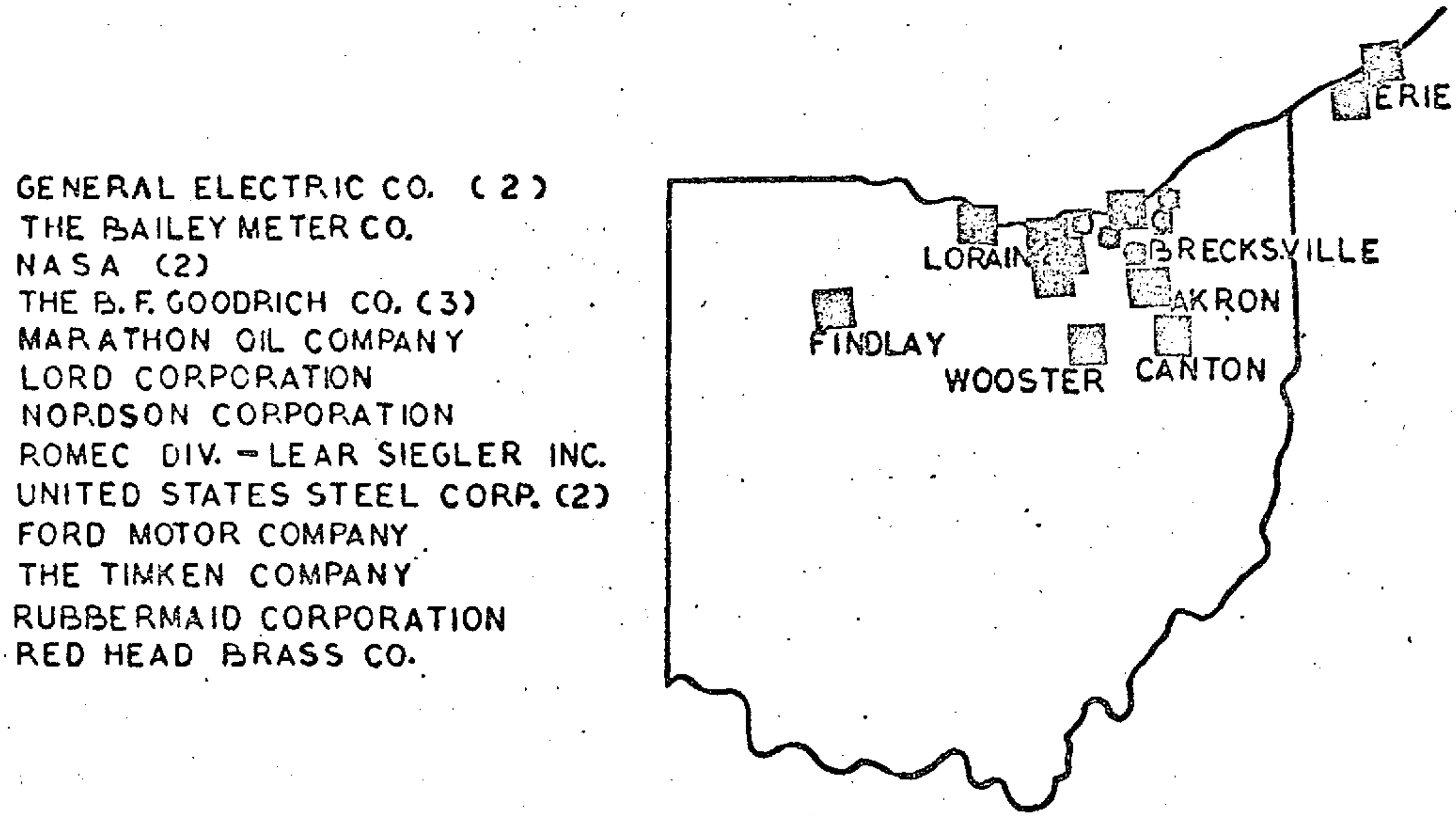

Figure 9.2.4.1. Case Western Reserve University television network participants and sites. CWRU information packet. (72)

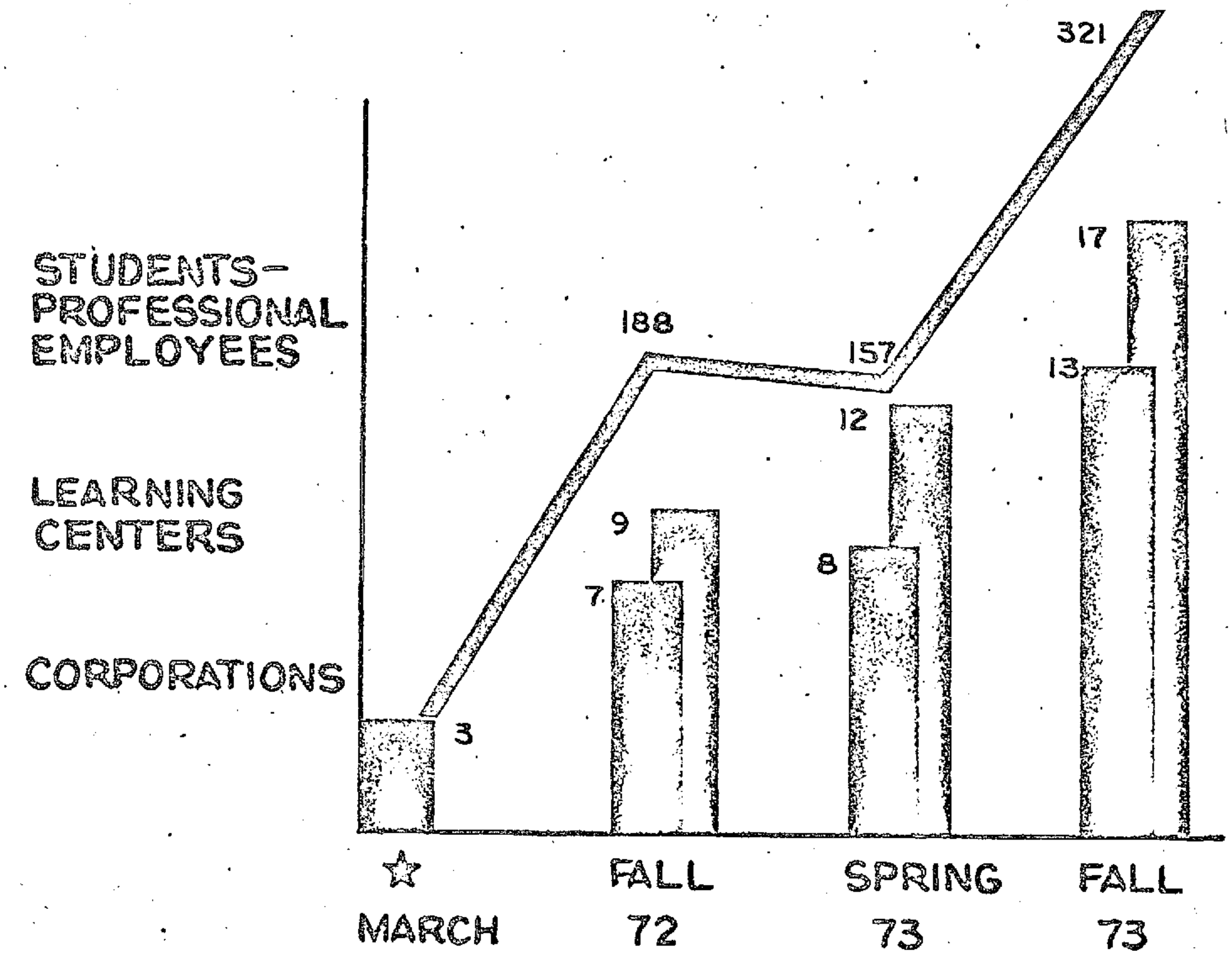

Figure 9.2.4.2. Case Western Reserve University television network growth chart. CWRU information packet. (72)

as Case Western Reserve University meets the needs of the industrial community, the growth of the system will continue. Financially, the network is self-sustaining totally on student fees. (71, 72)

9.2.5 Other ITFS Television Systems

Although not much information was available, it is known that both Bradley University and the University of Pennsylvania are operating ITFS systems.

Since 1969, Bradley University has been offering both classes for college credit and continuing education in the Peoria, Illinois area. (73, 74)

Likewise, the University of Pennsylvania has served industry in the greater Philadelphia area and an outlying campus at Valley Forge through an ITFS system, which began operation in 1972. (74, 75)

The State University of New York at Buffalo is also reported to have such a system. (53)

APPENDIX 9.3

POINT-TO-POINT MICROWAVE TELEVISION SYSTEMS

9.3.1 The Association for Graduate Education and Research of North Texas

TAGER is the Association for Graduate Education and Research of North Texas. It was proposed in 1966 and became operational in the fall of 1967. (71) The initial purpose of the TAGER network has been to serve the technical industries of northern Texas through a cooperative consortium of higher education institutions interacting with industry. (76)

TAGER participating institutions and industrially-located receiving classrooms are identified and depicted in Figure 9.3.1.1. From Figure 9.3.1.1 it can be seen that TAGER is primarily active in the Fort Worth-Dallas area.

TAGER's success in fulfilling the educational needs of industry has encouraged the network to seek out and meet educational needs in other institutional areas. In 1969, a TAGER member, Southern Methodist University, expanded to allow underclassmen at liberal arts colleges in the region to receive science and engineering courses and, then, transfer into the third year program at SMU. (77, 78) Currently, courses in the social sciences, business, law, humanities, and arts are also offered through TAGER to industry and TAGER member educational institutions. These non-technical courses are the most recent addition to the TAGER programming schedule. (76)

In February 1970, in accord with the TAGER effort to more completely serve learners in higher education, the TIES-US (TAGER Institute for Environmental Studies in Undergraduate Sciences) program

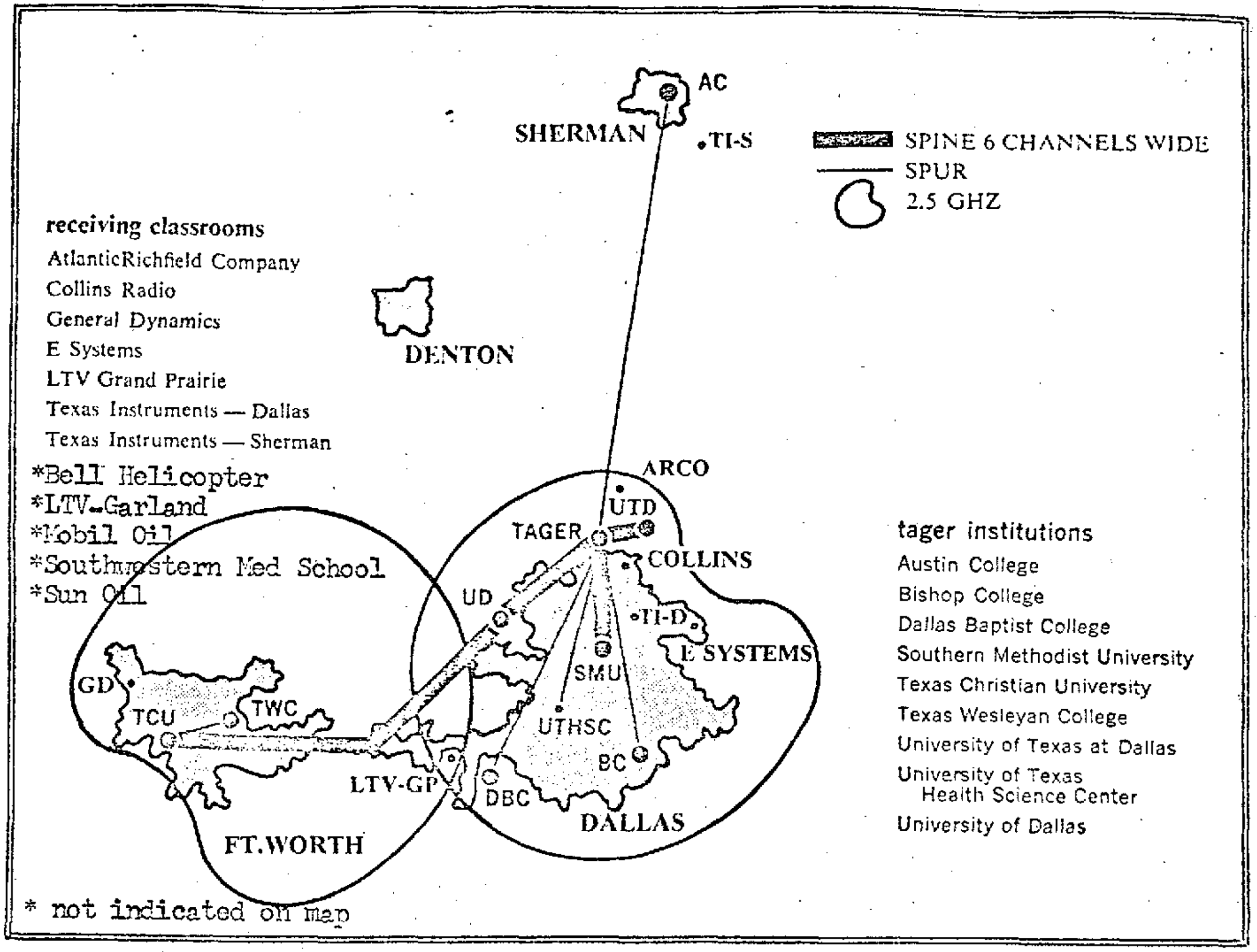

Figure 9.3.1.1. TAGER member institutions and receiving classrooms. TAGER information packet. (76)

was established with the support of the National Science Foundation. The participating institutions have been Austin College, Bishop College, Texas Wesleyan College, and Dallas Baptist College. (76)

"TIES-US emphasizes interdisciplinary, problem-oriented, educational approaches and use of two-way...see and be seen... television capability in four initial program areas: experimental and theoretical studies, science teacher education, urban studies, and racial and ethnic studies." (76)

Presently, however, it is more common for courses to be broadcast with one-way video and two-way audio, and for these courses to be formulated along conventional lines with regard to subject matter and teaching format. Courses are beamed live from several locations. Southern Methodist University has four originating studios; Texas Christian University, the University of Texas at Dallas, and the University of Dallas, each have an originating studio as do Austin, Bishop and Texas Wesleyan Colleges. (See Figure 9.3.1.2.)

A typical classroom at SMU, which has the greatest number of studios, comes equipped with two cameras, two television monitors for the class to view when necessary, plus an adequate number of microphones so that off-campus students may follow the discussion.

The instructor in the studio classroom is seated at his desk on a slightly raised platform before a conventionally meeting class. A camera at the rear of the room may follow the instructor's motion horizontally and vertically while also zooming in for a closer picture. A second camera is situated over the desk where any material written on a pad may be broadcast to the receiving sites or over the studio classroom monitors. In fact, this procedure of writing on the desk

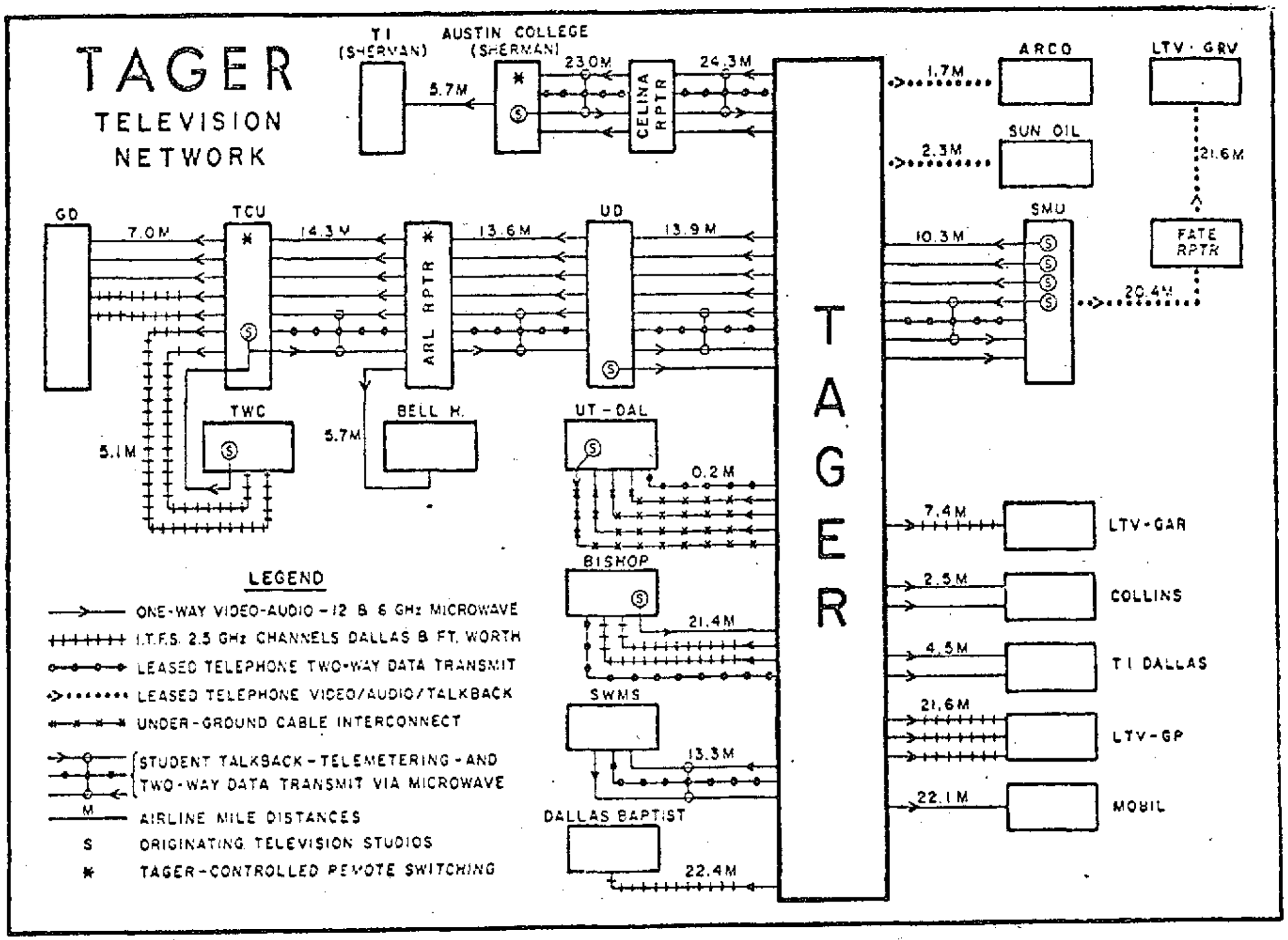

Figure 9.3.1.2. TAGER member institutions and industries with their technological capabilities. TAGER information packet. (76)

pad, rather than using the blackboard, is preferred by the instructors because the class and instructor can nearly always be in face-to-face contact. A technician in the rear of the room then controls either camera or presents both pictures through split screening.

There are enough microphones in each studio classroom so that the instructor's lecture and studio classroom discussion can be heard by any other off-campus class taking the same course. Each off-campus class sees the classroom and instructor but can not, in turn, be seen by either the instructor or other classes. However, because the audio system is two-way, all sections whether on or off-campus can hear and take part in the discussion. (77)

Also, because the configuration of the TAGER network is radial in form, which means that all originated courses feed to a central switching area in order to be beamed to any receiving site, any receiving classroom, anywhere in the system, may receive a course being broadcast from any originating studio in the network. (78) Figure 9.3.1.2 diagrams the TAGER network and the technological capability for program delivery and reception to and from the TAGER participants.

The off-campus students meet in the receiving classrooms at the proper time to listen to the lectures. The most satisfactory configuration for the off-campus classrooms is one television monitor for every eight students in two rows of four chairs. Generally, there are two television monitors for each classroom or a total of 16 seats. Where there is more than one classroom per site, the classrooms are ordinarily clustered together about a logistics office. In 1971, thirteen industrial plants were equipped with over 50 receiving classrooms, and 36 receiving classrooms were located on campuses of the eight participating educational institutions.*

Class assignments or examinations are picked up or distributed daily by a courier who travels over 300 miles a day. Assignments for on and off-campus sections alike are the same, and they are graded together as a single course.

It is also worth noting that every instructor in the SMU Institute of Technology, which televises 85% of the TAGER courses, has had a course broadcast at one time or another. (33, 77) Presently, the SMU studios operate from 8:00 a.m. until 9:30 p.m. Monday through Thursday and from 8:00 a.m. until 5:00 p.m. on Friday to round out a full week of broadcasting. (77) Other off-campus student-instructor interaction can take place through telephone consultation, or even over the television system during unscheduled broadcast hours. Saturday on-campus sessions and instructor visits to the outlying classrooms are the other major forms of student-instructor interaction. (78)

With the exception of research, which is typically done on campus, it is possible to earn a bachelor's, master's, or doctorate degree without having ever attended classes in an on-campus situation. However, because off-campus students are dealt with in the same manner as traditional students, the facilities of the campus, such as libraries, are at the off-campus students disposal should the need ever arise. In fact, in the fall of 1969 at SMU, a principal TAGER participant, out of some 1070 full and part-time engineering graduate students, 890 were taking courses off-campus at work via the network

*Where different references gave different figures for classrooms, the most recent source was used.

for an average of one and a half courses per student. Some 180 other students were conducting study and research on campus as full-time graduate students. Of the 1070 graduate students in the major fields of engineering, some 870 were seeking a master's degree, while 200 were pursuing a doctorate. (77)

Recent figures for late 1973 indicate a student population of about 1600 in the fields of engineering, natural and pure science, business, social science, law, theology, and the humanities. (71) These students are charged the normal $60 per semester credit hour, but, in addition to the $60, there is a $40 television fee per credit hour. This brings the total cost to $100 per semester credit hour. However, quite often the company or firm employing the students pays the $40 television fee. From the $40 television fee, $8 is retained by the TAGER system, and the remainder goes to the institution originating the course. (77)

Although the following figures are somewhat dated (reported in 1971) TAGER facilities cost: 1) approximately $60,000 for each originating studio including the necessary electronics equipment, 2) about $40,000 for the first receiving classroom and equipment and $20,000 for each classroom, thereafter, and 3) about $1,000,000 for the transmission network, sometimes referred to as the "Green" network because a philanthropic gift from Mr. and Mrs. Cecil Green financed the network.

These cost figures are essentially for the original 12 Ghz spine and 2.5 Ghz spur private microwave network. But, future plans include converting the TAGER network to a 2.5 Ghz microwave system with omni-directional, rather than discrete beaming of transmissions. (77)

The talkback element of TAGER is carried on over leased telephone lines. (36) However, the total system cost in the vicinity of 2.5 million dollars. Also, more educational institutions and industries will be incorporated into the network. (77)

TAGER maintenance costs are apportioned among the participating institutions, and the costs reflect the extent to which each institution makes use of the network. For example, SMU utilizes the system 85% of the time and pays some $30,000 annually in maintenance, which is a major portion of the bill. (77)

TAGER network administration and policymaking is carried out by a representative body comprised of individuals from the member institutions with appropriate committees involving educational and industrial concerns. This inter-institutional cooperative effort has played a major role in TAGER's success. (36)

9.3.2 The Indiana Higher Education Telecommunications System

In 1967, through the action and appropriation of funds by the Indiana State Legislature, the Indiana Higher Education Telecommunications System was made possible. The primary duty of the organization has been to provide an instrument through which educational resources could be shared by the universities of the state. The IHETS, once set in motion, has had four general goals to accomplish:

> "Communications-To operate communications networks inter-connecting educational centers in Indiana and to facilitate the flow of messages along these channels.
>
> Education-To assist users of the channels in shaping applications of the media to the attainment of educational objectives, and to encourage use of the media planned within the broader context of the teaching-learning situation.

Cooperation-Through its total organization, to link the State Universities and the many campuses of the Indiana Vocational Technical College in their mutual effort to improve their own educational programs and to assist their collective efforts to reach a wide spectrum of educational constituencies within the State.

Innovation and Change-To provide the human "networks" (committees, publication, telephone conferences, etc.) through which people involved in higher education may devise creative solutions to educational problems, and to manage change by collaborative planning." (79)*

The original participating members in the IHETS organization were Purdue University and Indiana University, who had previous experience with a microwave television link between their main campuses and between the main campus of each university and its regional campuses, and Indiana State and Ball State Universities. In 1971, Vincennes University and Indiana Vocational Technical College were added to the list of actively involved institutions.

The colleges and universities are linked together through the voice network and, in most instances, the video network of the Indiana Higher Education Telecommunications System. Table 9.3.2.1 is a list of the academic institutions that are interconnected via IHETS.

Video Network: The major component of the video network is a microwave system whose facilities are supplied by the telephone companies in the state. Through Indiana Bell Telephone, the primary supplier, General Telephone and Electronics, and the Long-Lines Division of American Telephone and Telegraph, the microwave system serves as the heart of the video network and links up with a CATV system, an ITFS station, and several public broadcasting stations,

*The majority of the information for this section was taken from "Indiana Higher Education Telecommunication System." (79)

Table 9.3.2.1. Indiana Higher Education Telecommunications System participating institutions*

Bloomington	Indiana University
Evansville	Indiana State University
Fort Wayne	Indiana University-Purdue University-Fort Wayne
Gary	Indiana University-Northwest
Hammond	Purdue University-Calumet Campus
Indianapolis	Indiana University-Purdue University Campus Medical Center 38th Street Downtown
Kokomo	Indiana University
Lafayette	Purdue University
Muncie	Ball State University
New Albany	Indiana University Southeast
South Bend	Indiana University
Terre Haute	Indiana State University
Vincennes	Vincennes University
Westville	Purdue University-North Central Campus
Richmond	Indiana University East
South Bend/Notre Dame	University of Notre Dame

*IHETS information packet. (79)

which help extend the area of coverage throughout Indiana. The system is composed of several discrete paths and several routing switchers to divert the telecasts to the proper locations. A computer controls the actual switching and diverting of the telecasts to the correct locations. (79)

Many of the transmission paths are bi-directional, which means many of the instructional centers can receive as well as originate programming. The main campuses of the four major participating universities, Purdue, Indiana, Indiana State, and Ball State Universities, are capable of originating two programs simultaneously. In addition to these four universities, the Indiana Medical Center and the IHETS control center are capable of reaching any location within the network. Some locations are able to receive two different telecasts simultaneously. The locations, which have the necessary facilities to receive two simultaneously different transmissions, are in Gary, Hammond, South Bend, Fort Wayne, the Indiana Medical Center, and the control facility of IHETS in Indianapolis. All other receiving locations are able to bring in only one program at a time. (See Figure 9.3.2.1 for the location of participants in the IHETS video network and their transmit/receive capabilities.)

By contracted agreement, telecasts that come to the South Bend campus of Indiana University are remodulated and transmitted via two cable TV channels of the Michiana Public Television Corporation to the University of Notre Dame, St. Mary's University, and Bethel College, plus four hospitals in the South Bend-Misiwaka areas. Although these telecasts are transmitted within the cable television spectrum, special

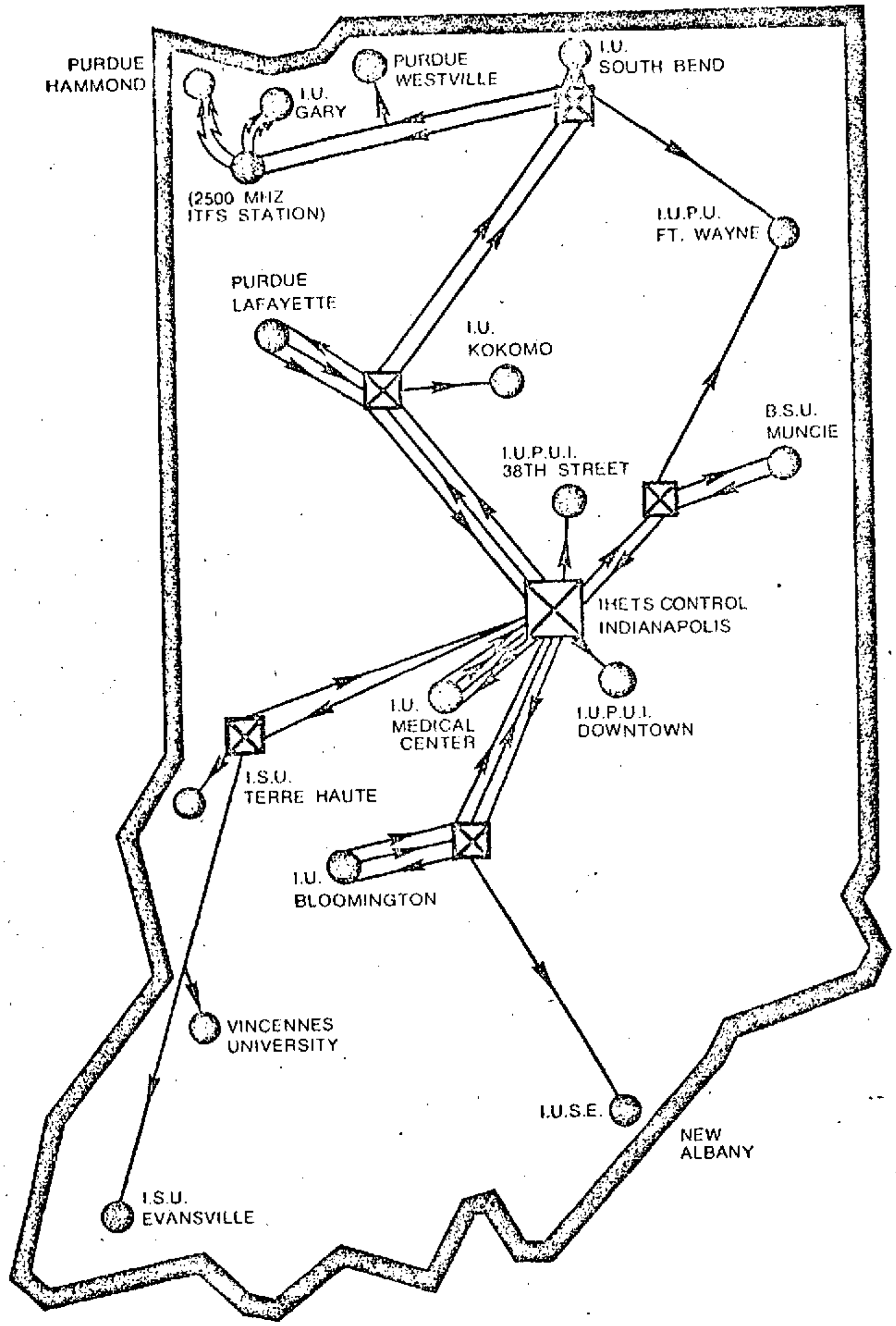

Figure 9.3.2.1. Fully-switched Multi-point Video Network of IHETS. Indiana Higher Education Telecommunications System. (79)

converters are required to decipher the signals and obtain the actual telecast.

The Indiana Higher Education Telecommunications System also operates an ITFS station in the Dyer area, and occasionally makes use of a second ITFS station in Indianapolis, which it does not own, to telecast programs. The Dyer ITFS station broadcasts to hospitals in the Hammond city area, Purdue University's Westville and Hammond campuses, and the Gary campus of Indiana University. There are also four public broadcasting stations whose over-the-air broadcasts are switched via the IHETS network.

The video network is also used in the teleprocessing of many videotaped courses. Since about 40% of the broadcast programs are not live, but videotaped, it has been necessary to transmit these programs during the off-peak hours of telecasting. By transmitting pre-recorded programs during the off-peak televising hours the network is kept relatively open for utilization of live programs, which employ two-way, real-time interaction.

The teleprocess consists of encoding a videotaped program at one location, transmitting the encoded information, and decoding the information onto another videotape at some other location. The transmission of the encoded information takes place in such a manner as to automatically decode onto unattended videotape machines. With the videotape essentially recreated at the new transmission site, IHETS is then free to use the video network for switching and routing the live programs. (79)

Voice Network: The talkback element of the live programs is carried from the remote locations to the origination location via the

SUVON line, which is the state universities' voice network. First the actual lecture, both audio and video portions, are beamed out to the remote receiving locations via the microwave system. The instructor in a TV studio presents a lecture that is picked up on studio camera and by microphone. The transmission is then modulated and transmitted from the local tower to the reception points either directly or by a series of relay stations. The transmission is picked up at the receiving site; the signal is demodulated and appears over a TV monitor or monitors. Questions or comments that arise are then transmitted back through the SUVON network. The student merely speaks into a handset whose automatic dialer connects with the local campus lines. The message, while travelling along the campus lines, reaches the campus telephone switching and connecting center. At this point the line carrying the message to the remote instructor is automatically connected with a SUVON line.

These SUVON trunk lines extend to the Medical Center switching site in Indianapolis. At the Medical Center, the incoming talkback calls arrive over one of two lines that are employed for talkback purposes. At some point, the two lines are mixed and then channeled over a dedicated full-period telephone circuit that connects a majority of the cities and campuses where it eventually arrives at the originating facility. Finally, the transmission is again adjusted for level and quality where the message is then heard over the TV originating studio's speaker system. (See Figure 9.3.2.2.)

The SUVON network, which makes the live talkback possible, is composed of fourteen major trunk groups which are composed of 162 telephone tie-lines. These tie-lines connect the universities amongst

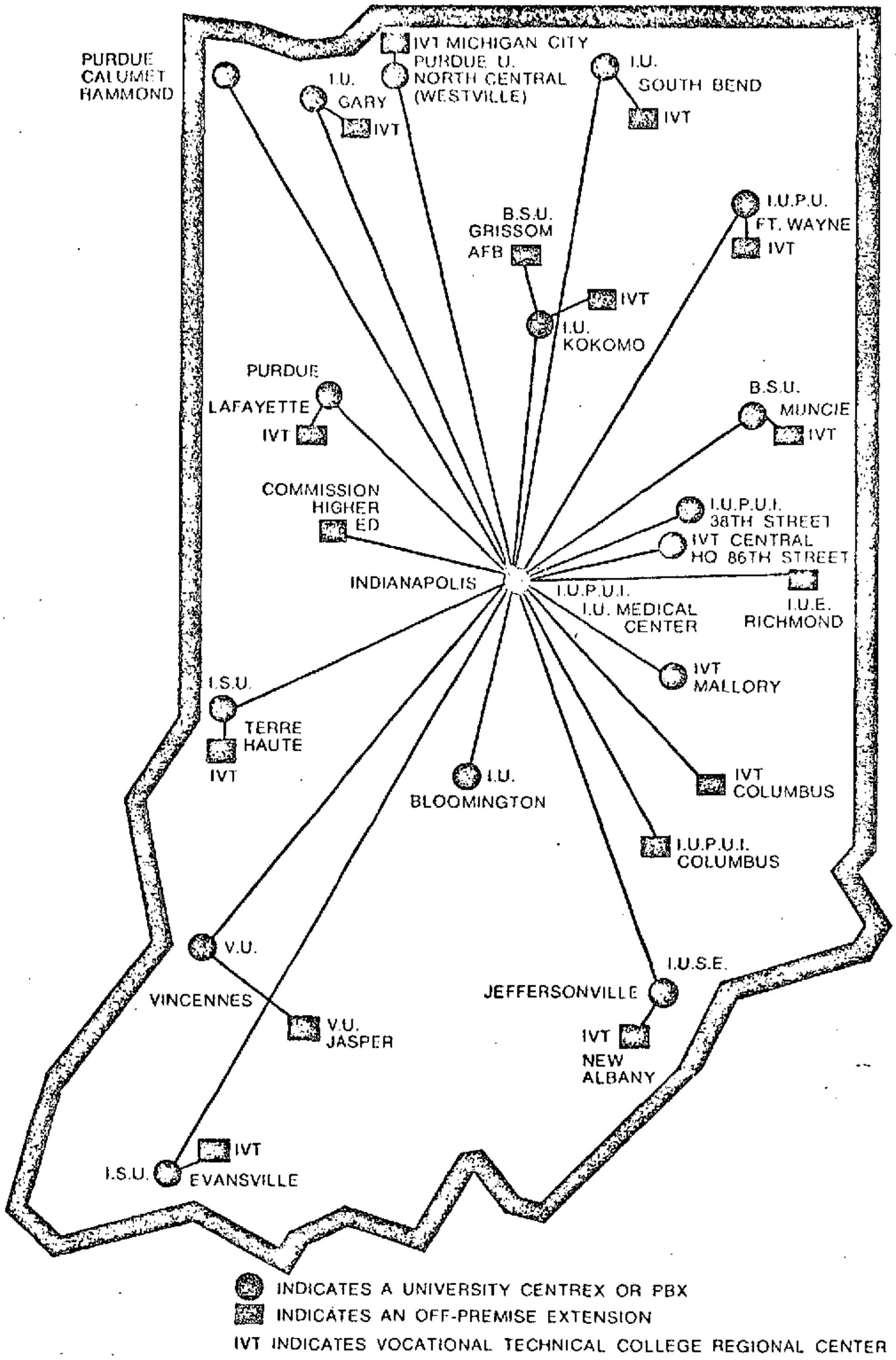

Figure 9.3.2.2. State Universities' Voice Network. Indiana Higher Education Telecommunications System. (79)

themselves and their regional or extension campuses through the central switching facility at the Medical Center in Indianapolis. The Indianapolis Medical Center also serves as a connection center for Indiana Vocational Technical College at Columbus, the Indiana University Eastern Center Richmond facility, and the Commission on Higher Education; these institutions are not directly connected into the fourteen major SUVON trunk lines.

The SUVON network, in addition to carrying telephone conversations, is also used for the transmission of information to electronic blackboards and teletypes, or for the production of facsimile. To a limited extent, SUVON can transmit computer data information. (79)

As the network now operates, the maintenance and development of the network itself is the major responsibility of IHETS, while the costs of originating and producing programs are incurred by the institutions directly involved. The primary structure of the telecommunications system was developed with the aid of the telephone companies involved and a $600,000 appropriation from the state legislature. (79)

Purpose and Goals: Since its inception, IHETS primary goals have included the transmission of undergraduate and graduate programs for students of the participating institutions. Courses in fields of music, nursing, communications, engineering, forestry, agriculture, and astronomy have been telecast over the network. There are also a wide variety of medical courses that are broadcast over the system in connection with extensive utilization by the Indiana School of Medicine.

Through the Higher Education Telecommunications System, programs involving inter-institutional cooperation and exchange have been initiated. The first concrete example of inter-institutional cooperation has centered around a course titled, "Non-West Studies: East Asia." For the first time, students could take the course at any participating IHETS university or campus and receive the credit from any of the universities involved.

In addition, several other groups are investigating the possibilities that inter-institutional cooperation may offer. Courses revolving around such themes as nursing and the law, family and the law, ecology, Afro-American studies, and history are being seriously considered for delivery in an inter-institutionally collective manner.

Both traditional and non-traditional learners have used the system. Many non-credit seminars and courses have been presented over the telecommunications system by professionals in the state for purposes of information and continuing education. Such professions as medicine, real estate, pharmacy, and accounting have employed IHETS to good advantage. Prison in-mates are also expected to be served in the near future.

Broadcast Hours and Student Enrollment: Although few adequate statistics were kept during the early phases of IHETS, early 1970 data concerning the number of broadcast hours and the number of students enrolled in credit and non-credit categories indicate the system to be progressing with a high growth rate. (See Table 9.3.2.3.) The largest area of growth, however, seems to be centered in the area of continuing education.

Table 9.3.2.3. Growth rate of the Indiana Higher Education Telecommunications System from fall 1970 to fall 1971*

	Fall, 1970	Spring, 1971	Fall, 1971
Student Hours of Instruction	54,034	272,006	681,850
Student Enrollments	2,228	3,785	5,569
Recorded Enrollments			
Credit	1,681	1,610	2,387
Non-Credit	607	1,875	3,182

*Indiana Higher Education Telecommunications System. (79)

The Indiana Higher Education Telecommunications System has undergone a series of reorganizations from the time its major concern was development of the system hardware to the present operational state. The network is now administered by a Board of Directors which was created by the six member institutions' Boards of Trustees and is the administrative body of the system. Through the Board of Directors, IHETS facilities are committed to inter-institutional projects. Under the Board of Directors, a Council serves to develop formal project proposals which are then referred to the Board. The Council also serves to advise, guide the Board, and carry out studies concerning the operation and management of the system. The final duty of the Council is to serve as supervisor for the various committees, panels, and conference groups.

The Indiana Higher Education Telecommunications System is still growing and expanding. Future plans include the more efficient use and development of broadband communications, using a "pipeline concept" for simultaneous transmission of a variety of information (raw data, audio, video) at different frequency ranges within the total operating spectrum of IHETS. The system will also increase the number of receiving and origination facilities that are reached within the state. Additional links will be established with public broadcasting stations. (79)

9.3.3 The Oklahoma Higher Education Televised Instruction System

The Oklahoma Higher Education Televised Instruction System was created in 1970 by an act of the Oklahoma State Legislature. The system provides statewide educational opportunities for the people of Oklahoma. Students who benefit from the television programs, attend not only the conventional educational institutions, but also include many who work in business or government agencies. The network has also reached students who have been hospitalized or confined to penal institutions. (80)

The televised instruction system consists of a privately owned, point-to-point microwave transmission system whose broadcasts reach and interconnect many ITFS areas. The signal is converted to the ITFS frequencies at the appropriate time. The courses are then viewed over a closed circuit, two channel system. Furthermore, most or all receiving sites have talkback capability. (33, 80)

The televised courses can be transmitted from any of four universities, or a college, or two junior colleges. The University of Oklahoma and the University's Health Science Center, Oklahoma State University, the University of Tulsa, and Central State University are the universities that have broadcast capabilities. Northeastern State College, and Altus and Oscar Rose Junior Colleges have course origination and transmission capabilities also. The televised classes are then received at many sites, academic and otherwise, throughout the state. (See Figure 9.3.3.1.) (80)

The courses are originated from studio classrooms of the various campuses that are equipped with cameras and microphones. Two cameras are positioned in each studio classroom. One focuses on the instructor and blackboard area, and a second camera focuses on the instructor's desktop to pick up any activity on the desk or writing on the desk pad. These cameras, which are controlled by technicians in an adjacent room, provide the visual component for the off-campus sections of the classes. Microphones pick up the audio element of the on-campus

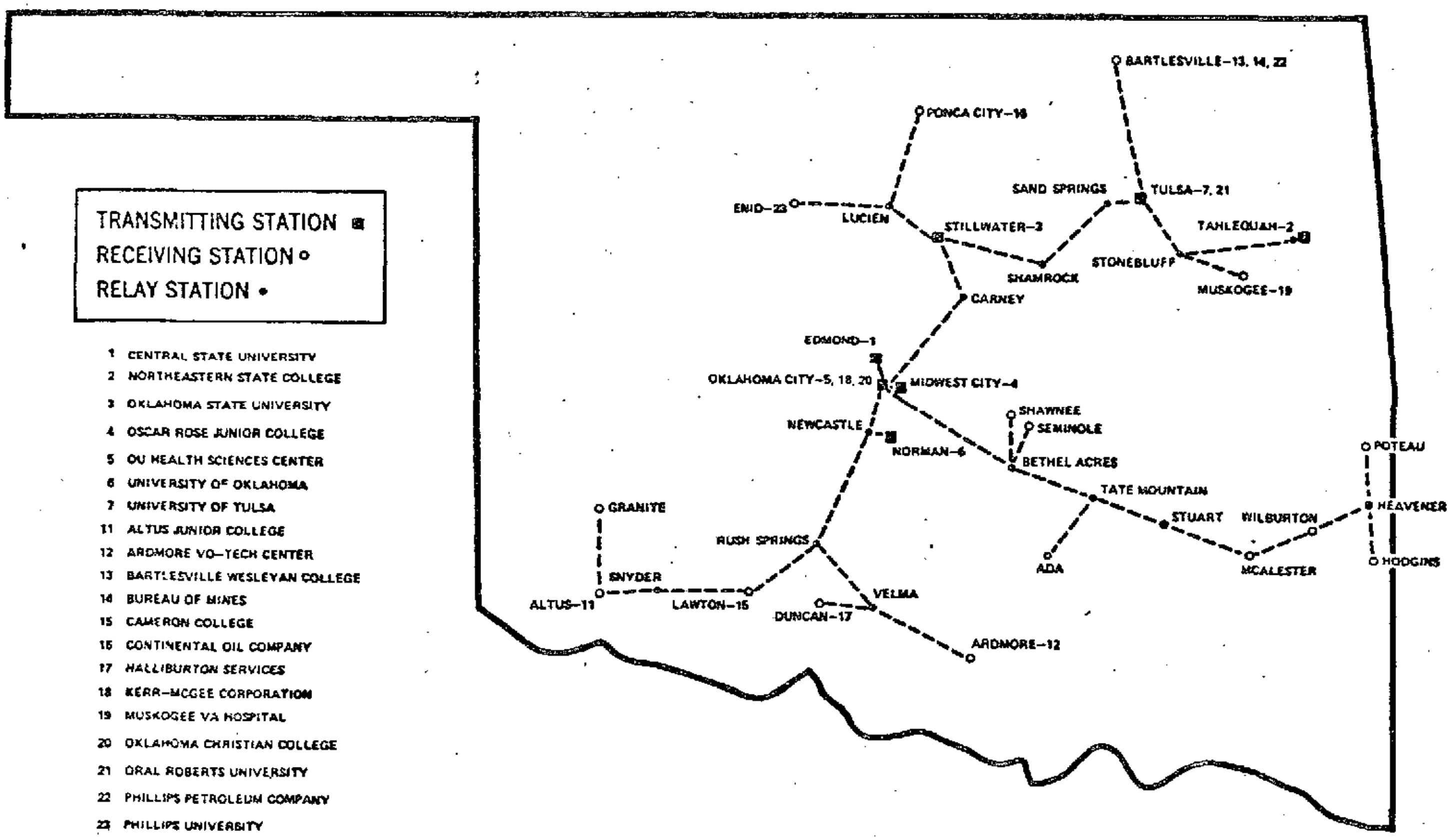

Figure 9.3.3.1. The Oklahoma Higher Education Televised Instruction System. Fall 1973 Bulletin. (80)

lecture and any questions or comments from the live on-campus student section. Return speakers allow the local students to hear the remote students' comments. In general, the on-campus classes are conducted in typical fashion in classrooms, which in many respects are conventional. The same can be said of the remote classes also. (80)

The receiving sites are able to watch and hear occurrences in the on-campus section via television monitors, and the remote students are able to respond with questions and comments via microphones and other talkback equipment. In order to prevent a student from missing a broadcast, videotaping of the telecasts is permitted, but all tapes must be erased by the term's end. All of the students do the same work for the class with a courier service picking up and delivering off-campus classwork. (80)

Admission to the televised program is based upon the same requirements of admission to any of the institutions. Each televised course is accepted for full credit value by the participating colleges and universities. It is the student's responsibility to be sure credit is transferred from the originating institution to the student's attendant institution. (80)

Courses, broadcast live, both of a standard or short/seminar nature are offered over the network. These courses may be graduate or undergraduate level, but the primary program orientation is towards graduate study in engineering, mathematics, computer sciences, business, and geology for students in industry. (80) The network is maintained by the Oklahoma State Regents for Higher Education and input from an Academic Advisory Committee and an Industrial Advisory

Committee insures the needs of both the colleges, universities, and business are met. (80)

Each student pays a fee based upon a regular student, or employee in business or public agency status. Regular students pay only the tuition fee for their attendant institution; employees of public agencies pay the enrollment fee charged by the participating institution, plus a $10 per credit hour system maintenance fee. Students in business and industry pay a $50 per credit hour fee. However, in addition to the business or industrial student's fee, each industry must pay $1000 per student to allow one student to enroll for one semester. If, however, an industry pays $25,000, that industry is granted unlimited enrollment rights for its students. (33, 80)

The industrial and business fee helps to cover the costs of, and investment in the Oklahoma Higher Education Televised Instruction System. The total system has cost in the proximity of $1,700,000 with the state government appropriating $1,000,000 to help cover the total costs. (33)

9.3.4 The Michigan Expanded Resources for Graduate Education Network of the University of Michigan

Fall 1970 marked the date on which the MERGE (Michigan Expanded Resources in Graduate Education) system of the University of Michigan at Ann Arbor began televising courses to southeastern Michigan. The MERGE system was developed as a means of extending the University of Michigan at Ann Arbor to the heavily industrial Detroit metropolitan area. (81)

According to Schulte, Jr., in the state of Michigan where much industry is firmly established, many of these firms are highly competitive, and there is always a need for continuing educational opportunities for these industries' workers. Engineers, scientists, and technicians are needed who possess the latest engineering skills and practices or who have upgraded their talents through graduate study. In addition, other skills are needed by these personnel which are related to business and other areas. (82)

While the need has been established, the manner of instruction must be a form that is attractive and tolerable to the learner. The learning experience must not deprive the learner of a large portion of the free non-working hours as has been the case with many evening programs. Nor, must the manner of instruction require the learner to spend an undue amount of time commuting as on-campus programs have done. (82)

Bearing in mind the educational needs of workers in industry and the need for an acceptable delivery system, the University of Michigan developed and implemented its two channel talkback ITFS system known as MERGE. In order to serve the industrial Detroit region, forty miles from the Ann Arbor campus of the University of Michigan, but where over 60% of the state's engineers are concentrated, MERGE has chosen to send its signal from the Ann Arbor studio classrooms to a transmitting tower in Detroit by two microwave channels leased from the Michigan Bell Telephone Company. From the tower the signal is converted to ITFS frequencies and radiated out to the greater Detroit area. (47, 81) MERGE leases space on the transmitting tower which the Detroit Board of Education has used for broadcasting to Detroit public schools. The two transmitters for the MERGE system are also housed in the building adjunct to the transmitting tower. The signal that is broadcast reaches out about 25 miles in all directions. (81)

The receiving classrooms pick up the broadcast off the air, convert the signal to the standard VHF-UHF band, and the picture is displayed on television monitors. The talkback element of the lectures is carried on over telephone lines. The lines are open during the lecture so a student wishing to respond in a receiving classroom need merely speak into a receiver. For students that unavoidably miss a lecture, videotaping is permitted, but all videotapes must be erased at the end of each term. As of fall 1972, there were four receiving locations. The four locations, Michigan Bell Telephone Company in Southfield, Warren's General Motors Research Laboratories, Detroit's Rackham Building, and the Dearborn campus of the University of Michigan, are equipped with two classrooms per site. Each classroom generally seats between six and ten persons. (82)

The transmission process begins at the West Engineering Building on the Ann Arbor campus where two classrooms have been remodelled to fit MERGE's needs. As the instructor meets with the on-campus section in traditional lecture fashion, any of three cameras or combinations of two cameras through split screening can send a picture to the off-campus classes. An overhead camera, which can move laterally over a distance of eight feet can picture materials on the instructor's desk or whatever may be written on a desk pad. The camera's lateral movement was developed to prevent the keystoning effect that a fixed camera might project. A second camera in the rear of the room shows the instructor at his desk or working at the blackboard. Finally, a third camera incorporates a frontal view of the class that is very effective in split screening for the off-campus students when the instructor and the on-campus students are in a highly interactive discussion.

An operator in a rear control booth monitors the outgoing televised broadcast. Satellite rooms with TV monitors and talkback facilities are also available for on-campus sections when the number of students exceeds the studio classroom's capacity. The classroom design and facility is very similar to the Southern Methodist University studio classroom facilities of the TAGER system. (81, 82) (See TAGER.)

As of March 1972, some 48 engineering courses have been taken by 250 off-campus students with 750 attending the on-campus sections. Also, 29 business courses have been taken by 490 off-campus students and 230 traditional students. Courses from within the College of Engineering and Mathematics' twelve departments are offered during the day, and courses in business administration are offered in the evening as part of the business graduate school's evening program. (82)

Presently, it is possible to earn a master's degree in either engineering or business administration by coursework primarily completed through television. Admission to the engineering or business graduate program is automatic if the student meets all graduate school requirements. Tentative admission, which may last until 12 credits of work have been completed, is granted to students who show promise of being able to meet the admission requirements of the graduate school. This tentative admission status is granted to students whose present academic records cannot be fully evaluated because their previous educational experiences may have been undergone at an unaccredited school or in a foreign country. The temporary admission enables these students to do graduate work and prove their academic capability to advance to a higher degree. (82)

Because MERGE has tried to make its system attractive to industry and employees alike, a flat membership fee is charged, rather than any fee which is proportional to an industry's annual gross sales or the number of persons employed by that particular firm. Each firm that joins the MERGE system is charged $5,000 each year and must guarantee that sum for at least three years. The membership fee helps cover the amortized cost of the equipment, costs of operation and expansion, and the costs of instructors and program development. After the membership fee, each company must furnish its own classrooms and receiving equipment and pay the cost of the dedicated telephone lines back to the studio classrooms at Ann Arbor. The classrooms and receiving equipment cost in the neighborhood of $3,500. (81)

Once the membership fee is paid, there is no limit to the number of students who may register for the televised courses. These students pay only the part-time tuition fee that all part-time students must pay. Since the membership fee entitles a company to enroll as many students as wish to take courses, it is left to the firm to recruit the students.

Future plans for MERGE include expanding from two channels to four channels and increased diversity of courses, which will include the schools of medicine and education. And, in its final form, the MERGE network will extend 140 miles west to the Benton Harbor and Grand Rapids areas and north 100 miles to the Flint, Saginaw, and Midland areas. (81) (See Figure 9.3.4.1.)

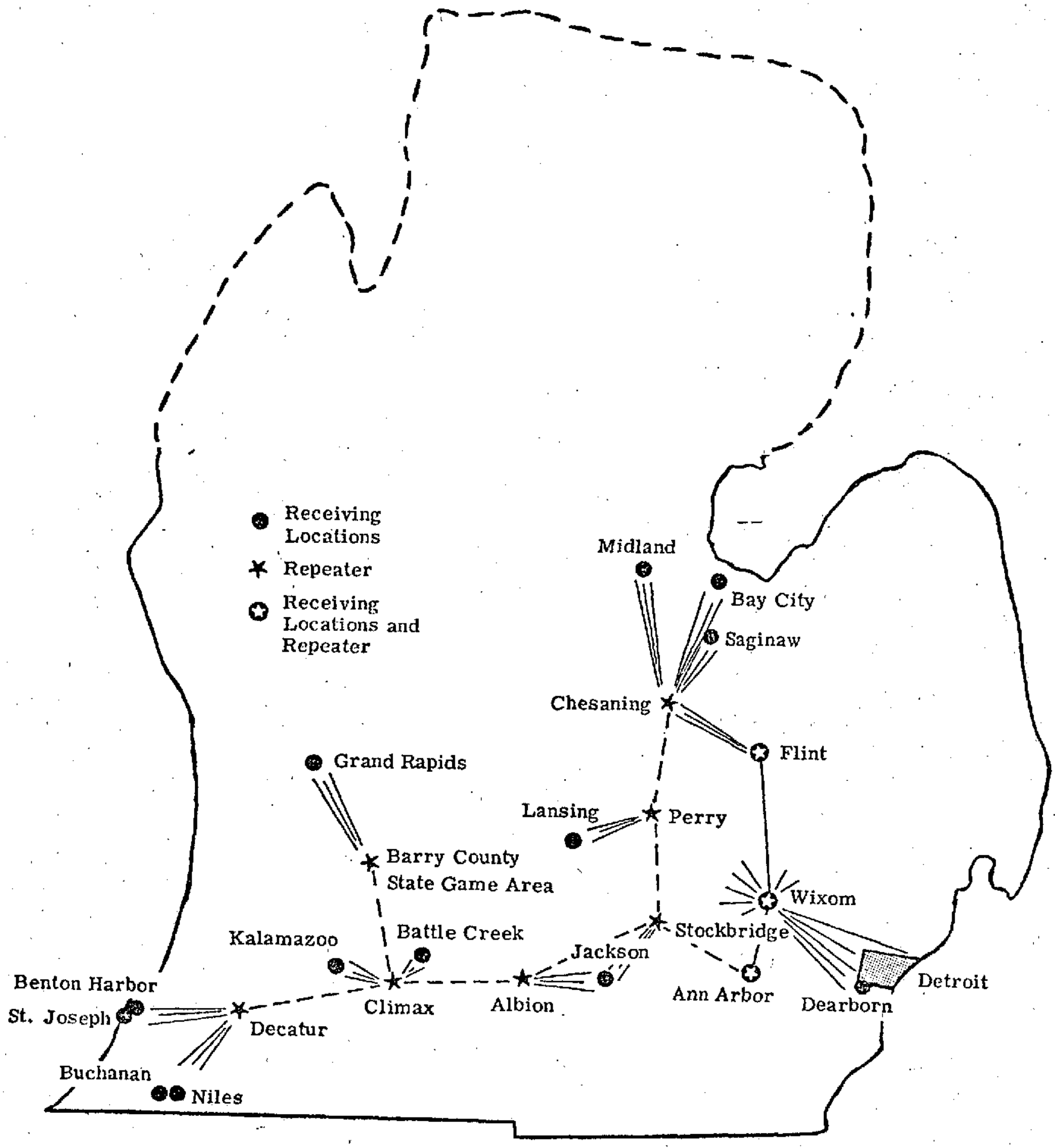

Figure 9.3.4.1. Complete MERGE System. Farris.(81)

9.3.5 The University of Rhode Island Instructional Television System

For over a decade the University of Rhode Island at Kingston, Rhode Island, has been microwaving television courses across Narragansett Bay to the Submarine Signal Division of the Raytheon Company and the Navy's Underwater Systems Center located in Newport, Rhode Island. (83)

The television system was devised as a means of bringing graduate level instruction into a field which was largely dependent upon the intellectual growth of its technical personnel. The system also circumvented the long and costly journey for either the Rhode Island instructors or the Raytheon and Navy employees. Commuting in either direction involved a short car trip, riding across the Bay on a ferry, and finally another short car trip. This tedious procedure had to be repeated each time a single, one-way trip was made, whereas the system could readily bridge the fourteen miles air line distance between the University and the receiving facilities. In 1969, a new bay bridge helped to remove some of the inconvenience of travelling between the University and the Raytheon facility, although it is still more convenient to receive televised courses. (71, 83, 84)

When the system was first used in 1961, its primary purpose was to offer regular, graduate level engineering courses to off-campus students. The courses most often taken have been at the master's degree level in electrical engineering. The participating Raytheon and Naval students take part in the program on a part-time basis gradually accumulating the necessary courses to obtain the master's degree. (83)

The system itself consists of one-way, black and white video with two-way audio capabilities. The camera and audio transmissions are sent to the Raytheon situated classroom from the URI campus. First, the on-campus camera signal is carried by cable to a one-watt microwave transmitter. The transmitter broadcasts the signal to one of two dish antennas atop a water tower. The receiving antenna atop the tower is tied to the second antenna by a section of waveguide, which reradiates the signal in the direction of a receiving antenna also mounted on a water tower, but on the Raytheon side of the Bay. The receiving antenna, as in the first step of the signal's journey, is tied to a second antenna atop the tower. The second antenna reradiates the signal to a receiver at the Raytheon plant where the signal is demodulated and carried by cable to the company monitors. The audio talkback is carried on through rented telephone line facilities. (83, 84)

The receiving classroom is equipped with two large television monitors, plus the talkback facilities. This off-campus classroom is dimly lit to allow students to take notes. The lighting, however, does not detract from television viewing. (84)

At the origination point, an instructor presents his usual lecture to the on-campus class. Very little rehearsing is done before the live broadcast. The classroom has been modified to accommodate the required broadcasting of lectures, while seating a standard URI class of 32 students, although graduate courses typically have a smaller enrollment. The blackboard has been given additional fluorescent lighting to facilitate off-campus viewing, and microphones and speakers have been added for return comments from the off-campus section. The camera and the control booth, which is at the rear of the room, are also additions to the classroom.

A student operator working from the booth can manipulate the camera so that any 3.5 x 4.7 foot section of the blackboard can be brought into the field of view. The operator can see the picture being put out by the camera through a small control booth monitor. This enables the operator to insure the quality of the picture that is being transmitted. (83)

In the late sixties, the URI program and system underwent many changes. In addition to serving primarily engineers, occasional courses were offered to public school teachers doing graduate work in education. The system also added a second originating classroom, and each classroom was outfitted with two cameras rather than one. This occurred at the same time a second microwave link was installed. Not much information was available to the author as to how the additional facilities are used though. (83)

Classes are televised during the weekday working hours to the Raytheon facility. A course may be televised even if only one student has registered for the class. However, for any student to receive credit for any course, the individual must have been accepted into graduate school, which implies meeting all formal admission requirements. During 1971-73, there have been about fifteen students per semester taking the televised courses. (83)

All equipment costs for the Rhode Island system were covered by the Raytheon Company. The $20,000 Raytheon investment included the mounting of the antennas and the audio and video, transmitting and receiving facilities. The University of Rhode Island paid approximately $1,000 for the modification of the necessary classroom. (83, 84) Students are required to pay the standard, part-time, graduate tuition fee of $30 per semester credit, plus a $5 registration charge. (83) The University of Rhode Island system has reached a stable level of operation, and no expansion is anticipated unless additional industry should move into the area. (71)

9.3.6 The Ohio State University Instructional Television System

In 1963, Ohio State University began operating an audio-video instructional television link between the main campus of Ohio State University in Columbus, Ohio, and the Air Force facility at Wright Field. (71, 85)

For several years preceding 1963, Ohio State University faculty had commuted the 70 miles between the OSU campus and Wright Field in order to take graduate school programs to the engineers who assembled at Wright Field. These students worked at the air base or in Dayton industry. However, the tedious journey and the once a week lectures had major drawbacks and left much room for improvement in the "commute-and-lecture" method. (85)

When the Ohio State University faculty became aware of the University of Rhode Island experiment with instructional television to teach courses off the campus, a similar solution to the OSU off-campus instructional program was seriously considered. Consideration led to action, and a one-way video, two-way audio link was implemented between OSU and Wright Field. The system was designed with special emphasis directed at maintaining simple real-time verbal contact, and to further encourage free exchange within the total class, both on and off-campus sections were deliberately kept small. (85)

The link begins with a home classroom at OSU and ends at the receiving classroom on the Wright Field air base. The home classroom is fitted with a camera on a turret that allows the camera to be positioned anywhere along the twelve foot long blackboard. Since the camera can only pick up a field the height of the blackboard and four feet of its total length, the instructor must select the blackboard panels that should be transmitted to the receiving classroom. A small television monitor is set up so that the instructor can see what kind of picture is being transmitted, as well as be certain that it is the right picture. The general effort, though, has been to keep the classroom equipment as indiscernible as possible.

Ohio Bell Telephone Company picks up the television camera signal and it is transmitted at video frequency to downtown Columbus over coaxial cable. A carrier signal is then modulated by the video signal, and finally the carrier signal is microwaved through two repeater stations to the off-campus classroom. The audio talkback aspect of the system is also handled by Bell Telephone.

At the receiving classroom, the picture is displayed on two large television monitors. Classes usually consisting of six to ten students see the transmitted lectures. The students are primarily part-time undergraduates and graduates in engineering. The system serves approximately ten to twelve classes per week and is used for individual student conferences also. (71, 85)

The equipment for the system was purchased with a $10,000 grant from the University in 1963. The system's present operation costs are paid for by University funds, student fees, and by a surcharge that is paid by the Air Force. (71, 85) Ohio Bell Telephone Company charges the University special educational rates to use the telephone lines.

This amounted to $30 per month for each air line mile, or approximately $1,800 each month for 24 hour service in 1963. (85)

For the past decade, the Ohio State instructional television system has done the job of providing a link to the Dayton area. Furthermore, the future function of the system does not appear as though it will change by much. (71)

9.3.7 The University of Connecticut Television System

The University of Connecticut has been involved with instructional television since 1961. In the early stages of the University's television experience, the Radio/TV Center was responsible for utilizing cable to tie many of the University of Connecticut's Storrs campus lecture halls and auditorium facilities together. At this time, the use of television was seen as a solution to providing instruction to a growing freshman enrollment with an already overstrained staff. (86) However, recent study by Morgan (87) indicates that higher education enrollment from traditional sources has been levelling off.

In 1966, a microwave link to the University of Connecticut's Hartford campus, 27 miles away was established. However, the link as well as the Storrs closed circuit system went nearly unused for a full semester. It seemed as though the UC television system was undergoing mass rejection from a student body which saw the network as one more step towards an increasingly depersonalized state education. Many of the faculty apparently shared those feelings. In the course of one full semester, the Hartford microwave link was used only twice. Once it was used to transmit a history lecture and then a second time to transmit a drama. (86)

In the summer of 1966, the Hartford television link became a solution to a problem of a UC instructor in Aerospace Engineering. With the concentration of aerospace industries in the area of Hartford, it was not unusual for engineers to seek advanced instruction for engineering related areas. However, these students were hesitant to drive the 27 miles to Storrs, especially in the winter and after work. It was then arranged for the instructor to lecture from the Radio/TV Center studio while the students watched the lecture at the Hartford branch campus. In the case of the University of Connecticut television network, courses are originated from a special studio facility, and there is no on-campus section that the instructor meets in face-to-face fashion. Because the course was taught in the evening with only five students, the University's WATS (Wide Area Telephone Service) line was kept open so that there could be two-way interaction. (86)

The success of the engineering course led to renewed interest in the system, and eventually five additional branch campuses were incorporated into the network. The additional branch campuses are located at Stamford, Torrington, Waterbury, Groton, and Avery Point. (See Figure 9.3.7.1.) The intent of the expanded network was to allow freshmen and sophomores who attend the branch campuses to take courses being taught at the main campus at Storrs.* The Electrical Engineering and Home Economics Departments were the first to take advantage of the network's expanded facilities. (86)

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*Freshmen and sophomores attend the branch campuses until they graduate to become juniors at the Storrs campus of the University of Connecticut.

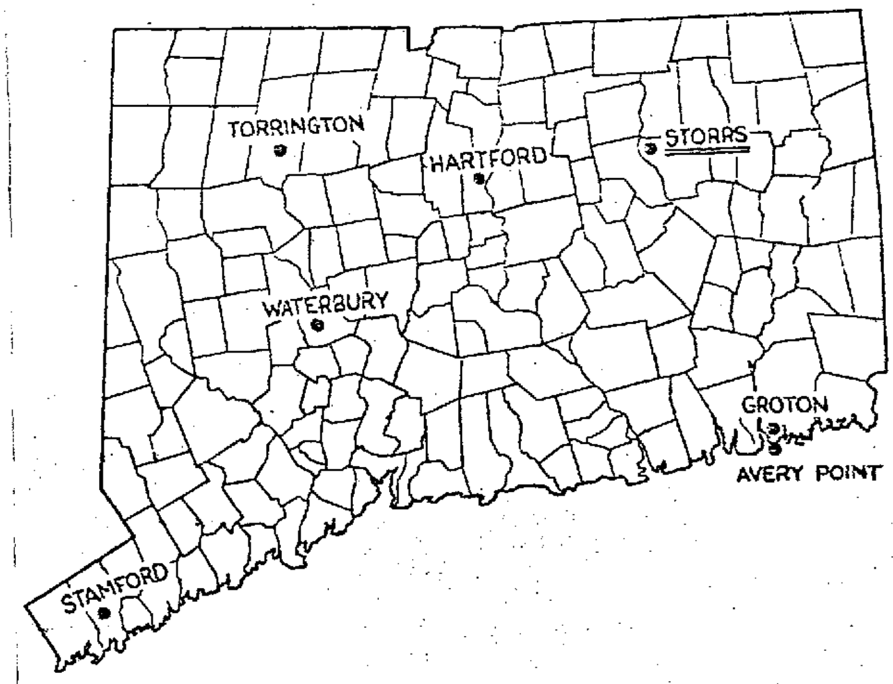

Figure 9.3.7.1. Branch campuses of the University of Connecticut served by the microwave television network. (86)

With the expanded network came larger classes, and unfortunately the previous talkback procedure and facilities were inadequate. Even as late as 1969 and with Southern New England Telephone Company assistance, the audio talkback problem had not been totally solved. Nonetheless, the network expanded transmission from two classes in 1967 to transmitting six hours each day, each week. (86)

Since the late sixties the system has been primarily serving professional persons, semi-skilled workers, or the general population in a continuing education or cooperative extension capacity. It is expected that the professional, semi-skilled, and general population will be the primary users of the network in the near future, and it appears as though these may be growing groups. (71) The development and operation of the University of Connecticut television system has been financed through university funds which have been allocated by the state. (71)

9.3.8 The University of California-Davis Instructional Television System

Since its initiation around 1972, the University of California at Davis has been operating a microwave television system between the Davis campus near Sacramento and the Livermore site approximately sixty airline miles distance. (See Figure 9.3.8.1.)

From the Davis campus, a microwave dish antenna broadcasts a microwave signal to the Mt. Diablo tower where the signal is amplified and rebroadcast to the Lawrence Livermore Laboratory facilities and to Livermore's Sandia Laboratory. As the system is set up, there is one-way video, two-way audio from each direction. The transmission path from Livermore to the Davis site also goes through the Mt. Diablo

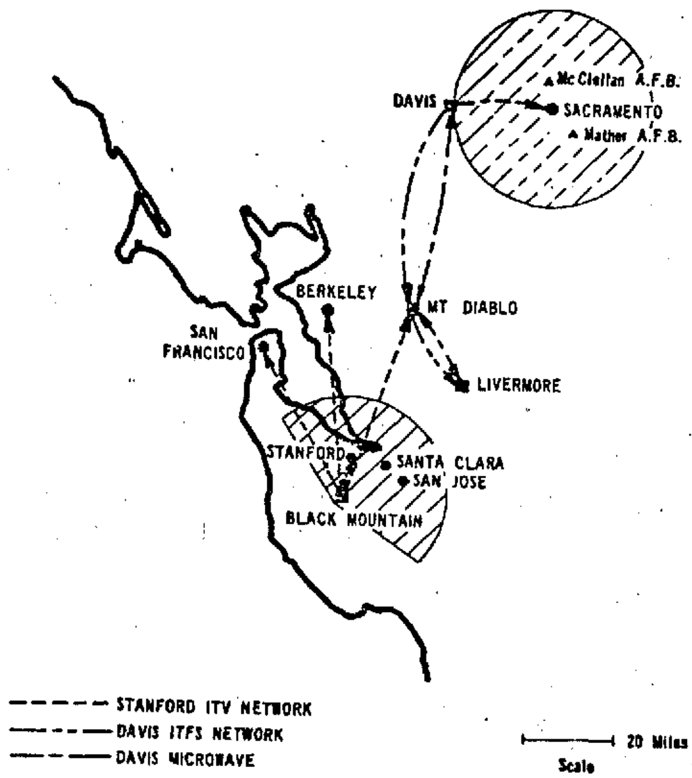

Figure 9.3.8.1. The University of California-Davis and Stanford University Television Systems. Loomis and Brandt.(88)

tower and then terminates at Davis. Thus, students at both sites can simultaneously be receiving courses, or courses can be simultaneously transmitted from either site. (88)

The Livermore site receives about thirty graduate courses each year in the engineering and applied sciences and also transmits twelve courses annually. The engineering sciences are primarily in the fields of electrical, civil, and mechanical engineering. In the near future, it also appears likely that Livermore will originate courses in the computer sciences area. (88)

The courses are originated from studio classrooms which are equipped with a single manually operated rear camera. The camera is controlled from a booth at the back of the classroom. The only other modifications to the classroom are television monitors for the students, a speaker which enables remote comments to be heard by the local section, and a blackboard mounted on a glare treated wall. The cost for the room modification is estimated at about $15,000. (88)

At the receiving facilities each two students share a television monitor. When more than one course is being transmitted at the same time, students, located in the same receiving classroom wear headphones, rather than listen to a loudspeaker, so that the correct audio accompanies the correct video component. (88)

Among one of the unique features of the UC-Davis system is the use of an overhead camera at the Livermore receiving facility. The camera in conjunction with two-way audio enables a student's work to be shown and discussed with an instructor at Davis. Some dozen instructors' offices actually have individual monitors set up for this purpose. (88)

In 1973, the UC-Davis network was being extended to the greater Sacramento area to reach industrial organizations and a Sacramento teaching hospital. The UC-Davis system, in addition to the microwave link, has an ITFS system that reaches into the Sacramento area. (88)

9.3.9 The University of South Carolina Instructional Television System

Since late 1970, the University of South Carolina has offered a statewide televised graduate program in business administration. Since that time the network has grown to incorporate programs in engineering, computer science, nursing, pharmacy, and a variety of other fields. (89) The system is principally centered around the University of South Carolina's Educational Television Center where the courses are produced and the Southern Bell Telephone Company, who supplies the telephone lines that are used by the remote students for talkback.

The studio classroom can accommodate the instructor and a class of 30 students with a satellite classroom which can handle any overflow problem. The studio classroom is equipped with three cameras to record or transmit the lecture to the remote students, push-button microphones for each local student, and two TV monitors.

The three camera configuration enables two rear positioned cameras to focus on the instructor and front section of the room. The overhead camera enables activities on the desk to be followed. Students either on the local or remote campuses are able to follow the instructor's activities or lectures over the TV monitors. Students in the studio classroom may watch over two large TV monitors as may students located in the on-campus satellite classroom. The remote locations are also equipped with two TV monitors over which the students can watch the programs. Transmission from the studio classroom is controlled from a rear booth which allows the operator to oversee the classroom broadcasts. (89)

Each studio classroom costs in the vicinity of $80,000, and as of late 1973, a second studio classroom was under construction. (89, 90)

Talkback facilities allow any questions or comments posed by the on-campus students or off-campus students to be heard throughout the network. More appropriately though, the talkback facilities provide an immediate, real-time communication link directly to the class and instructor for the remote students. While the on-campus students use the push-button microphones, the off-campus students use telephone handsets. Students in the engineering programs, rather than receiving live, real-time telecasts, receive the videotaped programs that are played back with facilities at the off-campus sites.

Presently, over twenty different locales in the state of South Carolina are reached through the Educational Television Center programs. (89) (See Figure 9.3.9.1 for listings and locations.) Although there is a wide variety of televised programming at both the undergraduate and graduate levels, the most prominent program is the Master's degree in Business Administration. During the first year of the University's Educational Television Center operation over 54 business organizations, banking concerns, and the military service participated in the program through 129 enrollees. (89)

LOCATION*		Location of Facilities
1	Columbia	TV Center (USC)
2	Spartanburg	regional campus
3	Greenville	technical center
4	Rock Hill	technical center
5	Cheraw	technical center
6	Florence	technical center
7	Greenwood	technical center
8	Sumter	technical center
9	Conway	regional campus
10	Aiken	regional campus
11	Charleston	local high school
12	Beaufort	regional campus

*Incomplete listing of receiving sites.

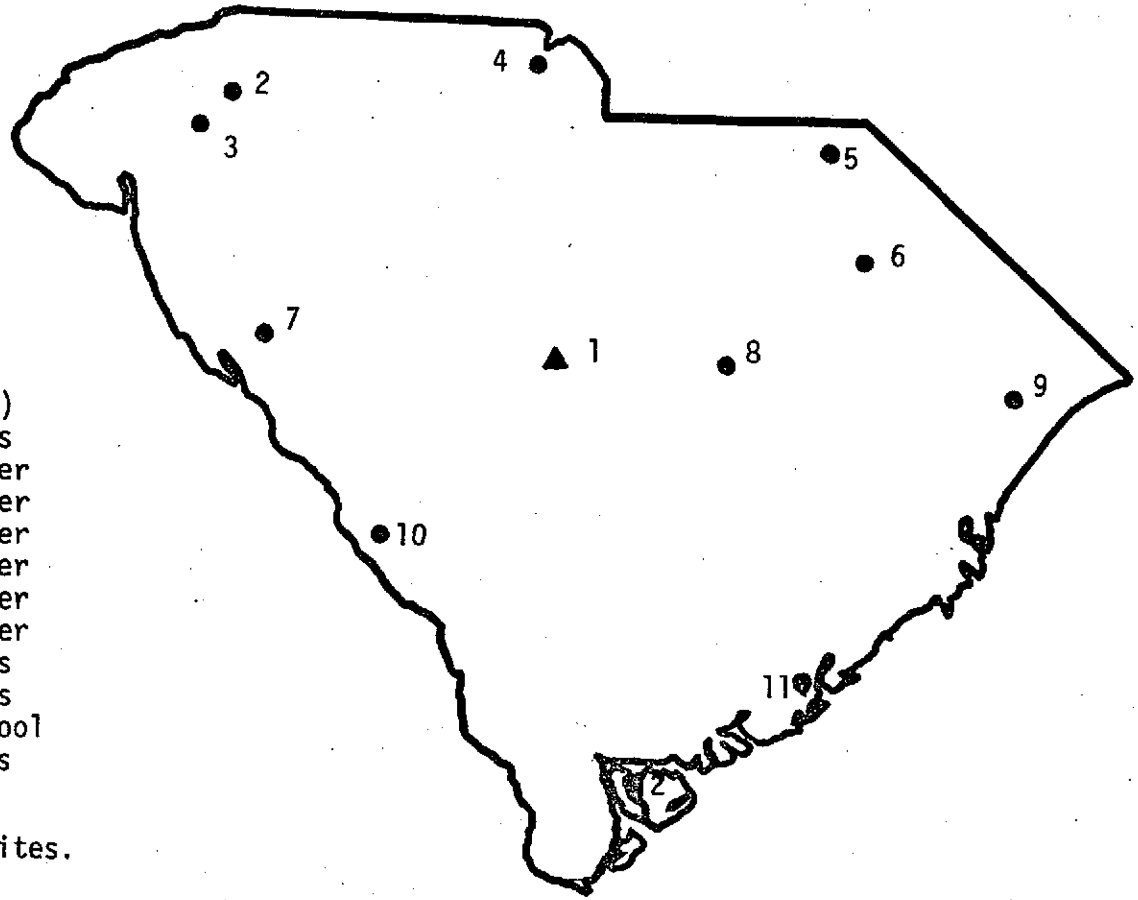

Figure 9.3.9.1. South Carolina Educational Television Network

APPENDIX 9.4

BROADCAST TELEVISION NETWORKS

9.4.1 TV College of Chicago

The TV College, part of the Learning Resources Laboratory of the City Colleges of Chicago, has been broadcasting television courses since 1956 to the greater Chicago area. TV College is probably the first and presently the most prominent American example of accredited college instruction via broadcast television. Over-the-air broadcasts from educational television channels 11 and 20 have brought the live televised or videotaped courses to students either at home or in classrooms at other colleges. However, since 1969, only courses that have been videotaped in advance are broadcast over the air. (91, 92)

Channel 11 is a VHF station, while channel 20 is UHF. Due to the state of disrepair of channel 20, it was not used during the 1973-74 academic year. Zigerell and Chausow in their "Fifth Report" (92) point out that in due time channel 20 should once again be in operation. With the loss of channel 20 services, the evening broadcasts have been temporarily discontinued although channel 11 has picked up some of the evening broadcasts by additional Sunday morning programming. (37, 92) Channel 11 has approximately a 75 mile area of coverage. (93) When both stations were operational TV College broadcast on the average, 26 hours each week, both day and evening.

The telecourses are grouped into "bands" which represent different fields of study. For example, there are "bands" of courses in such fields as general education, culture, foreign language, business, and mathematics. Courses within the "bands" are televised during the year with at least two terms lag between rebroadcasting of any course in order to help keep enrollment per course relatively high. In this manner, Zigerell points out that Chicago's six-and-a-half million population provides a nearly inexhaustible student body. (91, 92) Over 80 courses are available for credit, as well as 6 which are not for credit, during one time or another. (92)

Nearly all the televised courses are developed and taught by faculty within the Chicago City College system. The instructors are given time to prepare their particular course and during the term in which the course is being videotaped are relieved of other teaching duties. (92)

Many courses are broadcast each term that are needed as graduation requirements for students enrolled in the junior college system. The rest of the televised classes are of an elective nature. (37) Although it is possible to fulfill all of the requirements for the associate degree through broadcast television courses, few students who take televised courses earn a degree in this manner. As of 1974, approximately 400 students have earned the associate degree wholly by television. However, another 2,200 have earned a full semester's credit via TV College. Furthermore, over 150,000 students have participated in at least one credit or non-credit course. The breakdown is such that about 80,000 have taken at least one course for credit, while the other 70,000 have taken at least one non-credit course. Also there is an uncounted number of casual viewers for the television courses. (37, 92)

Students who enroll in TV College courses fall into one of five categories: 1) the more typical students who are home viewers;

2) those who take TV courses concurrently with other regular classes; 3) those who watch TV courses in the classroom at a campus; 4) students who do not want credit, but pay for the study guide; and 5) the casual viewers. Home viewers comprise about 70%-75% of TV College's credit seeking enrollment. These students, on the average, tend to be about 30 years in age, married, and highly motivated with degree achievement in mind. These home centered students enroll in courses through one of the colleges in the City Colleges of Chicago system and take examinations and meet for conferences or laboratory work at one of four centers. The centers, Mayfair, Loop, Olive-Harvey, and Southwest, are situated in reasonably accessible locales in Chicago. (37, 94, 95)

Those who are campus-centered telecourse viewers tend to be the more traditional type of college students. This group totals about 20%-25% of the total credit seeking audience per term. Generally about 40% of the TV College credit seeking audience is interested in entering the teaching profession or may already be teachers. (37)

All students who take TV College courses are expected to follow the study guide that accompanies each course. Each study guide provides the student with a prescribed set of readings, assignments to be mailed in, and self-assessment exercises. Each course also includes two midterm examinations, plus a final examination, which are done at one of the four centers in the Chicago area. (94) Home centered students also have the opportunity to have telephone discussions with the TV instructor two hours each week.

For students that watch the TV courses at a campus, an instructor provides additional guidance and assistance once each week. For other special student groups there are also auxiliary personnel available to provide assistance. In the case of confined prisoners, penitentiary educational personnel supervise the in-mates. Furthermore, it appears that about 75% of TV College graduates with the associate degree have been in-mates, or 300 in-mate graduates of the approximately 400 graduates. For the handicapped or confined, social workers, nurses, or other groups serve as advisors and proctors for coursework and exams. (92)

The cost to the student varies according to residency status. Chicago city residents pay only a service fee, while other residents of Illinois or the United States pay a semester credit hour fee plus the service charge. (94) (See Table 9.4.1.1.) As far as the cost of production, administration, and support services, Zigerell points out that TV College is a relatively costly operation. The total annual budget is typically between $800,000 and $900,000 for general operations, which does not include any special projects or accompanying funding. (92) (See Table 9.4.1.2.)

It costs approximately $70,000 to produce and broadcast a thirty program television course, whose per program duration is 45 minutes. (See Table 9.4.1.3.) The production cost of a course which is about $61,000 is a one-time cost with the exception of minor editing changes for a course life span of six to seven years. This, of course, assumes that the overall nature of the telecourse is considered to be effective and well done. (37)

Zigerell also points out that as long as TV College can enroll approximately 2,000 individuals each term, which approximates 500-525 full-time students, and present only three new courses of the total

Table 9.4.1.1 TV College Tuition Fees *

Chicago	Tuition free	+	service fee ($10 for less than 8 units, or $20 for more than 9 units)
Illinois residency	$33.50/ semester credit hour	+	service fee
U S residency	$50/ semester credit hour		service fee

*TV College information packet. (94)

Table 9.4.1.2. Approximate Total Annual Budget for TV College*

studio operations	$330,000
teacher and related instructional salaries	275,000
staff salaries, videotape and equipment purchase, overhead	250,000
Total Annual Budget	$855,000

*Zigerell and Chausow. (92)

Table 9.4.1.3. Approximate Production and Transmission Costs for a Thirty Program, Television Course*

Studio production and purchase of videotape stock		$35,000
instructor salary		16-17,000
production support (production assistant, artist, designer)		7,500
administrative and clerical support		2,500
	total program production costs	$61,000 $62,000
transmission costs (repeated twice over the air)		$7,000
study guide production		1,800-2,000
	total transmission costs	$8,800 $9,000

*Zigerell and Chausow. (92)

seven broadcast, the cost per credit hour is about $45. (93) Another way of describing the enrollment is that there must be a per course enrollment of about 275-300 students to maintain the $45 cost per credit hour. (92) This cost per credit hour of $45 then compares favorably with the overall cost per credit hour in the Chicago City College system which is reportedly about $50. (92)

Although TV College's primary emphasis has been to enable students to earn an associate degree in arts or applied science via instruction through broadcast television courses, as the general education environment changes so to does TV College. In recent times, TV College has begun to extend its operations in the direction of vocational-technical areas and adult education. (92, 93)

Through the "Study Unlimited" project, course programs are available at public libraries on videocassettes in the Chicago area for use by students that wish to take "high school equivalency" or "college exemption" examinations. Although this program is a recent innovation, it should allow the student a more flexible period of time in which to complete the coursework. (37, 92, 94) TV College may in the near future link up with an ITFS television system as well as cable television services to reach industry, governmental agencies, and health care groups and to provide more specialized courses. (37)

9.4.2 The Maryland Center for Public Broadcasting

The Maryland Center for Public Broadcasting has been in operation since about 1970. Through the Center, college courses are broadcast over the air and via cable TV to students located throughout the state of Maryland.

The Maryland College of the Air began as a cooperative effort between three community colleges and the educational television station, channel 67, in the greater Baltimore area. Essex Community College, Catonsville Community College, and the Community College of Baltimore worked together to locate and choose courses that could be broadcast over the air, were worthy of being accredited college courses, and were appropriate subjects. During the first year, four courses mutually acceptable to all three institutions were rented and broadcast over channel 67 to students in the Baltimore area. These courses were selected from the materials available from the Great Plains National Instructional Television Library, Chicago's TV College, the State University of New York, or the Central Virginia ETV Corporation. (96)

Since that time, the Maryland College of the Air via the Center for Public Broadcasting has reached students who have participated through seventeen two and four year institutions. Of the institutions, six are community colleges, while the remainder are four year colleges or universities which include the University of Maryland and John Hopkins University. (See Table 9.4.2.1.) (97) Several businesses, industries, and agencies in the state are also served with short courses in business and management. In 1972, over thirty such organizations participated in these mini-courses through the broadcasting center. (See Table 9.4.2.2.)

With the exception of the short courses for business, the Maryland College of the Air has aimed at serving college undergraduates primarily at a general academic level although there are a few graduate level courses. For this reason, the bulk of the courses are lower

Table 9.4.2.1. Academic Institutions Participating in the Maryland College of the Air*

Baltimore Hebrew College	John Hopkins University
Bowie State College	Morgan State College
Catonsville Community College	Ocean City College
Community College of Baltimore	Salisbury State College
Dundalk Community College	Towson State College
Essex Community College	University of Maryland-Baltimore County Campus
Frostburg State College	University of Maryland-College Park campus
Harford Community College	University of Maryland Eastern Shore campus
Howard Community College	

*Maryland Center for Public Broadcasting information brochure. (97)

Table 9.4.2.2. Organizations Participating in the Maryland Center for Public Broadcasting Television Training Courses*

Aberdeen Proving Ground	Frederick Memorial Hospital
Airco Welding Products	General Electric Corporation
Anne Arundel County Government	The Hecht Company
Anne Arundel General Hospital	International Paper Company
Baltimore City Hospital	Lehigh Portland Cement Company
Baltimore Gas and Electric Company	NAC-Korvette Credit Corporation
Baltimore News American	Parks Sausage
Bennett Associates	Potomac Edison
Blue Cross and Blue Shield of Maryland	Sacred Heart Hospital
Celanese Fibers Company	The Rouse Company
Chesapeake Instruments Corporation	The Stieff Company
C & P Telephone Company	The Sheppard and Enoch Pratt Hospital
City of Cumberland	Tri-State Regional Resources Institute
Cumberland Police	Western Electric Company
Cumberland Cement & Supply	W. R. Grace and Company
Federal Reserve Bank	Westinghouse
Four Roses Distilling Company	

*Maryland Center for Public Broadcasting information brochures. (97)

division courses which are common to many undergraduate programs that students take. The short courses that have been rented or purchased for televising are primarily for in-service business personnel and cover topics in management, supervisory skills, and other fundamental skills and practices of business. (97)

Courses have been televised in the fields of English, history, humanities, and data processing. During the first years of operation, many of the courses were rented or purchased from existing sources of produced programs. One major source of materials was and has been the Television College of the city of Chicago. Presently, the Center has developed the capability to produce its own programs at the rate of about two courses each year. The courses are largely designed along the same lines as those of T V College of Chicago, which are usually for three credits with about thirty lectures per course for a duration of about 45 minutes per lecture. English literature and biology were the first courses to be produced with courses in economics, sociology, and psychology being the next in line for production. (97)

In cooperation with the University of Maryland's Open University program, the Maryland Center for Public Broadcasting has also been responsible for the distribution of the Open University courses to the students in that program. Six courses in the areas of the humanities, natural and social sciences, mathematics, technology, and the Renaissance are available on film and audio tape at thirteen regional centers in the Washington-Baltimore area for students to view. These courses have been directly imported from the Open University of Great Britain. (97, 98, 99)

It is possible to participate in the college accredited courses in three different options. In the first option, a learner registers in the course for college credit at the participating institution from which the credits are desired. (96) The student follows the study guides, does the necessary coursework, and then must come to campus for examinations twice each term. Students may also contact the teacher administering the course by mail or telephone. An instructor for each major section of the state is assigned the responsibility of the students in that particular area, and this is carried out by rotating instructors from the various participating colleges. (97) In the second option, the learner may purchase the study guide and materials and follow the course without registering for credit or paying a tuition fee. The third option is for the casual follower, who can simply watch the program. (96)

All of the courses for the College of the Air and the training courses for industry are televised through the Maryland Center for Public Broadcasting. Courses are broadcast over the air on channels 67 and 73 in Baltimore and channel 28 in Salisbury and televised over 22 cable television systems in the five states of Maryland, Pennsylvania, Delaware, Virginia, and West Virginia. (See Figure 9.4.2.1.) The courses are scheduled for viewing during the weekdays with programs being repeated during the weekends. The range of television coverage through over-the-air broadcasting and cablecasting forms the boundary of the network that encompasses Maryland and parts of four other states. (97)

The entire Maryland College of the Air system is still growing in the number of participating institutions, programming, and numbers

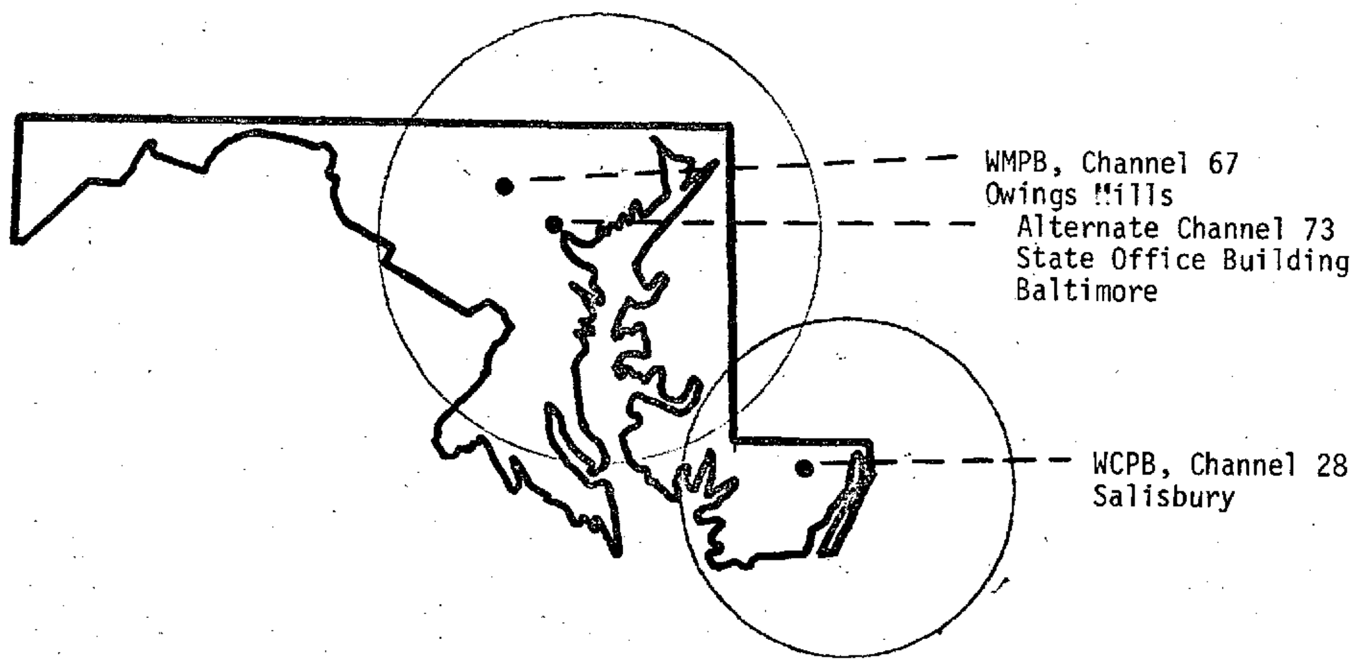

Figure 9.4.2.1. Maryland College of the Air transmitter locations. Spring 1974 course catalogue. (101)

of students. Enrollment was expected to exceed 400 students in the fall of 1973, which is a growth of about 33% since the first term of operation. (100) This figure does not include the additional students from the Open University project that number about 350, or the individuals in industry that have the opportunity to see training courses, which number over 1,000. (97, 101)

9.4.3 Miami Dade Junior College of Florida

Miami Dade Junior College of Miami, Florida, has been and is presently involved with broadcast television delivery of accredited, college-level instruction to students off the traditional campus.

As of early 1974, the only course of instruction has been centered around the "Man and Environment" theme. The series was produced by the Miami Dade production unit although there were workshops in which nationwide consultants' expertise was drawn upon. Documentary-like, color television programs, which number thirty for the entire two-semester course, presenting various concepts and aspects of the environmental situation are broadcast to students and other casual television viewers who may be watching. (102) Other series in the social and health science fields are in the planning and production stages in addition to the "Man and Environment" series.

Although the Miami Dade delivery of the environmental programs are by broadcast television, it is possible to utilize closed circuit television or film. The educational concepts rely heavily on the ideas of open learning systems. The instructional presentation involves the use of study guides, textbooks, and individual, computer prescribed review lessons, plus open discussions heard over the radio. (See Figure 9.4.3.1.)

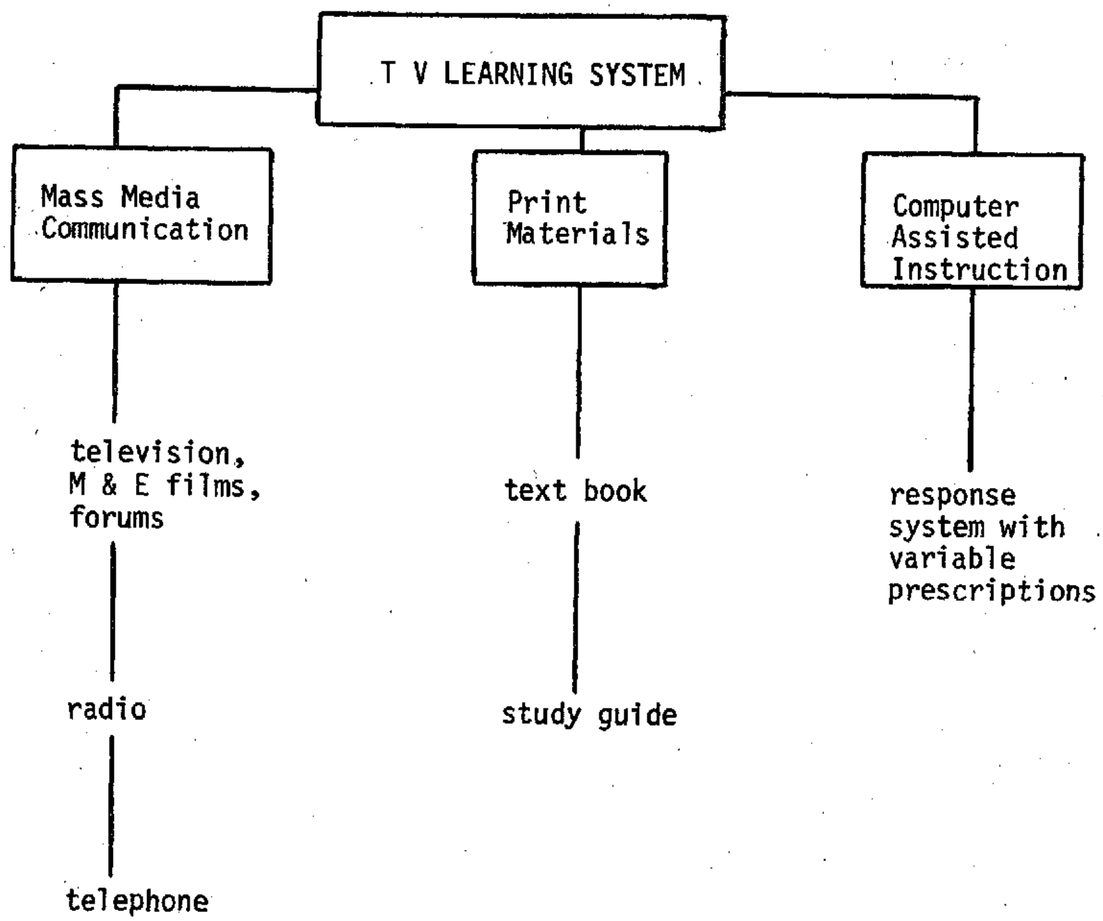

Figure 9.4.3.1. Miami Dade Junior College learning system. Man and Environment information packet. (102)

Delivery of the "Man and Environment" programs centers around a videotaped series that can be aired over broadcast television or closed circuit television. The course can also be purchased on film. Each of the thirty minute color segments which are broadcast to the students presents a group of concepts. While the programs provide the initial stimulus, highly integrated assignments, textbooks, and other recommended readings are suggested to the learner. The various elements of the learning process are always intended to interrelate with each other, but are never overlapping in content. With the information thus provided to each individual student, there are homework assignments that are to be completed and mailed in to the college. The assignments, which are of a multiple choice nature, are then graded by a computer. The computer has the programmed capability to analyze each individual assignment, and on the basis of correct or incorrect responses, the computer can measure mastery of the various concepts and make specific study and review recommendations to each student. (102, 103)

To further stimulate student involvement, each week a panel discussion, broadcast over the air, covers and helps to clarify many of the week's ideas and concepts. Directly after the airing of the program, telephone calls posing questions or comments to the panel are accepted, and their responses are broadcast over the local radio station. (102)

Because the course is designed in discrete modules and is flexible enough to allow relevant regional input from most any college, the "Man and Environment" course can be adapted to any college's needs. Modules may be deleted or substituted for in the original series, and open panel discussions can be carried on over the air or in classes, which are more pertinent to each college's own regional situation. (102)

Although the "Man and Environment" course can be leased through two major options, the leasee has a choice of the following components: 1) choice of series delivery, videotape or film; 2) the necessary number of study guides or rights to reproduce the necessary number of guides. In addition, the leasee receives the following components: 1) two copies of the textbook, 2) survey questions and the computer tape that corrects and prescribes courses of individual study, and 3) a taped example of panel discussion presentations and the handling of the following question and answer period.

What makes the options different is the time for which the series is leased and the way in which the cost to the leasee is derived. The course is leased on a per semester basis or per half-course basis. One option stipulates that the leasee must pay $15 per student each semester and that a minimum cost be incurred that is equivalent to a 200 student enrollment per semester. The second option requires that the leasing institution pay $10,000 for the right to use a one semester portion of the course for a two year period. The total two semester course is offered by Miami Dade Junior College for six semester units. (102)

As of 1974, over thirty community colleges from various parts of the nation are using the "Man and Environment" course. (See Table 9.4.3.1.) The environmental course has enrolled not only traditional students, but also home bound students or confined students, such as in-mates in prison. (104)

Table 9.4.3.1. **Participants in the "Man and Environment" Course Produced by Miami Dade Junior College***

Maricopa County Community College District
Phoenix, Arizona

Department of Education
State of Arkansas
Little Rock, Arkansas

Coast Community College District
Huntington Beach, California

Brevard Community College
Cocoa, Florida

Broward Community College
Fort Lauderdale, Florida

Hillsborough Community College
Leesburg, Florida

Manatee Junior College
Bradenton, Florida

Pasco-Hernando Community College
Dade City, Florida

Polk Community College
Winter Haven, Florida

Seminole Junior College
Sanford, Florida

St. Petersburg Junior College
St. Petersburg, Florida

Valencia Community College
Orlando, Florida

Chicago City Colleges
Chicago, Illinois

Marcer County Community College
Trenton, New Jersey

Brookdale Community College
Lincroft, New Jersey

Centenary College for Women
Hackettstown, New Jersey

Essex Community College
Newark, New Jersey

Middlesex Community College
Edison, New Jersey

The William Paterson College
Wayne, New Jersey

College of St. Elizabeth
Convent Station, New Jersey

Trenton State College
Trenton, New Jersey

Cleveland State University
Cleveland, Ohio

Portland Community College
Portland, Oregon

Northeastern Pennsylvania Educational TV Association
Pittston, Pennsylvania

Weatherford College
Weatherford, Texas

Hill Junior College
Hillsboro, Texas

McLellan Community College
Waco, Texas

Navarro Junior College
Corsicana, Texas

Tarrant County Junior College District
Fort Worth, Texas

University of Vermont
Burlington, Vermont

Milwaukee Area Technical College
Milwaukee, Wisconsin

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*Man and Environment information packet. (102)

9.4.4 The Kentucky Educational Television Network

The Kentucky Educational Television Network has been in operation since 1968. The network is a combination of broadcast educational television, closed circuit television, and cable TV systems. As a system, it serves the broad educational community of Kentucky. Much of the programming is directed at pre-school, elementary education, adult basic education, and continuing education as well as higher education. (105) The network covers the expanse of Kentucky, north to Corrington, south to Murray, east to Pikeville, and west to Paducah with the main facility located in Lexington. (48)

It should be emphasized that higher education institutions are only one of many groups served by the Kentucky Educational Television Network. Nearly all of the community colleges, colleges, and universities of the state are interconnected via a closed circuit television system. But only since 1973 has accredited college level instruction been offered over the network. For this reason, very little information is available about the actual nature of the networking or the level of usage presently applied to higher education. (71, 105)

9.4.5 The State University of Nebraska -- SUN Project

One project on which much of higher education will focus upon concerning the viability of large scale utilization of technology for education will be the SUN project of the State University of Nebraska. The SUN project will be the first major application of an extensive total "Open University" learning system in the United States. In many ways, it will parallel a similar English counterpart known as the Open University of Great Britain, which has been operating since 1970. (106)

If SUN is successful, it may well become a model and example for the rest of the United States. (107)

The SUN system under the sponsorship of the National Institute of Education will rely heavily on such technologies as educational broadcast television, video and audio cassettes, individual student instructional kits, and other more conventional learning tools such as textbooks and other reading materials. (108) A major element of the delivery system is the public color television network of the state of Nebraska which not only can reach every home in Nebraska but can also reach portions of Colorado, South Dakota, Kansas, Iowa, Missouri, and Wyoming. (38, 109)

Resource centers, accessible to all students, will be distributed throughout the state and will house videotape playback units, TV color receivers, and audio cassette recorder/playback machines. The videotape and audio playback machines will allow greater flexibility in watching the telecast lessons than do the broadcast TV programs. The resource centers will also serve as local centers of the SUN open learning system, thus allowing students to enroll in the SUN curricula at these sites. In addition, the resource centers will provide a local meeting area so that fellow students or students and tutors can meet. Occasionally, the course instructor will meet with students at each of the resource centers, or an instructor might conduct a telephone conference with students at the resource center. Other kinds of materials, such as printed matter, will also be available at these centers for student use. The sites will also serve as testing centers for the courses. The resource centers will be located in local public institutions like libraries, high schools, and colleges throughout

Nebraska and will be accessible in the afternoons, evenings, and on weekends. (110)

SUN programming will offer in-house produced courses that were initially slated to enable a learner to fulfill all the requirements for an associate degree. The courses will cover fields of study in the humanities, fine arts, science, social sciences, and business. (111) Each course will be developed, evaluated, and finally produced by a full-time production team. Each team will consist of a variety of experts that will work together to produce the most effective presentation of each course. Each of the teams is staffed by an educational psychologist, content specialists, an instructional designer, a graphic artist, writers, producers, and a variety of other educational technology specialists. In this particular area, Nebraska already has a sophisticated Telecommunications Center which is capable of producing quality programs for broadcast television or videotape. (109, 112, 113) Nebraska also has the Great Plains National Instructional Television Library, which is reportedly the largest such distribution facility in the world. If the system and telecourses, then, are successful, SUN will have ready access to a distribution system. (109)

The television broadcast or videotape playback of the courses will be the first step in the instructional process. Each televised lesson will be broadcast over the air two, perhaps three times each week. The student then will follow the accompanying course study guide, read the necessary materials, and possibly conduct some other outside activities. For instance, the instructional kit that will be provided to each individual taking the science course may require that certain experiments be done. For music or art students, it may be necessary to listen to taped musical selections or view a variety of art slides. There will even be a weekly article in a statewide daily newspaper that points out many of the facets of the week's lesson. According to SUN literature, the various elements, television broadcasts, audio cassettes, the study guide, the instructional kit, and other printed materials, will complement the other elements and will provide an integrated learning environment. (122)

SUN programming was initially committed to serving two student populations; the accelerated high school student and the adult who can not attend the traditional college campus. But, it is expected that other groups such as older students preparing for career changes or study for enrichment, college drop-outs, handicapped persons, rural isolates, and others will be served also. These students will come from Nebraska, and most probably many other midwestern states according to a recent NIE recommendation. (38, 114)

9.4.6 Other Broadcast Television Networks

According to Watson, in the vicinity of Orange County, California, broadcast television is being used to deliver college accredited instruction to learners at home. The instruction is delivered by one of the community college districts which owns and operates a UHF station. Orange Coast College and Golden West College are two year institutions in this district. (115)

It has also been pointed out by Porter that as of 1974 North Carolina is laying the foundation for its own Open University. The Open University of North Carolina will utilize a nearly statewide broadcast television system that will serve to offer higher educational opportunities to the residents of North Carolina on a part-time, high access basis. (116)

APPENDIX 9.5

OTHER INSTRUCTIONAL TELEVISION NETWORKS

9.5.1 The City University Mutual Benefit Instructional Network of New York City

Since 1968, the City University Mutual Benefit Instructional Network (CUMBIN) of New York has educationally linked several of the colleges of the City University of New York through live televising of college courses. (117)

The system has been developed to allow the various colleges of CUNY that are located throughout the New York City area to take advantage of various disciplines and instructors located at other CUNY campuses. It has also been reported that CUMBIN is an efficient educational resource for the City University of New York, which has had the academic goal of offering admission to every New York City high school graduate since 1970. (117)

The City University of New York is composed of ten four year colleges, eight two year colleges, a graduate center, a medical school, and two urban facilities. CUMBIN, an electronic network, interconnects many of the institutions into what has been considered a more effective total entity. (117)

The present institutions actively involved in CUMBIN are the Graduate Center, which serves as CUMBIN headquarters and the switching center among the various colleges; plus Brooklyn College, City College, and Queens College, which have both originating and receiving facilities; and Hunter College, which has receiving facilities only. (117)

The Graduate Center, Brooklyn, Queens, and City Colleges are each equipped with a studio classroom and two receiving classrooms. The seating capacity for the studio classrooms varies among the colleges with the Brooklyn and Queens Colleges' facilities seating between 30-35 students. The City College facility can accommodate 20-25 persons, and the Graduate Center seats the fewest, which is between 15 and 20 persons.

Each studio classroom has the traditional classroom facilities. However, at the same time, each classroom is equipped with three, variously positioned, remotely operated cameras, a sufficient number of TV monitors, microphones, speakers, and other additional instructional facilities. These devices permit the local students and instructor to be seen and heard at the other receiving classrooms and, at the same time, allow the remote students to be heard by the instructor or local students. (117)

The three cameras are used to capture different views of the instructor, class, or materials in the studio classroom for the remotely situated students. Two cameras provide the general view of the instructor and the surrounding area at the front of the class from the point of view of the seated students. The third camera provides a desktop view from its ceiling mounted position. This particular camera is used when the instructor wishes to use the desk writing pad, rather than the blackboard, or when demonstrations are conducted in the vicinity of the desk. The camera scenes may also be combined through split screening to keep the instructor on camera most of the time to enhance the live lecture format. (117)

Although the cameras are capable of picking up activity at the blackboard, the instructors are discouraged from using them as much as possible. The tendency for the board to absorb a great deal of light creates a situation where there is difficulty with the TV receiver producing a picture with enough contrast to produce distinct, legible boardwork. Instead, instructors are encouraged to use the desk writing pad or a unit called a "write a mile." The "write a mile" unit, which is located only at the Brooklyn and Graduate Center facilities, is a large roll of paper mounted on a set of electric rollers. The rollers allow the paper roll to be advanced or backed up. This enables an instructor to always be writing on a clean surface or to back up to an earlier topic. Both activities are easily picked up with the overhead camera. (118)

Control of the cameras, switching and amplification of the transmission, and monitoring the class in progress are carried on from a control booth which is located at the rear of each classroom. From the control booth, all matters concerned with either transmitting or receiving lectures are handled. A private telephone line between each control booth and CUMBIN headquarters facilitates total coordination of programming throughout the network.

In the studio classroom, TV monitors are set up so that the students attending the "real" lecture can watch via the monitors when it is more convenient of which desktop demonstrations might be an example. The audio element of the class lecture is picked up by a lapel microphone that is worn by the instructor and by other strategically placed microphones in the student seating area. These microphones are suspended from the ceiling and pick up questions or comments made by the students. Return speakers in the studio classroom allow the comments made by remote students to be heard by the local section. The system is designed so that any comment made by any student at a receiving location can be heard at all other sections. (117, 118)

Each receiving room is equipped with a large television monitor and an adequate number of talkback handsets, which allow remote students to interject a comment or question merely by depressing a button and talking. Approximately fifteen students can be accommodated in each receiving classroom. (117)

The entire network is tied together through lines which are supplied by the New York Telephone Company. In addition to the private telephone line which provides communication between the studio classroom control booth and CUMBIN headquarters, each CUMBIN campus has two video lines and four audio lines. One video line brings in the received program, while the other video line transmits any program originated on that particular campus. Of the four audio lines, two are used for receiving purposes, and the other two are used for transmission purposes. All of the lines lead to the master switching and distribution facility that is located at the Graduate Center. From this point, the various elements of televised courses, the video and talkback transmissions, are patched into or channeled to the various receiving centers in the network.

The choice to use leased telephone lines was made primarily because such a network could serve as a spine that could later be used to support either a microwave service or an ITFS system, either of which would have had problems of negotiating the New York skyline in the initial phases of CUMBIN. A secondary benefit of using leased lines is that the New York Telephone Company is responsible for maintaining the transmission facilities. The major disadvantage to CUMBIN for leasing the lines is the high annual rental costs. (117, 118)

Presently, 97% of the televised courses are "live," which is the emphasized element of the system. The live televised lectures allow for talkback or real-time interaction between the instructor and students or among the students. Because interaction has been emphasized, videotaping of courses has been kept at a minimal, if not negligible, level. Each CUMBIN originated class has the capacity to serve 130 students in the televised, live, real-time interactive method. (117, 119)

CUMBIN was initially intended to serve students primarily in the areas of science, engineering, and advanced technology. In 1969, the first year of CUMBIN operation, the course offerings reflected this intent. During the winter 1969 term, two graduate physics courses and a graduate chemistry course were televised to 35 students. The spring term represented a growth to four graduate level chemistry courses and two electrical engineering courses for undergraduates. These courses were televised to 124 students. The second term, also, represented twenty hours of televising courses each week. (117)

By the 1972 spring term, CUMBIN was televising forty hours a week during the day and an additional six hours during the evenings with future plans of adding an additional six hours to the evening televising schedule. Other natural and engineering science areas were being served, such as chemical engineering and oceanography. There was also a course in Judaic studies offered to the students. (117)

In the 1974 academic year, twelve courses are to be offered, not only in the engineering and natural sciences, but also in the humanities, economics, and journalism fields. It is expected that approximately 500 students will be enrolled in these CUMBIN courses. (119)

The costs of developing the CUMBIN system were approximately $170,000 for initial equipment costs and building alterations. (120) The annual budget for 1973-74 appears to be about $250,000. (118) (See Table 9.5.1.1.)

CUMBIN has already demonstrated its beneficial aspects to many engineering students. Many of these students have been able to complete the four and a half year engineering curriculum on schedule because CUMBIN offered the necessary courses during their sophomore year. Within the CUNY system, only the City College has an engineering curriculum. Thus, students who choose to enter the engineering program must begin their college curriculum at City College or eventually transfer to City College. Transfer students, especially from community colleges, often lose up to a year because courses that are normally taken during the sophomore year were not conveniently taught on CUNY campuses other than City College. The unfortunate result was an incompatible program of coursework as well as deficiencies in particular courses, which required at least a term to make up. CUMBIN has helped to alleviate this problem. (117)

In fall 1973, CUMBIN's network was extended via a telephone microwave relay link-up with the Teleprompter and Sterling-Manhattan

Table 9.5.1.1. CUMBIN Initial Capital Outlay and 1973-74 Annual Budget

INITIAL CAPITAL OUTLAY (1968-69)*		
Equipment Costs (4 studio classrooms, 8 receiving classrooms)		$110,000
Building Modification		60,000
	Total	$170,000
ANNUAL BUDGET (1973-74)**		
Equipment and Supplies		$ 22,000
Telephone Rental		92,000
Microwave System (Cost of adding to CUMBIN)		18,000
Personnel Services CUMBIN		119,000
	Total	$251,000

*Freund and Mailman. (120)

**CUMBIN information packet. (117)

cable TV companies in New York. Through the cable TV channel, courses in journalism, economics, and the humanities are televised to viewers at home. (117, 118) In the near future, an interconnection with channel 31, WNYC, is also planned. WNYC is an over-the-air broadcast TV station owned by the city of New York. (117)

The future for CUMBIN will mean more than just televising live courses through the New York City area. It will include CUMBIN's fuller development as a network that also provides other information services, library materials, audio-visual aids, and computer instruction. CUMBIN will serve as a storehouse and an exchange and distribution center for the entire City University of New York in the area of educational technology. (118)

Through the Center for Innovative Development, CUMBIN will act as a coordination and extension center for the educational-instructional facilities that are technologically oriented which are developing on the various CUNY campuses. The Center will provide funding and encourage and support projects that involve media and technology. The Center will also provide for the research and evaluation of the projects within the CUNY system. Where fruitful programs are developed, the Center will be responsible for initiating and implementing these programs from the time of production to the time of distribution, as well as providing various other technical services. (118)

APPENDIX 9.6

EDUCATIONAL TELEPHONE NETWORKS

9.6.1 The University of Wisconsin Educational Telephone Network

Since 1965, the University of Wisconsin-Extension has developed an extensive, statewide multi-media telecommunications system that provides instruction to the people of Wisconsin. Presently, these telecommunications systems are administered under the Instructional Communications Systems group of the University of Wisconsin-Extension division. Under the direction of the ICS, the University of Wisconsin operates an Educational Telephone Network (ETN), the telephone network in conjunction with the electrowriter technology in the Statewide Extension Education Network (SEEN), and the WHA radio station. (122)

The Educational Telephone Network is essentially a statewide party line. As a private, four wire service, the network reaches over 173 listening centers in Wisconsin. The listening centers are located in courthouses, extension centers of different agencies, libraries, and on campuses and centers of the University of Wisconsin. (123) (See Figure 9.6.1.1.)

For learners to attend and participate in the programs presented over the network requires little technical skill on the part of the student. Each listening center is equipped with an adequate number of telephone handsets and speakers to pick up the distant lecture and any comments. To speak to the instructor or other distant listeners, a student merely picks up the handset and talks. The statement is heard throughout the entire network and by the instructor. Although most of the lectures emanate live from Madison, any of the sites could serve as

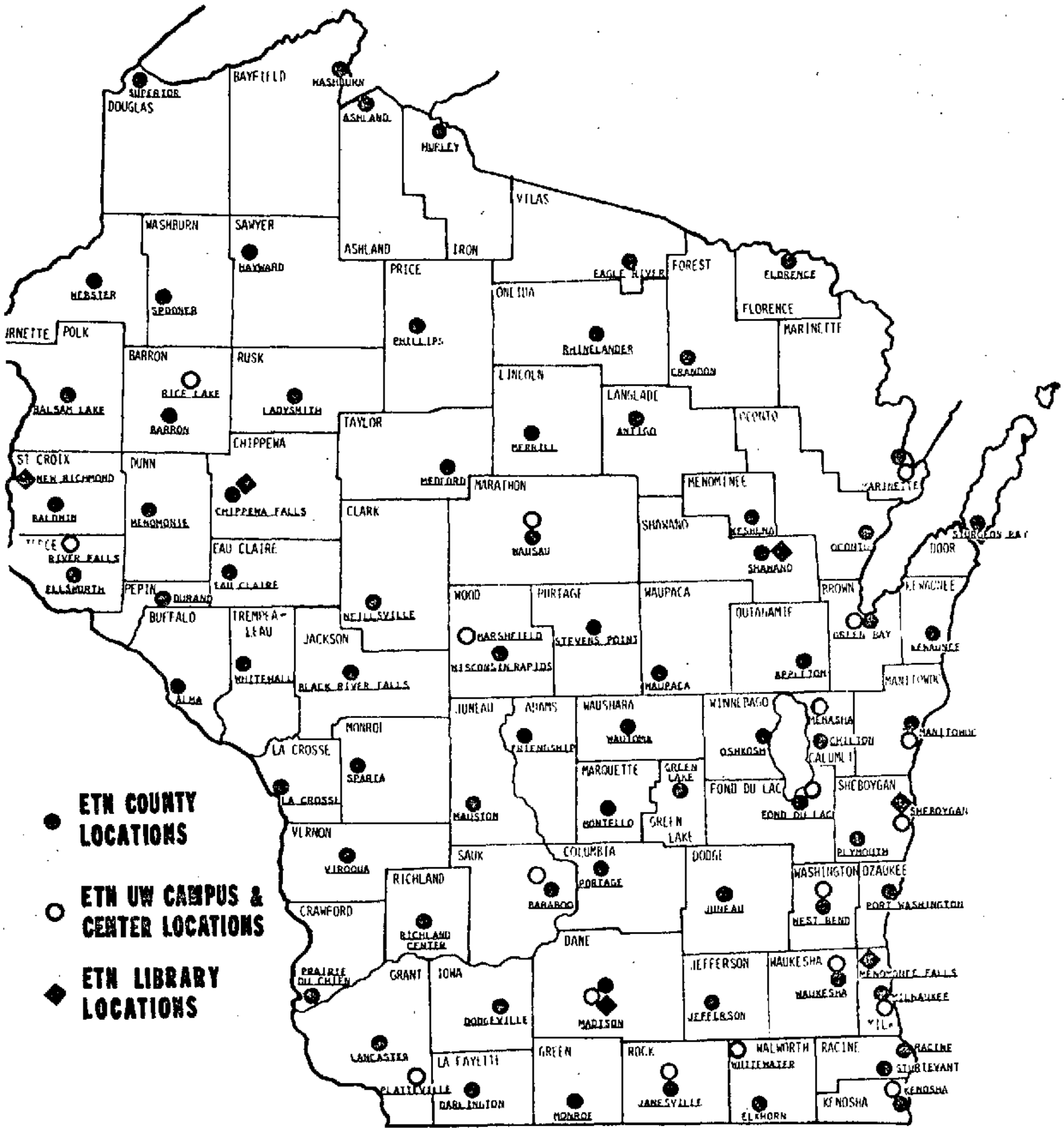

Figure 9.6.1.1. University of Wisconsin-Extension Educational Telephone Network, 1973. University of Wisconsin-Extension information packet. (124)

a lecture origination point. In fact, the instructors are encouraged to lecture from different origination locations whenever possible so that different students at different sites can be involved in face-to-face interaction with the instructor occasionally. (123, 125) If there are any visual materials to be used, such as films, slides, printed materials, these are mailed to the listening centers in advance. (125)

The SEEN program, which has been in effect since 1970, relies heavily on ETN and in addition makes use of the electrowriter for presentation of real-time visual material plus any other visual material delivered in advance. The program is primarily intended for use by engineers in undergraduate, graduate, and continuing education study. ETN-SEEN presently reaches seventeen communities and twenty different locations in the state. (See Figure 9.6.1.2.) As the system is set up, it has the potential of making instruction either of a continuing or college oriented nature available to 80% of Wisconsin's engineers. (124)

The Educational Telephone Network also operates in conjunction with WHA radio station. WHA is the primary element of the Subsidiary Communications Authorization of the Instructional Communications System of the University of Wisconsin. The over-the-air broadcasts are only accessible to locations with special receiver facilities. The receiver facilities enable the signal which rides "piggyback" in a primary FM signal's allocated bandwidth to be removed and translated into the corresponding audio element. The WHA broadcasts are distributed through much of Wisconsin by way of 8 FM transmitters of the FM Radio Network. Any site, which is within the fifty mile broadcast radius of

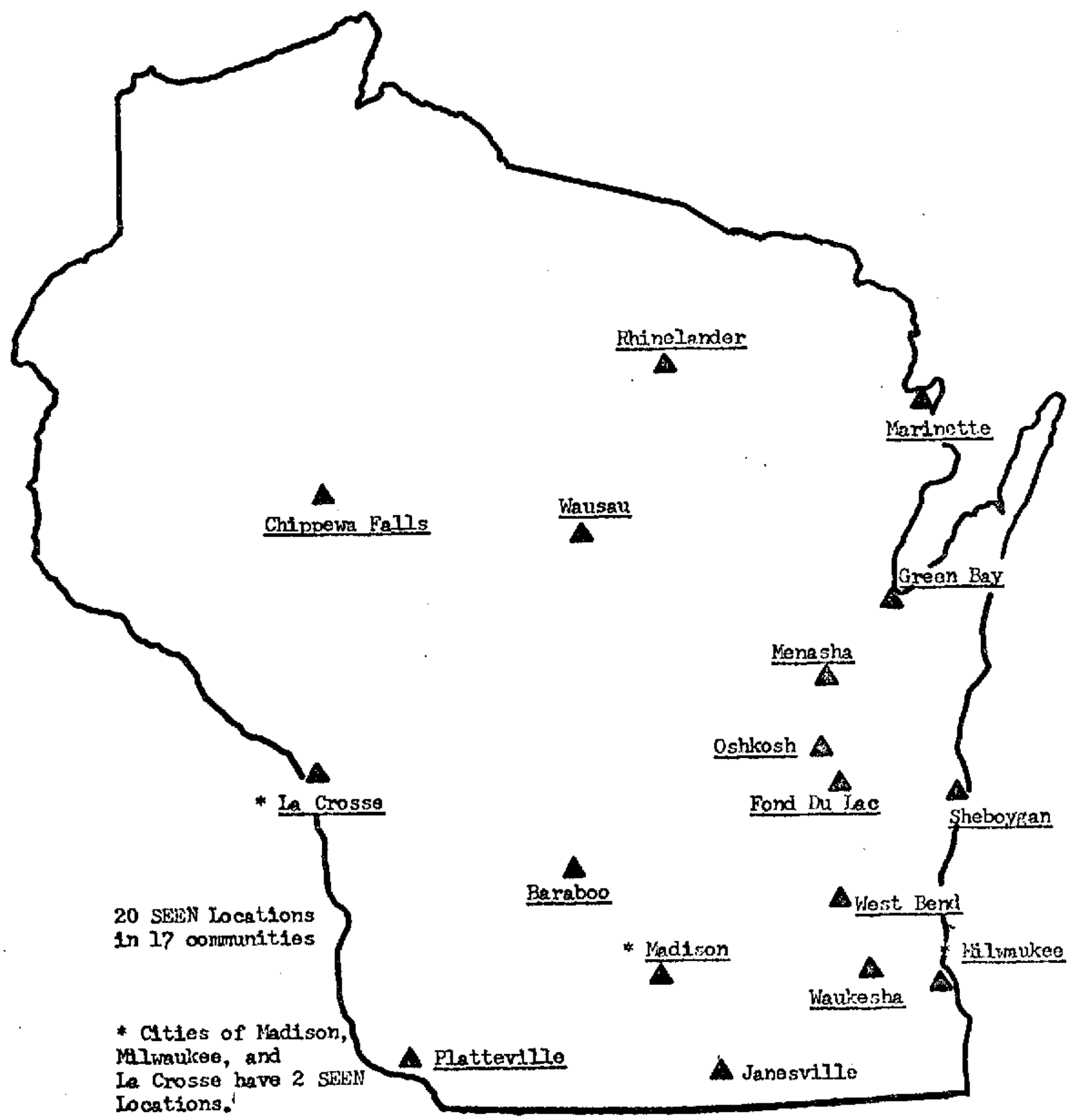

Figure 9.6.1.2. University of Wisconsin-Extension Statewide Extension Education Network. University of Wisconsin information packet. (124)

the FM transmitters, having the necessary receiving and translation equipment can pick up the programs. There are some 90 receiving sites located in the state. (125, 126)

The individuals taking the course listen to the lecture and when any questions or comments arise, the listeners have access to a phone. The listener calls the instructor and the question and response are put over the air so that all participants can hear the dialogue.

ETN-SCA was initially intended for use by the medical profession but is now also used for a variety of other purposes. ETN-SCA has been used for the delivery of college-level instruction, continuing and professional education and has covered such areas as engineering; education; social, health, library and natural sciences; nursing; and domestic home economics. (123)

It is very important to point out that although the system is extensive, geographically and content delivery-wise, no more than 37% of the total number of hours of programming by ETN-SCA is dedicated to the application of college-level accredited instruction. The rest of the programming hours are used for either medical professional and continuing education, which is delivered directly to the enrolled hospitals, or else is of a public service nature that does not solicit registered enrollment. (123) (See Table 9.6.1.1.)

Many of the accredited college courses are also graduate level education courses that are taken by Wisconsin teachers. The courses average three hours per session with segments of lecture broken by more collective group discussion, in order to avoid creating a tedious lecture routine. (123)

Table 9.6.1.1. ETN-SCA 1971-72 academic year programming distribution+

	Program Hours	Number of Students	Percent of All Programs Offered
General*	382	6,921	37.42
Medical**	237	6,623	23.20
Public Service***	402	5,930	39.38
	1021	19,474	100%

*Programs are offered through the UW-Extension for students. Students are required to register.

**Programs are transmitted directly to participating hospitals.

***Programs do not require formal registration.

+Parker. (123)

All of the programs are scheduled months in advance. Adequate time is set aside for development and preparation of each course. Nearly all the programming is live. However, very infrequently a lecture may be previously recorded and played back to the student listeners. All of the courses are designed with the belief that any or all necessary media and materials should be integrated to form the best possible and most effective delivery of information to the learner. In addition, each term's courses are publicly distributed and advertised, and enough time is left so that the information can be fully disseminated to any potentially interested individuals well in advance of actual delivery. (124)

The costs of the programs vary according to the nature of the course and who and where it is presented. Generally, for all college-level courses, the tuition fee for the on-campus and off-campus student is the same. Whereas, for the continuing education courses the fees are less. Each public listening site pays a monthly fee which helps to cover the costs of the ETN-SCA network, while the other organizations pay on a program-hour basis. (124)

As indicated by Parker, the total Instructional Communications System appears to be providing a valuable statewide service. (122)

As of 1974, the University of Wisconsin-Extension, the division to which the ETN-SCA and SEEN programs belong, has offered several courses over approximately 20 of the state's cable television systems. The courses are offered over the educational access channel, and two of these courses are for college credit. One of the credit courses deals with the economics of family planning, while the other course is concerned with aspects of determining and forecasting the weather. (127)

It is also reported that the University of Wisconsin, also as of 1974, has recently begun to implement a videotape program. (47)

9.6.2 The Kansas Statewide Continuing Education Network

The Kansas Statewide Continuing Education Network is a telephone dependent teaching system. Six major Kansas universities and colleges use the telephone conference network to teach both college accredited courses and other kinds of courses to over twenty locations throughout Kansas. (See Figure 9.6.2.1.)

The network began originally as an extension of Kansas State University's Division of Continuing Education. During that 1970 spring only the Hoxie community was connected to the University. Since that time, the network has continued to grow and expand including more colleges, universities, two year institutions, vocation-technical institutions, high schools, and other educational facilities that are able to receive the amplified voice network.

In mid-1972, the Kansas State Telenetwork became the Statewide Continuing Education Network, and six major institutions have sponsored the network. These institutions are Fort Hays State College, Kansas State College and Teacher College, and Kansas, Kansas State, and Wichita Universities. Each term more than ten college accredited undergraduate and graduate courses are offered over the network in fields of nutrition, physical education, education, history, literature, and the social sciences. (128)

The network consists of a two-way, Southwestern Bell Company telephone link. Audio signals are transmitted via a four wire dedicated service although it is not operational 24 hours each day. The lectures are supported by other printed and audiovisual materials. (128)

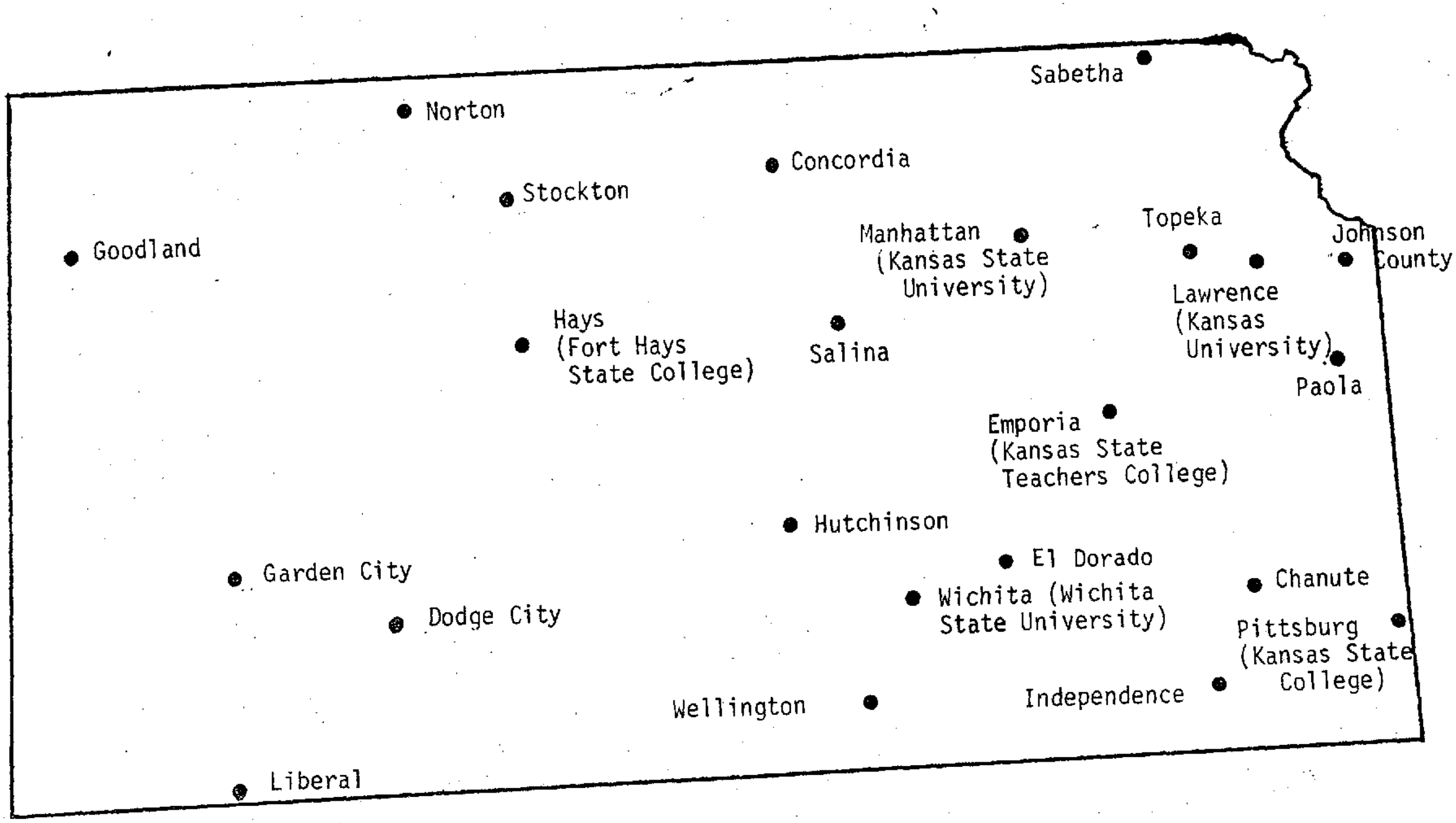

Figure 9.6.2.1. Kansas Statewide Continuing Education Network locations. (128)

9.6.3 The Virginia Polytechnic Institute Multi-Media System

Since 1969, Virginia Polytechnic Institute has conducted an off-campus engineering graduate program, primarily with electrical engineering courses. The network has been used to connect Virginia Polytechnic Institute and the State University to the Virginia cities of Reston, Dahlgren, and Richmond. The Dahlgren facility is used to serve the U. S. Naval Weapons Laboratory. (129)

Via the off-campus program, students can earn either the Master of Engineering degree or the Master of Science degree wholly through classes conducted at the remote learning locations. The network has been used to teach 89 courses in the past three years which has made the degree programs possible. (129)

The network itself, has several components that are integrated together to produce the multi-media system. The components of the system are the videotaped lectures, a live interactive audio system, the electrowriter, plus the standard notes and the occasional instructor visits to the remote sites. (129)

Videotapes of lectures are produced for the courses which form the core of the curriculum and viewed by the off-campus sections, but not every course is taped. Of the courses taped, however, a thirty minute videotape is produced for each fifty minute lecture. These tapes are then delivered to the off-campus sites with approximately 25 tapes comprising a course. (129)

The videotapes are produced with two cameras which are controlled by a camera technician who films the lecture. One camera provides a view of the instructor, while the second camera focuses on the instructor's desk and a writing pad. (129)

The off-campus sections view the lecture for the thirty minute period, and then the audio and electrowriter components are used for the following twenty minutes of the session. The audio system is comprised of a private telephone line that interconnects the classrooms. The classrooms are equipped with ceiling mounted microphones which pick up any of the dialogue within the classroom and speakers which bring the comments from the separated classes. During the time the audio system is used questions concerning the videotaped material are answered. It is the audio system which forms the heart of the network. (129)

The electrowriter is used to provide the live, real-time, visual contact. The instructor uses the electrowriter, which is essentially a remote electronic blackboard, to work example problems for the students. On-campus classes as well as the off-campus sections can see the instructor's demonstration. The off-campus sections are only able to receive the instructor's work and are not able to transmit written information to the instructor via the electrowriter. When some of the more advanced or less frequently offered courses are taught, often the audio talkback system and electrowriter are the only devices involved as these courses are not generally videotaped.

The audio, electrowriter, and videotape components are always supplemented with mailed handout lecture notes of the videotapes and electrowriter transmitted information, plus problem assignments and tests. Instructors are also expected to visit each remote location three times each quarter to have the opportunity to meet and work with the students in face-to-face fashion. It is the integration and utilization of these technologies which form the multi-media system. (129)

APPENDIX 9.7

ELECTROWRITER NETWORKS

9.7.1 The University of Illinois University Extension Network

Since 1966, the University Extension division of the University of Illinois has extended its on-campus classrooms to locations across the width and breadth of Illinois. The University Extension network, known as the UNIVEX-Net, relies primarily upon the electrowriter technology and accompanying voice transmission.

The electrowriter is essentially an electronic blackboard, which allows material written on a surface at one place to be electronically transmitted and recreated at one or many other locations. The general procedure is to write on the transmitter or transceiver surface with an electronic stylus. This, in turn, is picked up by the remote receivers or transceivers, and then the visual image is projected on a screen. The service requires two wires in which one of the lines serves to carry the visual signal, while the second carries the audio element of the program. In this manner, material that might normally be written on a blackboard such as diagrams or equations, can still be presented to distant viewers. As the UNIVEX-Net system is designed, each location has both visual display and audio capabilities. (See Figure 9.7.1.1.) Each location is able to communicate with any of the sites that are active during a lecture via Illinois Bell Telephone lines.

The UNIVEX-Net works not only independent of, but in conjunction with, other extramural programs of the University of Illinois. In the cases in which no extramural university personnel are involved, other

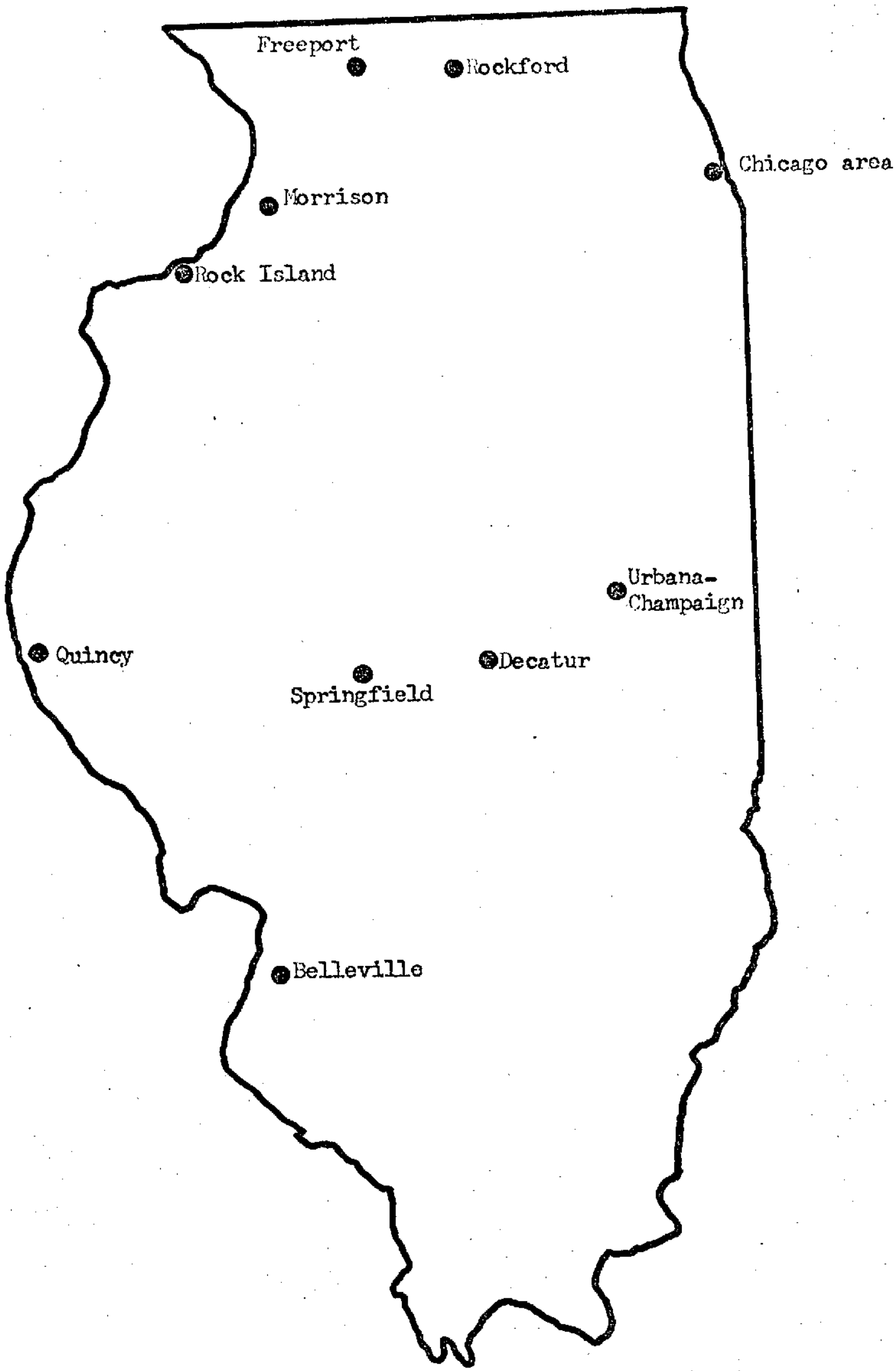

Figure 9.7.1.1. The UNIVEX-Net. (130)

forms of interaction are arranged to partially displace the lack of frequent face-to-face, student-instructor interaction. For instance, telephone conferences or periodic visit/lectures to the various sites are conducted by the course instructor. There are also times when the student is necessarily on campus for orientation or laboratory work.

In the near future it is expected that other materials, such as videotapes, films, or slides will be used as an integrated element within the UNIVEX-Net system.

The courses are taught as "loops," which are transmitted at different times. A "loop" is simply a period of time during which several sites are receiving instruction. The early morning "loop" from 8:00 a.m. until 10:00 a.m. is used to teach engineering graduate courses and some mathematics courses primarily from the University of Illinois at Urbana. A later "loop" is used to send undergraduate courses in education, engineering, and agriculture. The primary purpose of this "loop" is to enhance and supplement what can be offered from the two year institutions in Illinois. Some upper division undergraduate and some graduate courses are also scheduled on this "loop." (130) In addition to the graduate engineering loop courses, many special presentations or seminars are transmitted over the network whenever it is possible and convenient.

For the engineering students, it is possible to take part in the courses in any of several categories. An individual can be accepted and participate as a graduate student, or as a non-degree seeking student. It is also possible to participate in a non-graduate degree program, which leads to a graduate engineering certificate however. (130)

9.7.2 The University of Tennessee Electrowriter Network

In order to solve the time consuming transportation problems of University of Tennessee faculty teaching courses at extension centers in the state, the University of Tennessee has been using the electrowriter technology since 1966. (131) The instructor teaching from the Knoxville campus, or any other center for that matter, might be conducting a graduate engineering course or a home economics course to any or all of the linked up locations in the state or at centers in nearby Alabama, Florida, or North Carolina. (132) (See Figure 9.7.2.1.)

The linking of the various remote sites is by way of five WATS (Wide Area Telephone Service) lines. The WATS line is a unique feature of most telephone companies where the user pays a predetermined monthly or annual fee for unlimited rights to telephone usage. In fact, using the WATS lines for the electrowriter system during the evenings has made it economically feasible for the University of Tennessee to have WATS line service. (131)

Since 1969, the videotaping of some classes has also been integrated into the instructional process with the electrowriter units. Videotapes, primarily in graduate level engineering courses, are made of on-campus class sessions and delivered to the extension centers. The tapes are then viewed, and the instructor and remote classes are in communications with each other during and immediately after the viewing session to handle any questions, to clarify material, and to work with the students on assignments and problem solving sessions, which are often mailed to the Knoxville campus. The instructor and students have always had two-way audio and visual (via electrowriter) interactive capabilities. There also are occasional instructor visits

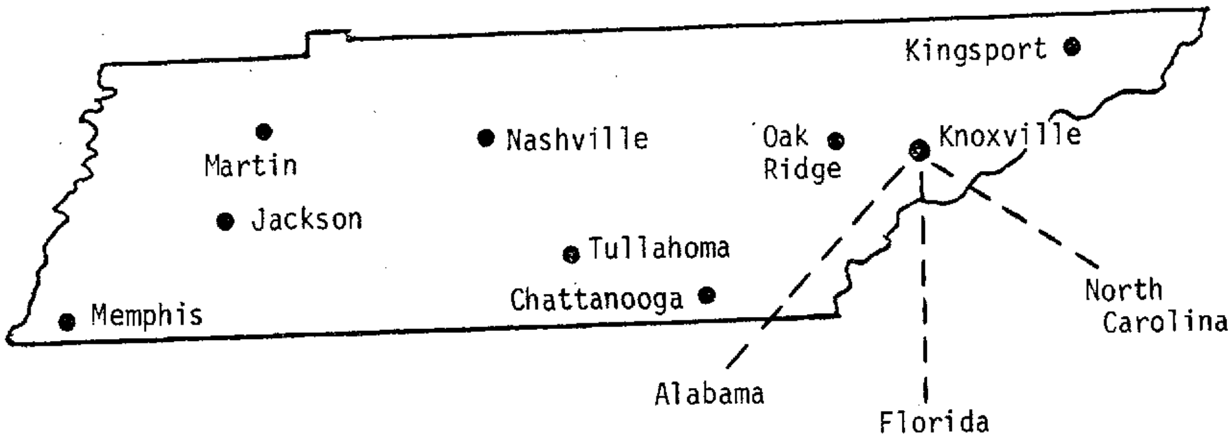

Figure 9.7.2.1. University of Tennessee electrowriter/videotape system. University of Tennessee information brochure. (132)

to the extension centers. However, the videotaped sections add another instructional dimension for the remote students. (132) For some of the off-campus classes there are no on-campus sections, and in these cases, the instructor teaches the off-campus students by the electrowriter. (131)

The electrowriter network is used to transmit graduate engineering courses, courses from the College of Business, mathematics courses in the liberal arts school, and home economics through the continuing education division. (132) The graduate engineering classes are generally limited to a total on and off-campus enrollment of twenty students. All the graduate engineering students are expected to meet the University of Tennessee's graduate school requirements. There is, however, a marginal post-baccalaureate category that allows a student to take courses, which coupled with proficient academic marks provides an entry route into the graduate programs. All credits accumulated in off-campus study are accepted at full value by the University of Tennessee. (131, 132) Via the electrowriter/videotape system, students can choose courses of study that lead to a master's degree in chemical, civil, electrical, industrial, or mechanical engineering, or there is the engineering administration program. (132)

According to Smith, the overall electrowriter/videotape network has been successfully serving many off-campus students at remote locations, and many other locations in Tennessee may be interested in having an extension center to receive instruction. (132)

APPENDIX 9.8

ITFS Per Channel Costs

University ITV System Annual Operating Budget *

Item	8 Hours/Day/Channel Channels 1 (dollars)	2 (dollars)	3 (dollars)	4 (dollars)	Notes
FIXED					
Director	9000	9000	18 000	18 000	assume ½ time for 1 and 2 channels
Secretary	0	0	3000	6000	assume school supplies part-time for 1 and 2 channels, one-half time for 3 channels
Chief engineer	16 000	16 000	16 000	16 000	
Engineer	0	5000	10 000	10 000	¼ time for 2 channels, full for 3rd and 4th channels
Engineer (2nd)	0	0	0	5000	½ time from school
Driver	2000	2000	4000	4000	½ time for 1 and 2 channels; full time for 3 and 4 channels
Direct labor	27 000	32 000	51 000	59 000	
Overhead at 20%	5400	6400	10 200	11 800	
Car	1000	1000	2000	2000	
Tower rental	5000	5000	5000	5000	
Sub-total—FIXED COSTS	38 400	44 400	68 200	77 800	
VARIABLE					
Operator costs at 2.50/h	3500	7000	10 500	14 000	1400 h, 1 channel 2800 h, 2 channels 4200 h, 3 channels 5600 h, 4 channels assume 8 h/day/channel, 5 days/wk, 35 wk/yr
TOTAL OPERATING COST	41 900	51 400	78 700	91 800	
Cost/h	29.90 30/h	18.30 19/h	18.75 19/h	16.40 17/h	

University ITV System Capital Budget

	Number of ITFS Channels 1 (dollars)	2 (dollars)	3 (dollars)	4 (dollars)
Consulting and legal fees	20 000	20 000	20 000	20 000
Program management, design engineering and drawings	35 000	35 000	35 000	35 000
Installation and test	44 000	57 000	69 000	80 000
Studio classrooms equipment	23 000	46 000	69 000	92 000
Studio control	19 000	37 000	56 000	74 000
Master control	8 000	27 000	46 000	49 000
RF transmission equipment emergency power	75 000	88 000	102 000	116 000
Talkback receiving equipment	26 000	27 000	29 000	30 000
Spare parts	6000	12 000	18 000	24 000
Test equipment	15 000	15 000	15 000	15 000
Totals	271 000	364 000	459 000	535 000

*From Martin-Vegue, Jr. et al. (36)

APPENDIX 9.9

COST PER QUARTER CREDIT HOUR OF CSU-SURGE**

The CSU unit costs of off-campus instruction for the 1971-72 SURGE programs can be computed from these cost factors. The following enrollment and program data are required:

Total Courses	=	69
Total Sections*	=	261
Total Off-campus enrollment	=	883

Therefore, $$N = \frac{261}{69} = 3.78 \left(\frac{\text{sections}}{\text{course}}\right) \text{ or } \left(\frac{\text{tapes}}{\text{recording hour}}\right)$$

$$S = \frac{883}{261} = 3.40 \left(\frac{\text{students}}{\text{section}}\right)$$

and let C = 1.00 qt. credits granted for 10 contact hours of course work.

$$F = \frac{\left(\dfrac{\text{recording hours}}{\text{course}}\right) \cdot \left(\dfrac{\text{dollars}}{\text{recording hour}}\right)}{\left(\dfrac{\text{ave. off-campus student credits}}{\text{course}}\right)}$$

where $\left(\frac{\text{dollars}}{\text{recording hour}}\right)$ is subdivided into fixed cost/course hour plus variable costs/course hour.

$$F = \frac{(10C) \cdot \left(\$32.25 + [\$4.75 \cdot \$1.30\ S]\ N\right)}{N \cdot S \cdot C}$$

$$F = \frac{322.5}{NS} + \frac{47.5}{S} + 13.$$

$$F = \frac{322.5}{(3.78)\ (3.40)} + \frac{47.5}{3.40} + 13.$$

$$F = \$51.97/\text{qt. cr.} \approx \$52./\text{qt. cr.}$$

* A section is a group of off-campus students meeting at a location and requiring a tape.

**From Baldwin, (39)

APPENDIX 9.10

SURVEY OF THE ROLE OF TECHNOLOGY IN HIGHER EDUCATION

PLEASE FILL IN THE APPROPRIATE INFORMATION

NAME____

POSITION______________________________________

INSTITUTION AND/OR SYSTEM__________________________

1) In what year was your system proposed? ____________
2) In what year did your system become fully operational (technically)? ____________
3) In what year were fully accredited college level courses taught over your system? ____________
4) Which groups was your instructional system <u>intended to serve</u> when the system was under development:

GROUP	CHECK HERE IF APPROPRIATE	PLEASE ADD ANY ADDITIONAL INFORMATION CONCERNING SPECIFIC GROUPS OR DISCIPLINES SERVED*
Full-time undergraduate students		
Part-time undergraduate students		
Full-time graduate students		
Part-time graduate students		
Professional persons		
Semi-skilled persons		
General population		
No group in particular		
Other		
Other		

*For example, under Professional persons indicate which professions have been emphasized, etc.

5) Which groups have turned out to be the principal users of your system generally?

Please include the approximate number of students in each group in the right hand column.

GROUP	CHECK HERE IF APPROPRIATE	PLEASE ADD ANY ADDITIONAL INFORMATION CONCERNING SPECIFIC GROUPS OR DISCIPLINES SERVED*
Full-time undergraduate students		
Part-time undergraduate students		
Full-time graduate students		
Part-time graduate students		
Professional persons		
Semi-skilled persons		
General population		
No group in particular		
Other		
Other		

*For example, under Professional persons indicate which professions have been emphasized, etc.

PLEASE KEEP IN MIND THE POSSIBLE FOLLOWING GROUPS IN ANSWERING THE NEXT TWO QUESTIONS:

1) traditional college students
2) non-traditional students (not typically college students) such as in-service professionals; skilled, semi-skilled, and unskilled workers; general populace; or special groups such as the military, housewives, or confined persons.

6) Have any other student groups other than those you are now serving or expected to serve shown any interest in receiving education/instruction by your system? As a result, do you anticipate expanding or altering your system to serve these groups? Please explain.

7) Have you ever encountered any potential student group that was unreceptive or uninterested in the idea of receiving education/instruction via your system? Please explain.

8) What conditions do you feel have to exist for telecommunications media to have a beneficial effect in providing education/instruction?

9) Under what circumstances do you feel that telecommunications media are <u>not</u> beneficial in providing education/instruction?

10) a. Although presently your system involves some local or instrastate networking, would you consider entering into a larger regional or national resources sharing network? Why? (NOTE: In this instance network refers to the linking of geographically distant areas for purposes of education/instruction.)

b. What would be the advantages and/or disadvantages of doing this for your?

11) a. Do you feel your system will continue to grow, or has reached stability, or perhaps will be reducing its scope presently or in the near future? Please explain. (NOTE: In this case growth refers to an increase in the number of locations reached or persons receiving education/instruction.)

11) b. If growth is anticipated, what kinds of audiences do you plan to reach?

12) Have system costs and expenditures been a constraining factor or have you been relatively free to develop the system as it was envisioned?

13) Approximately what percentage of your total aid was provided for by the following groups in the <u>initial</u> <u>development</u> of your system?

	Percent of Total
federal government grant	________
state government grant	________
private foundation grant	________
in-house funds	________
private endowment or gift	________
other	________

14) Approximately what percentage of your total aid helps to provide for the <u>present</u> <u>operation</u> of your system?

	Percent of Total
federal government grant	________
state government grant	________
private foundation grant	________
in-house funds	________
private endowment or gift	________
student fees	________
other	________

15) Do you feel your system is cost-effective? What criteria do you base this on? Please attach any supporting analysis you may have performed in the past.

THE REMAINING QUESTIONS ARE TO BE ANSWERED ON THE BASIS OF YOUR EXPERIENCE WITH TECHNOLOGY IN HIGHER EDUCATION AND ARE NOT NECESSARILY DIRECTED TO YOUR PARTICULAR SITUATION.

16) Do you believe the utilization of technology will have a major impact in higher education for providing education/instruction in the off-campus and/or between campus mode in the future?

17) a. In your opinion, what major influencing factors would tend to promote more widespread technology usage in higher education in the future. Please explain.

17) b. In your opinion, what major influencing factors would tend to inhibit more widespread technology usage in higher education in the future. Please explain.

We, the Center for Development Technology and myself particularly, appreciate your participation in this questionnaire. A survey report of these results will be sent to you. If we may list your name as a participant, please fill in the information below.

____
(Name and title or occupation)

____
(address)

____

I give permission to list my name as a participant in the "Survey of the Role of Technology in Higher Education".

____
Signature date

9.10.1 List of Participants

The following is a partial list of participants who responded to the survey questionnaire, "Survey of the Role of Technology in Higher Education,":

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Stanford University

Spencer A. Freund
Director, City University Mutual Benefit Instructional Network
City University of New York

Donald A. Keating
Director, Instructional Television Network
Case Western Reserve University

Robert D. Kersten
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Jack Munushian
Director, Interactive Instructional Television Center
University of Southern California

Morris E. Nicholson
Director, Continuing Education in Engineering and Science
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Lorne A. Parker
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