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ABSTRACT

Intended to provide background information and preliminary policy options for the California Community Colleges' Commission on Innovation, this document explores the cost and practical feasibility of delivering distance instruction using pre-recorded broadcasts. Following introductory materials detailing the Commission's charge, the paper suggests that distance education (DE) represents a natural starting point for enhancing the efficiency of community colleges. Current uses of DE are then reviewed, describing the simple case of an institution making use of television, consortia of institutions promoting DE, and "colleges without walls" which offer only telecourses and have no campus. Next, pros and cons of DE are discussed, indicating that studies of student outcomes show that DE students learn as well or better than classroom students and that most DE programs include opportunities for teacher/student interaction contrary to common criticisms of DE. A base model is then provided for statewide distance education, including assumptions about delivery and curriculum and tables of costs per full-time equivalent student with the use of full-time instructors, the use of part-time instructors, full- and part-time instructors with extra grading time, and full- and part-time instructors with extra meeting times. This section also provides tables of potential savings per option. Finally, three options for a statewide system are discussed and four policy changes concerning removing enrollment caps to provide incentive for DE are considered. A discussion of cost assumptions and 81 references are appended. (KP)

THE FEASIBILITY OF STATEWIDE DISTANCE EDUCATION

Commission on Innovation

Policy Discussion Paper #5

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Note: This paper was prepared by the staff of the Commission on Innovation to stimulate discussion. For comments, contact Daniel Weiler, BW Associates, 815 Allston Way, Berkeley, CA, (510) 843-8574, fax (510) 843-2436.

ABSTRACT

In the face of limited financial resources, rapid technological change, and the regular emergence of new fields of knowledge, California's community colleges are being called on to provide world-class education and training for increasing numbers of diverse students, insure access for all students, and increase the retention, completion, and transfer rates of ethnic minority and low-income students. The Board of Governors has recognized that a "business-as-usual" reaction to these challenges will not work; all colleges must now begin to shift to an active concern with the tradeoffs between productivity, effectiveness, and efficiency, and begin to implement practices that will enable them to analyze these issues and make the right choices. This change in perspective will require a profound change in the organizational culture of community colleges.

This policy discussion paper explores the cost and practical feasibility of delivering instruction at a distance using pre-recorded television broadcasts. The paper suggests that BOG and/or legislative policies could be used to establish a statewide approach to distance education. The technological revolution will ultimately enable community colleges to provide distance education using a combination of voice, data, and video images that can radically change how instruction is delivered. For the mid-term of three to five years, it is feasible both financially and technologically for community colleges to greatly expand their use of telecourses by taking a coordinated statewide approach. At the heart of a statewide system might be an Institute for Distance Education and Telecommunications which would function to establish coherent educational programs taught at a distance for students enrolled in their local college. With the proper set of incentives and with appropriate capital investments building on the current capabilities of the colleges, a much higher percentage of courses could be delivered by telecourses, eventually augmented by other technologies; in this way, the state could substantially reduce facilities needs and enroll more students for a given level of state support. By establishing a statewide approach to distance education as soon as possible, the community colleges will position themselves to make a transition to more advanced uses of distance education and educational technologies before the turn of the century.

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PREFACE

California's community colleges are facing a period of unprecedented growth in the number and diversity of students who will seek an education before the turn of the century. More students, especially from minority and poor backgrounds, will want to enter community colleges as their best—and often only—gateway to the higher levels of education necessary for success in an increasingly technological and competitive world. Yet the dual pressures of growth and limited budgets could reduce access precisely for those students for whom community colleges have traditionally been the principal avenue for equal educational opportunity.

Despite these pressures, the California Community Colleges are committed to insuring access for all students, and, in particular, to increasing the retention, completion, and transfer rates of ethnic minority and low-income students. To do so, the colleges realize they must introduce far-reaching changes in instructional programs, management strategies, relations with other sectors of society, and the use of facilities and resources.

The Commission on Innovation was formed by the California Community College Board of Governors in November, 1991 to address these concerns. With the colleges facing continuing budget pressures combined with unprecedented growth in student numbers and diversity, the Board realized that "business as usual" would no longer be possible, and asked the Commission to identify innovative ways in which the community colleges could respond to these challenges. The Commission was asked to write a report that proposes policies which build on the colleges' proven record of excellence in order to achieve higher quality, more cost-effective instruction and management for an era of growth and diversity marked by limited budgets.

As an aid to the Commission in its deliberations, the Chancellor has asked the Commission staff to prepare a series of Policy Discussion Papers that provide background information and *preliminary* policy options for Commission consideration. These staff papers are intended specifically to stimulate discussion from which the Commission can give direction to the staff to further the research and policy analysis process. All the papers will be widely circulated in order to facilitate discussion among community college professionals and feedback from the field. The papers, which will be based on reviews of relevant literature and discussions with community college professionals and national experts, will address nine crucial areas the Chancellor has asked the Commission and the three **Challenge XXI** Task Forces on Management, Instruction, and Facilities to consider:

1. How could facilities be more efficiently used and planned in order to accommodate growth and save money?
2. How could the colleges use technology in order to enhance learning, improve management, and increase cost-effectiveness?
3. How could partnerships between the community colleges and business be better utilized and further developed to help enhance community college growth and diversity, deal with college resource limitations, and address issues of economic development?
4. How could the community colleges work cooperatively with other education segments in order to accommodate growth and increase cost-effectiveness?
5. How could the colleges achieve continuous improvement in the quality and efficiency of their management and their services to a diverse clientele?
6. How could the community colleges become more effective learning environments for an increasingly diverse population, and in particular assure that underserved students receive the academic preparation required to prepare them for transfer?
7. What changes in system-wide and local college governance could enhance the colleges' efficiency and effectiveness?
8. How could additional revenue (from existing and/or new sources) be raised in order to help accommodate future growth?
9. What additional steps should the system take to ensure accountability for efficiency and effectiveness?

The Chancellor has made it clear that the answers to these questions must all address a common underlying theme: how the California Community Colleges can ensure access for all students, and increase the retention, completion, and transfer rates of ethnic minority and low-income students.

This Policy Discussion Paper addresses a central component of Question 2: How can technology be used to enhance learning, improve management, and increase cost-effectiveness? The paper explores the feasibility of using distance education on a statewide basis.

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A. INTRODUCTION

The use of technologies in education always raises a dual image. Glowing possibilities appear in one view—the belief that telecommunications and computer-based technologies promise not only a very different way of providing instruction, but also a more efficient and effective educational system. This belief is backed by numerous and growing examples of advanced technologies and exciting applications. In another view, there is almost despair that technologies are too expensive, do not live up to their promise, are resisted or simply ignored by faculty, and have not had the full commitment of state and local policy-makers. These criticisms are particularly trenchant as applied to community colleges for they are particularly well positioned to provide the skill in the use of technology that all members of tomorrow's workforce will need.

It is difficult to balance these competing images of promises and problems. In California, colleges and districts often plan to use technology in isolation from other technology resources in the state, and they make these plans without the benefit of any state technology implementation plan. In the ever-changing and fast-growing world of technology, this isolation is a recipe for duplication, ineffectiveness and inefficiency. While some districts or colleges "may take full advantage of each new piece of technology as it is introduced, others may not even know of its existence, let alone its potential utility."[1]

California has reached a historic turning point where the community colleges can no longer afford an uncoordinated and limited use of these technologies. The current and projected demand for enrollment in the community colleges—coupled with severe budget constraints—means that California's system of open access is in jeopardy. To be blunt, more and more students will be turned away, unless ways are found to greatly increase the efficiency and productivity of the colleges. Whatever their potential shortcomings, telecommunications and computer-based technologies must be seriously considered as

[1]Hayward, 1991, p. 7.

valid and appropriate educational tools to maintain access and help community colleges fulfill their missions in these difficult times.

Though many technological applications could be examined in the search for ways of enhancing the efficiency or effectiveness of community colleges, a natural starting place is *distance education*. This term refers to the non-traditional form of education in which the main body of instruction occurs at a distance—that is, the teacher and student are not located in the same physical space (e.g., the classroom). The most widely known form of distance education is delivered via television, either in live or pre-recorded broadcasts or with video cassettes. However, distance education also can involve communication over telephones or modems connected to an electronic network (with or without video pictures) and other telecommunication and information mediums. California's financial situation suggests that the extensive use of distance education should be investigated as a high priority: if large numbers of students could receive quality instruction at home, at work, or at community sites, then state funds for facilities construction could be reduced; furthermore, if distance education could be delivered more cheaply than traditional classroom instruction (while maintaining a high level of quality), more students could be served at less cost. In other words, distance education holds the potential for helping the community colleges to maintain their open admissions system.

This Policy Discussion Paper examines this potential by reviewing the current use of distance education in community colleges, describing the barriers to its use, outlining design options, and exploring policy considerations for state support of the widespread use of distance education.

B. THE CURRENT USE OF DISTANCE EDUCATION

A National Perspective

Distance education has been widely used around the world and in this country for most of this century. In its various forms, perhaps ten million people throughout the world were enrolled in a distance education course in 1988.[2] The particular form of distance education of concern in this paper, the use of live or pre-recorded television or video cassettes as a mainstay of a coherent instructional program, serves a large number of U.S. students in many academic and vocational disciplines. Moreover, the variety of types of institutional users of distance education have proliferated, ranging from (a) traditional post-secondary institutions that make extensive use of television to (b) consortia of institutions facilitating distance education to (c) "colleges-without-walls."

The Pennsylvania State University system is an example of the first type of distance education system. PSU offers open broadcasts over educational television stations and cable broadcasts over a learning network that links cable television outlets throughout the state (reaching over 700,000 subscribers, circa 1988). Most students registered in the Pennsylvania Learning Network courses are older and can watch television courses at easily accessible times because the courses are delivered three times a week and repeated six times a day.

An example of the consortia approach is the National Technological University (NTU), a nonprofit consortium of 35 engineering schools, formed in 1984, which broadcasts (to corporate employees in over 100 work sites) non-credit and credit engineering courses leading to Master's degrees. About one-third of the students view classes via live satellite transmission of broadcasts, with the remainder using videotapes of the broadcasts. NTU has an impressive list of corporate sponsors, including AT&T, IBM, and Hewlett-Packard. Despite considerable opposition from in-state colleges and universities,

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[2]Verduin, Jr. and Clark, 1991, p. 17.

the New York State Board of Regents found that NTU met New York's high academic standards and granted NTU permission to offer degree programs in 1991.[3]

An example of a college-without-walls is the entire community college system of Maine. The State of Maine has determined that a statewide community college offered through technology can effectively serve the needs of that state. The community college system, which is a division of the University of Maine, is a college-without-walls in its fullest sense—there are no community college campuses. All community college courses are telecourses, either pre-recorded or live. The student service infrastructure (counseling, etc.) is provided through the University. This system uses pre-recorded material from one or more of the main producers of telecourses in the U.S.:

- Boston Public Television
- Coast Telecourses (at Coastline Community College)
- Dallas Community College District Telecourses
- Educational Film Center (EFC), Annandale, VA
- INTELECOM (Pasadena, California)
- Maryland Public Television
- New York Public Television (WNET)
- Pittsburgh Public Television (WQED)
- South Carolina Educational Television

There are about 60 high quality pre-recorded telecourses available from these sources at the present time.

Some distance education approaches rely primarily on telecourses, available by video cassette. Other approaches are much more sophisticated and have become more so as the capacity of telecommunications technology has advanced. For example, the University of Maine at Augusta has developed an Interactive Television system that uses fiber-optic cabling, is distributed over Instructional Television Fixed Service (ITFS) microwave,

[3]Reilly and Gulliver, 1992, p. 13.

and is linked to viewers with telephones. The control center at the University provides 79 hours of support per week for students on the network. Thirty-nine transmitters are set up across the state, and each site linked to the network has its own antenna. There are also eleven library resource centers across the state which provide support, books and resource materials, and computers for those linked to the network. There are 50 courses per semester offered to distance learners, and enrollment has increased 55 percent since 1989. Funding for the system was provided, in part, by the Annenberg/CPB project as one of seven model sites across the country, and, in part, by funds from Title III of the Higher Education Act.

To give just one of many other possible examples at the community college level, Portland Community College has a Telecommunications Education Network called TelNet. This network broadcasts to 30 sites in the area, offers 10-11 hours of live, interactive televised courses per week, offers an average of 25 courses per term of pre-taped instruction, and serves 1,000-1,300 students per term through the public education television channel (Oregon Public Broadcasting) and local cable channels.

The list of distance education developments throughout the nation could be greatly expanded, but suffice it to say that many states and interstate organizations are rapidly moving to make distance education a major force in higher education's plans for the future. Despite the preeminence of California firms as global leaders in technology, telecommunications, and video productions, the state lags far behind national developments in bringing these resources to bear in a coherent, statewide system of distance education for either pre- or post-secondary education.[4]

Distance Education in California

The educational community in California has no statewide plan in place to integrate the use of technology into the infrastructure of schools, districts or even segments.

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[4]California Planning Commission for Educational Technology, 1992.

At the same time, examples of use at all levels can be found from rural settings to metropolitan centers. Models of everything from "virtual reality", multi-media networking, Instructional Television Fixed Service, open broadcast, cable channels dedicated to educational purposes, video disc, microwave, satellite uplinking and downlinking, audio conferencing, CD ROM, personnel computers, computer networks, videotext, wireless cable systems, statewide networking of computers, compressed video, and radio can be found somewhere in the state being utilized by a school, community college or university.

Private institutions, like those supported by tax dollars, are also utilizing technology to distribute and support instruction. The Catholic Church, for example, through its various diocese both in Northern and Southern California, has been using terrestrial (microwave and ITFS) delivered television for instruction and distribution of material for many years. The University of Southern California, Pepperdine, University of the Pacific, Stanford, Golden Gate, and many other private universities in the state are also using a variety of telecommunications technologies to support their programs. For example, over the past twenty-five years, Stanford University has distributed engineering and other regular class credit via Instructional Television Fixed Service to approximately 150 corporate locations in the Bay Area. Many other examples could be cited of initiatives by individual universities or colleges. Rather than document these separate efforts, a more statewide assessment is appropriate.

In trying to assess the magnitude of educational technology use in the state, several broad comments can be made:

- There is no formal clearinghouse so that each of the segments can identify, in a comprehensive way, what programs or technologies are being used throughout their systems. The state is so large and so complex that such a task has never been identified as a priority. The California Technology Project, which was funded through AB 1470, has come closest to such an assessment and has recently surveyed a random sample of 500 K-12 schools (259 responded) in order to get a grasp of what is probably happening in the field.[5]

- The community colleges have made few recent assessments of what technology is being utilized and what programs are offered through the use of telecommunications. Table 1 provides some relevant examples of educational technology at the community colleges.

- The University of California, with nine campuses, probably has the best understanding of its system-wide activity. However, because of the autonomy of the campuses—and the schools at those campuses— many projects occur that are not known to others within the university system. The University of California has just asked its Extension Division to study the uses of distance learning and determine how such resources can help the University.

- The California State University (CSU) uses both microwave/ITFS and satellite technology. Fourteen of the system's twenty campuses deliver instruction via ITFS systems. There is one portable uplink now at CSU Sacramento, five uplinks at Chico and one at San Diego State University. Through microwave networks, eleven campuses have direct access to uplinks. Several campuses provide off-campus students access to regular on-campus courses, using ITFS networks. CSU Stanislaus provides distance learners access to over fifty courses per term. This program serves approximately 350 FTES per year. CSU campuses in Chico, San Jose, San Bernardino, Pomona, Northridge, Fresno, and Bakersfield also offer regular students the opportunity to take on-campus courses via live, interactive television. Students are able to take courses in a variety of disciplines, including Education courses for in-service K-12 teachers. While the majority of the students are participating in state-supported courses, many CSU campuses offer ITFS courses on a self-supporting basis. The majority of self-supporting courses are delivered to business and industrial sites and are paid for by employers, generally on a tuition-reimbursement basis. Cal Poly Pomona has for several years offered college level courses for Advanced Placement students in regional high schools, utilizing both ITFS and satellite technologies.

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[5] The existing technology clearinghouses include the Software Clearinghouse at California State University, Long Beach and the Video Clearinghouse at the Stanislaus County Office of Education. Former Teacher Education and Computer Centers (TECC) provide 17 regional locations for local access to video and software programs loaned by the clearinghouses. The California Technology Project (CTP) and the 14 regional consortia also disseminate information and broker available resources to schools. In addition, California funds seven regional Instructional Television (ITV) agencies that provide catalogues and staff development for educators. Their primary role is to assist educators in utilizing instructional television and video programs in ways that will support and expand curriculum frameworks in the classroom.

Table 1

Examples of Distance Education Technology Used in California Community Colleges

TECHNOLOGY	EXAMPLES
ITFS (Instructional Television Fixed Service)	Butte, Peralta, Los Rios, Saddleback, San Joaquin Delta, Pasadena, Rancho Santiago, INTELECOM
Broadcast Television	San Mateo, San Bernardino, Coast, (PBS stations); Sierra (Low Power); about eighty colleges participate in two consortia utilizing broadcast and cable
CATV (Community Access Cable Television)	San Francisco, Chabot, College of the Desert, Mt. San Antonio, and many others
Compressed Video (uses telephone transport technology)	Coastline
Point-to-Point Microwave	Sierra, San Mateo, Sacramento City, Coastline, INTELECOM
Satellite	
Uplink	San Mateo, DeAnza, Sacramento City
Downlink	Virtually every campus (107) has at least one receiver
Radio	San Mateo, Modesto, Coastline, Pasadena
Audio Bridge (Audio Conferencing)	DeAnza, Foothill, Coastline, Grossmont, and many others

All CSU campuses have satellite reception capabilities. Eleven campuses have direct access to satellite uplink facilities. The system owns a mobile satellite, located at CSU, Sacramento. CSU owns five uplinks, one of which is mobile. Utilizing its uplink capability, Chico delivers self-supporting programs (M.S. and B.S. in Computer Science) on a live, real-time basis to approximately 300 students in locations throughout the nation. This program will be expanded next year.

Some CSU campuses (Chico, Sacramento, Bakersfield, Dominguez Hills, Hayward) are starting to use live two-way interactive technology to and from distance learning centers.

In addition to the capabilities of individual campuses, the CSU system operates CSUNET, linking all twenty campuses and off-campus centers. All campuses operate public access ports, making it possible for students to utilize library and information databases throughout the system from their homes or work places. CSUNET also provides students access to other national and international data networks. Through the use of e-mail, bulletin boards and computer conferencing software, CSU has started to use computers in distance education, but this use is not yet extensive.

Currently, CSU has a major system-wide initiative in progress—Project DELTA (Direct Electronic Learning and Teaching Alternatives). Project DELTA is considering the feasibility of expanding access to CSU's educational programs, particularly through the use of computing, telecommunications and information technologies.

Focusing specifically on the use of distance education in California's community colleges, two districts provide successful models of the "college-without-walls" concept. They are Peralta in the Bay Area and the Coast District in Orange County. Both districts use extensive technology-based deployment of instructional offerings. In particular, Vista College in the Peralta District and Coastline College in the Coast District are colleges without campuses, and both are fully accredited and enjoy full college status within their respective districts and communities. The Peralta Community College District provides full 24-hour programming to all cable companies in the East Bay, over a two-channel ITFS network. They transmit a maximum of five pre-recorded courses per semester; student services are provided at the district campuses. Though Coastline does not have a standard campus, most of its students are served in traditional classroom settings. About 18 percent of its students are enrolled in telecourses, and 24-25 telecourses are offered per semester. Coastline sends entirely pre-recorded, transferable telecourses through cable and through its own PBS station (KOCE). For example, tapes are delivered to KOCE, which broadcasts the signal, and tapes are also carried by cable companies. Coastline produces many of its own courses; the balance come mostly from INTELECOM (the Southern California Consortium—discussed below). Student services are provided at decentralized locations throughout the Coast District.

Colleges in both Southern and Northern California have banded together to form consortia that support distance education. In particular, INTELECOM, the Southern California Consortium of some 40 colleges, has two functions: to produce courseware and materials, and to provide courses (bought, leased, or produced) to members. INTELECOM charges each participating community college district a base fee predicated on the size of the district (i.e., its capacity to use INTELECOM resources), ranging from $3,000 to $20,000, and a use fee that is tied to the number of students enrolled. INTELECOM offers about 40-45 courses per year, utilizing its broadcast, cable, and ITFS distribution systems, with about three courses added per year. The Northern California Telecourse Consortium (NCTC), comprised of about 30 colleges, has one mission—to identify and provide courseware and materials for member colleges. It obtains these materials from the sources cited earlier; the consortium owns nine courses outright. NCTC currently offers 79 courses; it provides colleges with a core list of 12 courses, plus a longer list of options. Any college may elect to use any course that is available, and NCTC then negotiates the course licensing fees, which are sensitive to economies of scale—if more colleges sign up for a given course, the fee drops.[6]

The two consortia together enroll about 60,000 students, or 12,000 FTES per year—about one percent of the total credit FTES in the community colleges per year.

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[6]NCTC charges the participating colleges one dollar per ADA, plus a charge on a sliding scale depending on college size. It does not charge the colleges a minimum consortium entrance fee. The nine courses NCTC owns are provided free; other courses carry a "per head" fee in addition to the basic consortium fees.

Other colleges enroll additional students in one form or other of distance education, but the total distance education enrollment in the state is surely well under five percent of FTES.

In summary, despite outstanding practitioners and cutting-edge examples, the California community colleges' use of educational technology for distance learning has not evolved into a coherent statewide effort. Moreover, as states and consortia move rapidly and call for a national consensus on interstate policies for distance education, California seems to be lagging far behind.[7]

[7]Reilly and Gulliver, 1992, p. 14.

C. PROS AND CONS OF DISTANCE EDUCATION

Critics of distance education raise concerns about the quality and richness of student learning if their instruction is not based on face-to-face interaction between faculty and students in a campus setting. This argument has two parts. First, it is felt that the immediacy of the classroom setting allows the instructor to respond to different student needs in ways that tap into the idiosyncratic learning styles of each and every student—an individualization that cannot be realized in any but the most expensive live, two-way interactive visual/audio distance learning situations. The uniformity of delivery of distance education is thus seen as a detriment to solid education. In other words, it is believed that distance education students cannot learn (particularly the more sophisticated skills) as well as comparable students in traditional classrooms. Second, it is held that students need the interaction and support of other students in the collegial setting of a campus to maintain their commitment to education and to enhance their emotional and intellectual experience. Moreover, the support services provided by the comprehensive community college again have the human, personal touch that allows these services to be effective.

As to the first point—that students learn better in the traditional classroom mode—empirical evidence does not support this contention. Reviews of studies of distance education versus traditional education do not show that the latter produces better student learning outcomes than the former. Indeed, a variety of studies demonstrate just the opposite result. The University of Maine at Augusta, for example, recently completed one of the first comprehensive evaluations of a state-wide Interactive Television instruction program. The evaluation found that in 1990, there were 3,742 students enrolled in 40 televised courses at 73 different sites across the state of Maine. Approximately 74 percent of these students were female, and 30 percent were 30 years of age or older. The study found that "academic achievement was well above average and no differences were found between the grades of students in the live sections and those in the receive/televised sections of the courses."[8]

One reason that traditional classroom approaches are not necessarily more effective than distance learning is that traditional classrooms are generally comprised of students with a wide range of abilities. Under these circumstances, teachers often find it difficult to address individual student differences to the extent that would be most desirable, e.g., using different instructional techniques to match the learning needs of different students. This ideal is particularly hard to realize when one considers that community college faculty teach approximately five courses a semester, and that class size in California is among the highest in the nation. It is hard for even the best teacher, under these circumstances, to individually impact each student with the magic that outstanding teachers possess. Distance education, in contrast, has the potential advantage that its delivery can be of uniformly high quality, often employing extraordinary resources to provide powerfully crafted programs—one has only to think of the televised programs on the Civil War to grasp the quality of presentation available in distance education using pre-recorded televised programs. Even live, distance learning presentations often have the advantage of a master teacher with access to video resources and quality productions that no teacher in a class of thirty could command. The existing quality of pre-recorded courses now are of a sufficiently high level that the appropriate faculty committees at CSU, UC, and the Community Colleges have accepted a wide range of such courses as being acceptable for transfer credit—indeed, there is no designation in a student's transcript to indicate whether a student has taken a particular course in a traditional classroom or by distance learning.

[8]Johnson, 1990, p. 11. For a review of studies of distance education via television compared to standard classroom instruction, see Verduin, Jr. and Clark, 1991. Please note that though most studies show that students taught by telecourses fare academically as well as classroom students, several studies show lower completion rates.

Nonetheless, the designers of distance education do not deny the importance of human interaction. Distance education programs generally provide students with opportunities to receive feedback on their work and to ask questions of their instructors. In advanced applications, the interactions between student and instructor can be in real time with an instructor available by telephone, motion images, or modem. Most less expensive approaches have built into their programs a mixture of real time or delayed communication in a variety of audio, visual, and written forms. Most distance education programs also include limited face-to-face sessions with instructors and meetings among students.

Similarly, although some distance learning programs do not require students to go to a campus, most programs have a campus where students can receive services. Indeed, a college like Coastline offers only a fraction of its courses by distance; most students take a combination of distance courses and traditional classroom courses at centers established by the college. In this way, students are able to retain the value of a campus community but also have distance courses that meet their work, home and life situations as well as their learning styles.

Advocates for distance education also point to a number of real advantages of students learning at a distance. First, it provides ease of access to community college education for a variety of non-traditional students who, taken together, constitute the majority of today's and tomorrow's students. These students include the handicapped, women with young children, poor people who cannot afford transportation costs to the colleges, people in distant or remote rural areas, the many students who have full-time jobs, and those who frankly learn better in the privacy and support of their community, work-site or their home environment. In other words, assuming that distance education can be delivered with high standards of excellence, it can contribute to an equitable provision of education for adults who now truly have limited access to traditional forms of education. Second, the use of video cassette recorders, pre-recorded cassettes, or electronic bulletin boards[9] make it possible for students to "take" their classes at times that are convenient for them; mothers of young children and workers who must hold down two jobs are examples of students who might only have access to education via distance education.

This condensed review of the strengths and weaknesses of distance education suggests that the technology is on hand to offer a real alternative to the traditional classroom approach.[10] Distance education should not be seen as a replacement for standard classroom instruction. Each has its own utility and value. In a time of enormous enrollment pressures and limited resources, the experience with distance education indicates that it should become a major part of the state's educational strategy.

[9]These examples of communications and computer-based technologies exist today, and the predictable advances in these fields hold the certainty of cheaper, more convenient, more powerful, and more user-friendly technologies.

[10]See Selected Bibliography for references that review the uses and assess the utility of distance education.

D. BASE MODEL FOR STATEWIDE DISTANCE EDUCATION

At present in California, only a small percentage of all courses or of student enrollment across the state occurs via distance. What if distance education courses could be offered on a statewide basis, reaching many more thousands of students? Wouldn't the courses cost less per student because a mass audience could be reached, while instruction could be delivered at a uniformly high level of quality across the state? Would a statewide program of distance education increase the productivity and reduce the costs (while maintaining quality) of the California Community Colleges?

To address these questions, we need to imagine a model of how distance education might be offered on a *statewide basis, building on current statewide capacities and existing technologies*. As an earlier section indicated, the California Community Colleges do not currently have a statewide system or approach to offering distance education. Thus, we will start with a base statewide distance education model and then incorporate desirable additions, always paying attention to the possible costs and savings of these approaches. The purpose of such models is to develop scenarios and costs that advance the discussion of the extensive use of distance education; it would be premature to propose detailed design plans before a thorough policy discussion of various options had occurred. We start with a base model derived from the following series of assumptions:

1. **Television Courses.** The statewide distance education system would be based on pre-recorded telecourses.

2. **Students Receive Courses at Home.** Students would be able to receive telecourses on a television set at home, either over open broadcast channels such as PBS, or over public access cable channels.

3. **Distance Education Meets High Quality Educational Standards.** In addition to the television broadcast, the distance education course would have materials, exams, and an opportunity for interaction with an instructor and other students. The courses would be approved by the faculty.

4. **Statewide Distance Education Program Covers Academic Core.** Each distance education course would be a full credit course that is part of a state coordinated program of telecourses which cover the range of the general education curriculum and can be used for transfer to CSU and UC.

5. **Courses Operate on a Year-Round Basis.** The statewide program would operate on a year-round schedule based on a trimester plan.

Thus, the base model is one in which students enroll in telecourses that are received at home (or other convenient locations) and in which the video is pre-recorded with high quality production standards. Students would have an instructor for the course who would not necessarily be in the video programs, but would be accessible and qualified to direct the student's education. Much more than these assumptions needs to be specified in order to design an operating statewide distance education system. The next section discusses design issues, but the first order of business is to explore the cost implications of this base model.

Using these assumptions, we simulated the cost per Full-Time Equivalent Student (FTES) for delivering distance education on a statewide basis (see Appendix A for our detailed costing parameters and formulas). Before discussing this model in more depth, a look at the cost numbers displayed by Figures 1-4 suggests that distance education could save considerable money and/or provide more students with access to the community colleges for the same level of state expenditures.

These figures show the cost per FTES for a range of average student enrollments in the presumed statewide distance education program. For example, the graphs show what the cost in constant 1992 dollars would be per FTES if there were an average enrollment across the state of 50 students up to 10,000 students per course. All the curves indicate economies of scale, so that the more students are enrolled, the less the cost is per FTES; however, generally speaking, the cost per FTES levels off at about 1,500 students.

Figure 1

Cost for Base Model: Full-time Instructors

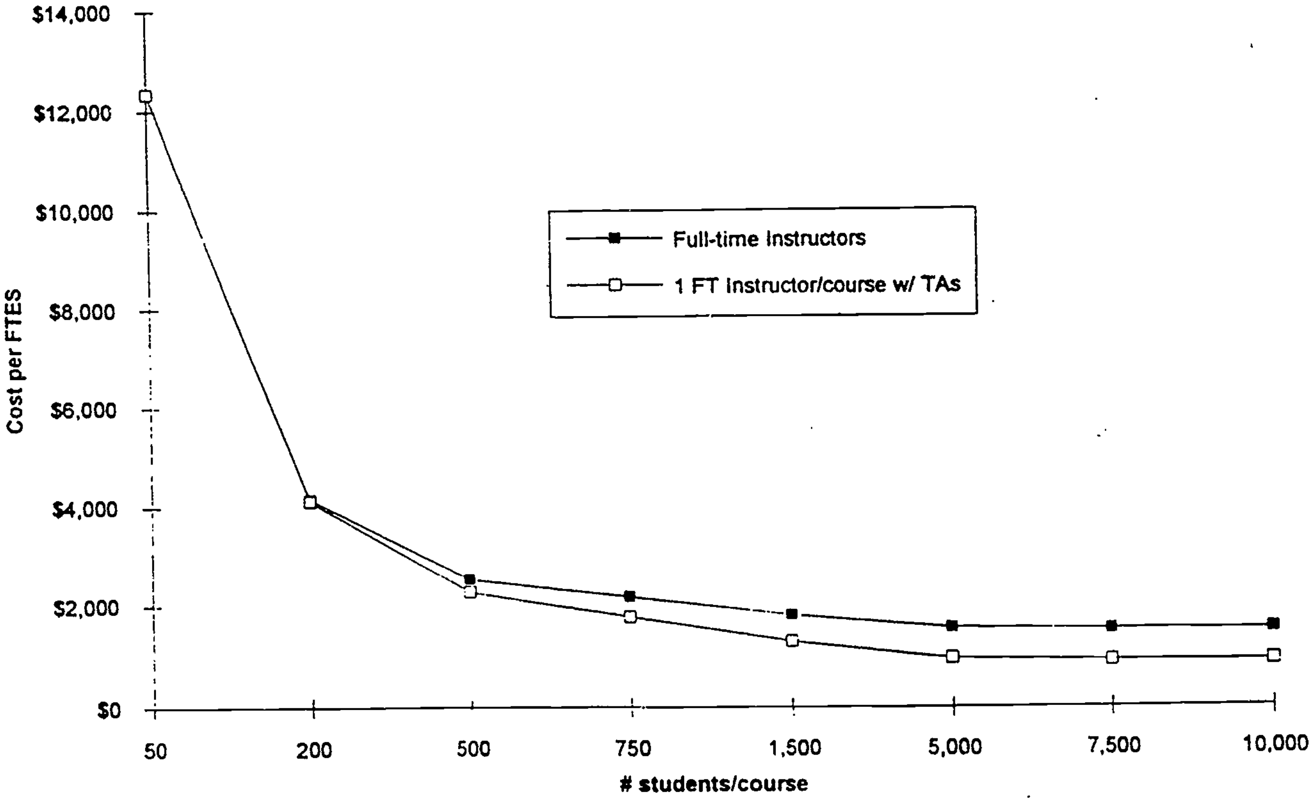


Figure 2

Cost for Base Model: Part-time Instructors

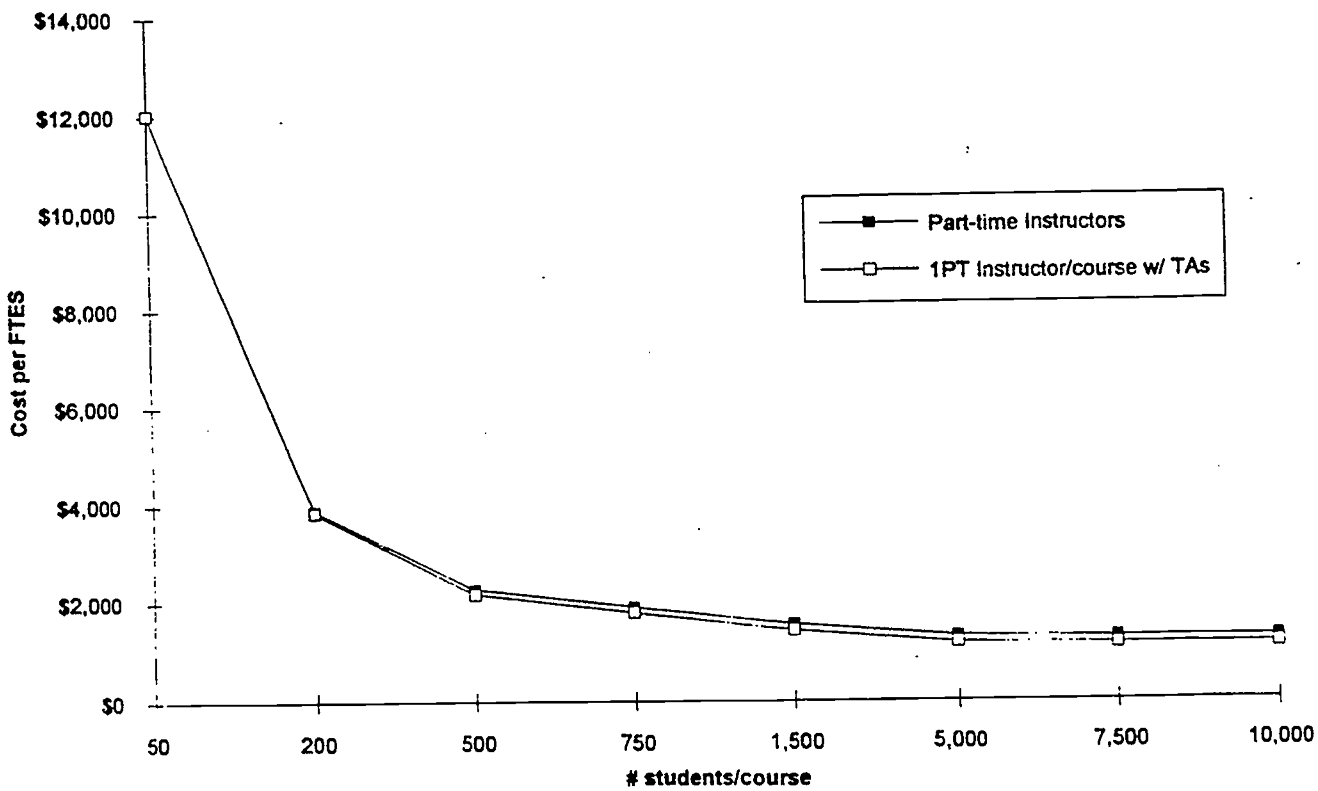


Figure 3

Cost for Base Model with Extra Meetings: Full-time Instructors

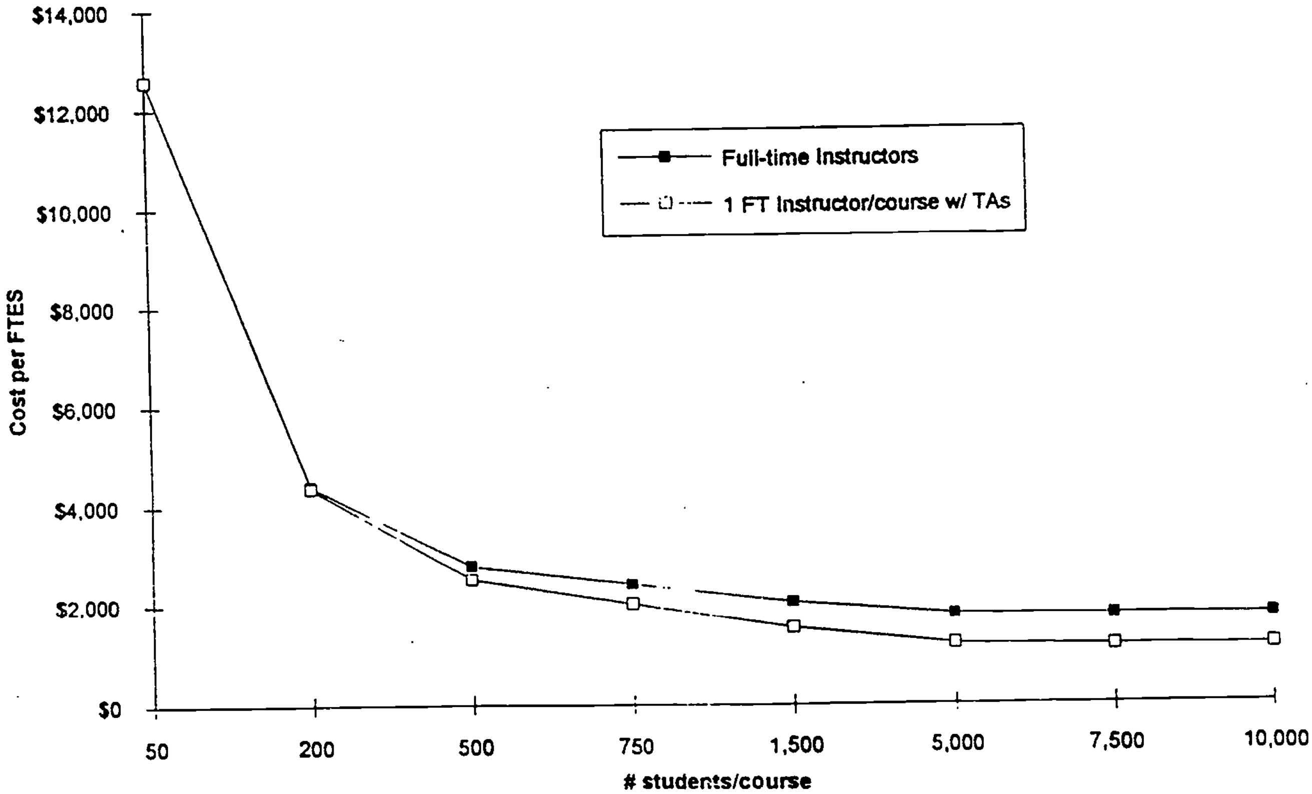
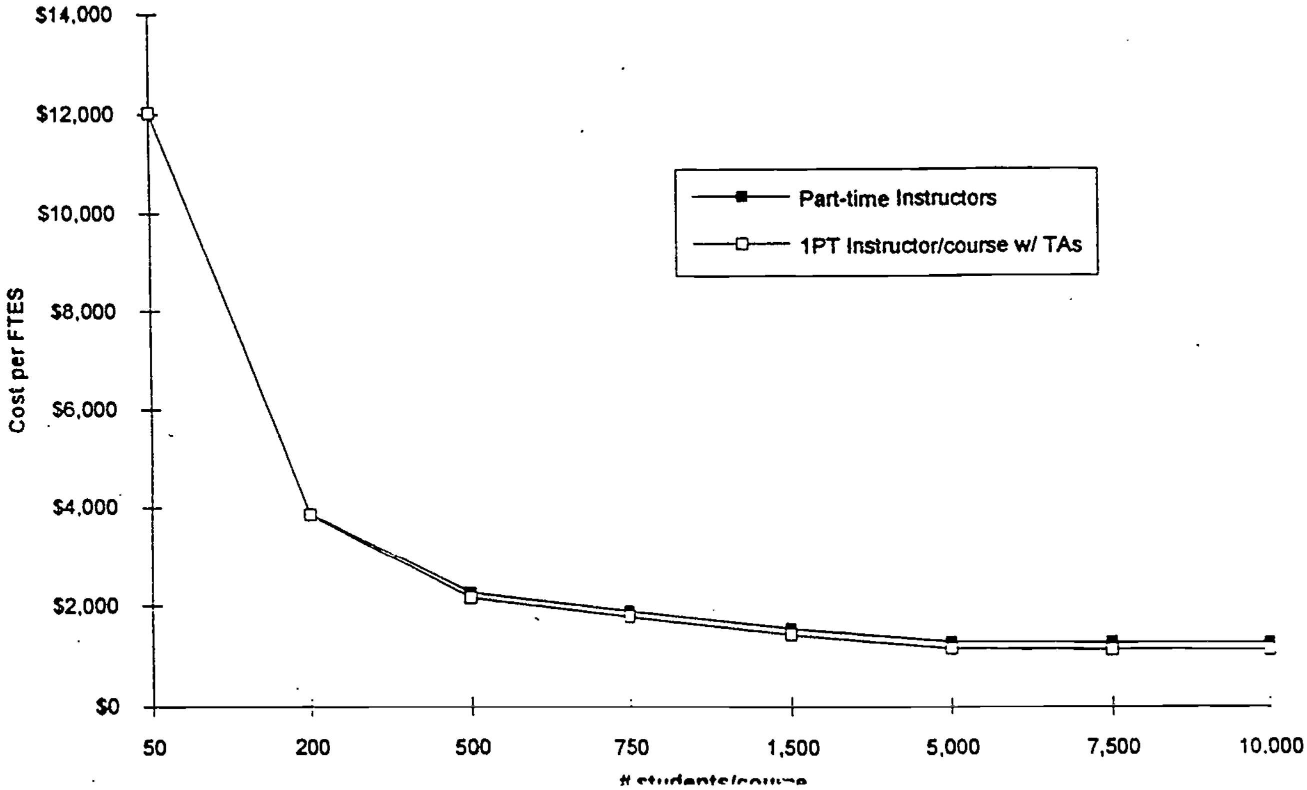


Figure 4

Cost for Base Model with Extra Meetings: Part-time Instructors



Any distance education approach must address the issue of how students can interact with and receive feedback from faculty. The numbers shown in the figures are based on the following common assumptions. For each student, an instructor would have an average of:

- one hour for answering questions from students (over the phone or at an office);
- one hour for grading examinations and giving feedback.[11]

The difference between Figures 1 and 2 is that the former assumes that full-time faculty are the instructors with or without teaching assistants, whereas the latter assumes that part-time faculty are used. Naturally, all faculty of record for a course are assumed to be qualified instructors in the subject of the telecourse. Though the base model allows for the amount of student-faculty interaction typical of many telecourses, we wanted to see how much more expensive it would be to have additional personal contact between faculty and students and among students themselves. Thus, Figures 3 and 4 assume that students have an opportunity to meet as a group and that students have an opportunity to meet with instructors. In particular, in addition to the time allocated above for student feedback and interaction with instructors, Figures 3 and 4 assume that:

- fifty students as a group would meet with instructors three times during the trimester;
- each group meeting would last three hours.[12]

[11]We assume that students would have three examinations or other written assignments during the course and that an instructor would devote an average of 15 minutes for two examinations and 30 minutes for the final examination. We also assume that a distance education instructor would have 15 hours for preparing for a course.

[12]We also assume that each instructor would have six hours of preparation for each meeting.

Such "class" meetings are used in a variety of distance education systems in this country and abroad. Their purpose is to enable students to gain the experience of sharing their ideas and questions with a qualified instructor and other students as the telecourse proceeds.

The simulations above are for the base model in the sense that minimal instructor time (one hour per student for all three exams in a course) is provided for the grading of students. Alternatively, we can calculate the costs allowing three hours per student for grading and feedback, which is a liberal time allowance for most purposes. Figures 5-8 introduce these new, more costly assumptions.[13]

These simulations (with and without extra group meetings) all show that (a) the cost of distance education depends on the extent of faculty involvement, but that (b) the cost per FTES is at or below the current expenditure of $3,000 per credit FTES. At a course enrollment of 1,500 students, the least expensive option (using part-time instructors with the help of teaching assistants and no group meetings) is about $1,000, whereas the most expensive option (using only full-time instructors with three group meetings, extra time for grading, and full license fees) is about $3,000 per FTES.

Thus, the potential savings from expanding the use of telecourses depends on policy choices. Using part-time instructors for telecourses is cheaper than using only full-time faculty. What difference would these personnel choices make to the quality of a student's education? Data do not exist to address this issue. Nonetheless, policy-makers must make a choice.

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[13]The license fee in the above simulations assumes $15,000 per course, statewide. This rough estimate assumes some economies of scale for the license fee per district. Since the total number of students taking telecourses might increase dramatically, a $15,000-per-course license fee might be considerably higher than one could negotiate in practice. Furthermore, we have also made calculations assuming one statewide institutional charge of $500 per course; if all students were to enroll in one statewide college-without-walls, this fee would be accurate, and telecourses could realize considerable savings (see Tables 6 and 7). The next section of this paper considers a variety of statewide approaches to the delivery of broadcasts in addition to a single statewide college approach.

Figure 5

Cost for Additional Grading Time: Full-time Instructors

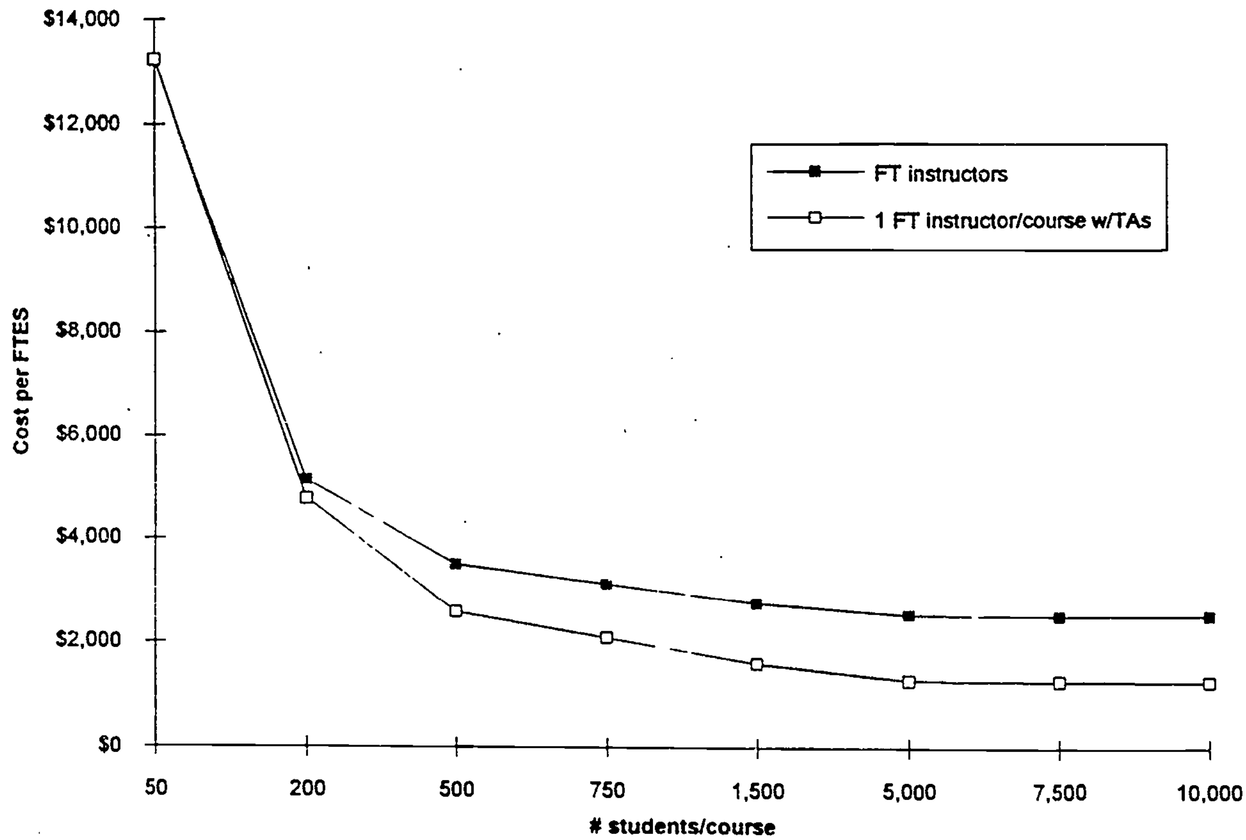


Figure 6

Cost for Additional Grading Time: Part-time Instructors

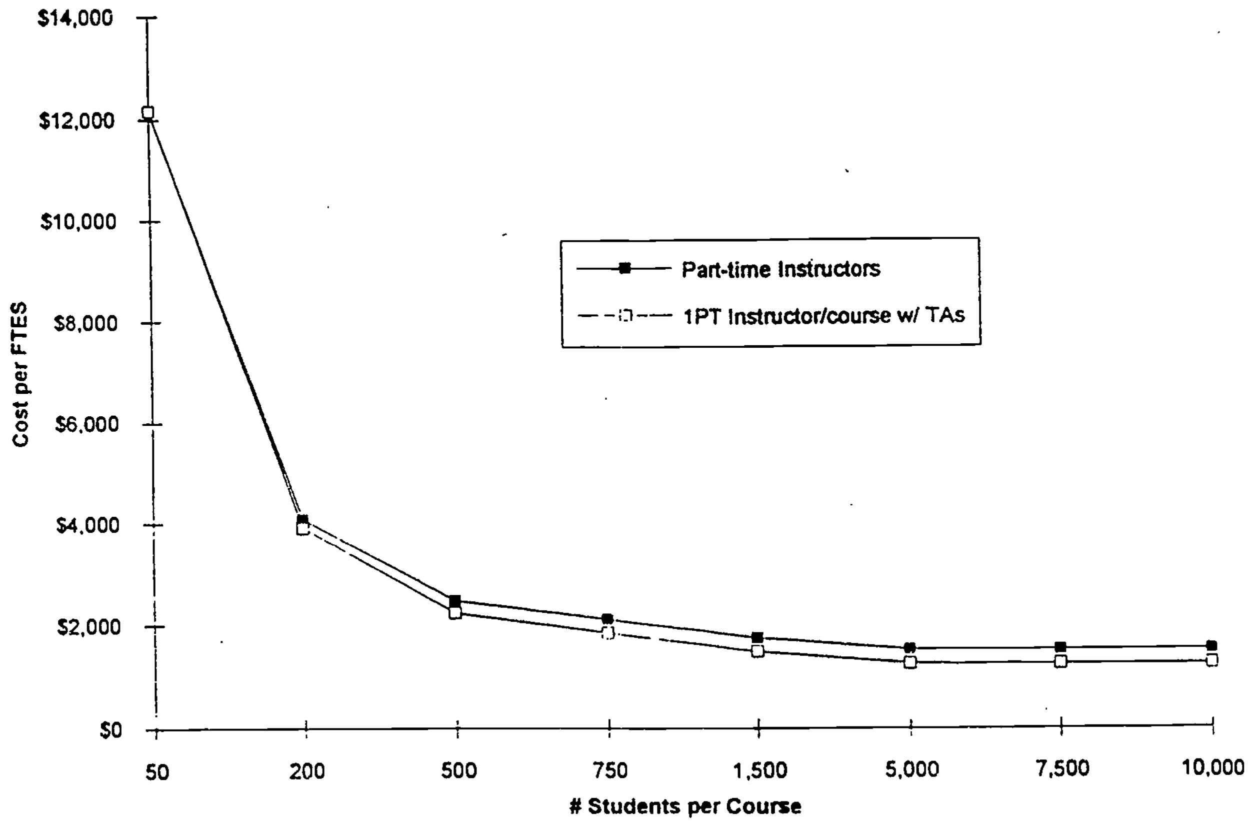


Figure 7

Cost for Additional Grading Time with Extra Meetings: Full-time Instructors

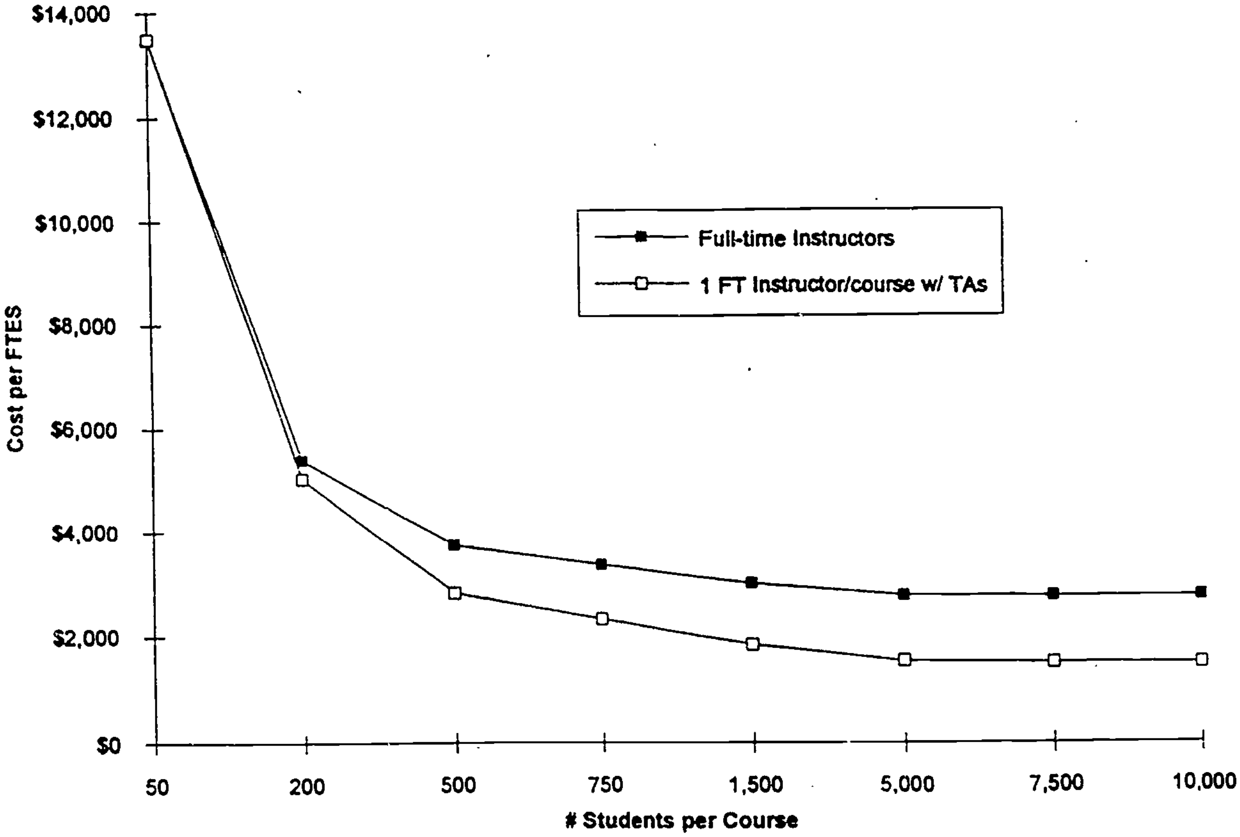
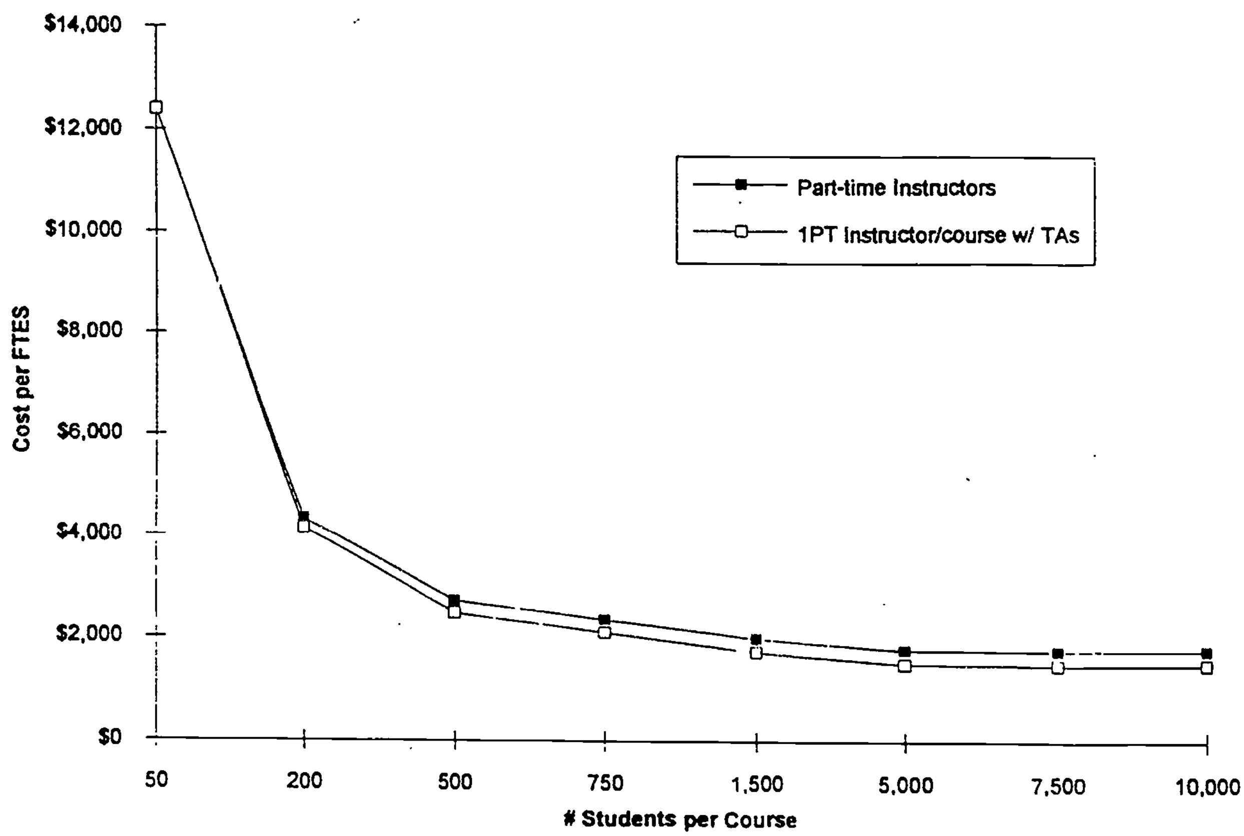


Figure 8

Cost for Additional Grading with Extra Meetings: Part-time Instructors



Similarly, how much time should instructors for a distance education course spend in person with students? The more instructor time, the more expensive the course will be—and perhaps the fewer the number of students the system will be able to serve. Would there be an increase in the quality of learning with more instructor time, and is the marginal increase worth the extra costs?

To further illuminate these questions, we can estimate how these different approaches might affect access. Assuming 10 three-unit core courses per trimester, an average of 1,500 students per telecourse in the general education core would equate to about 4,500 FTES per year in the distance education statewide program. The most expensive option discussed above (using only full-time instructors plus three group meetings) may save little compared to a traditional classroom cost of about $3,000 per FTES. Suppose rather than using full-time faculty, part-time faculty were the instructors. Then the cost would be about $1,990 per FTES—or a "savings" of $1,010 per FTES relative to the standard classroom costs—and the net reduction in the cost of distance education compared to the traditional delivery system could be on the order of $4.5 million per year. Furthermore, suppose that part-time instructors were used and they were given less time for involvement with students (i.e., no group meetings); then the cost would be about $1,300 per FTES which could mean a "savings" of $1,700 per FTES or about $7.65 million per year. (Figure 9 and Table 2 show the costs and savings for these three scenarios).

However, the assumption that the average enrollment in each statewide distance education course would be 1,500 students is very conservative, for it only represents about one percent of the students involved in general education core courses taught over a year throughout the state. Suppose much higher enrollments could be generated on a statewide basis.[14] For example, suppose one out of five (20 percent) core academic

[14] A later section considers state policies that might be used to try to raise enrollments from the very low current percentage to the much higher numbers assumed in these calculations.

Figure 9

Critical Trade-offs

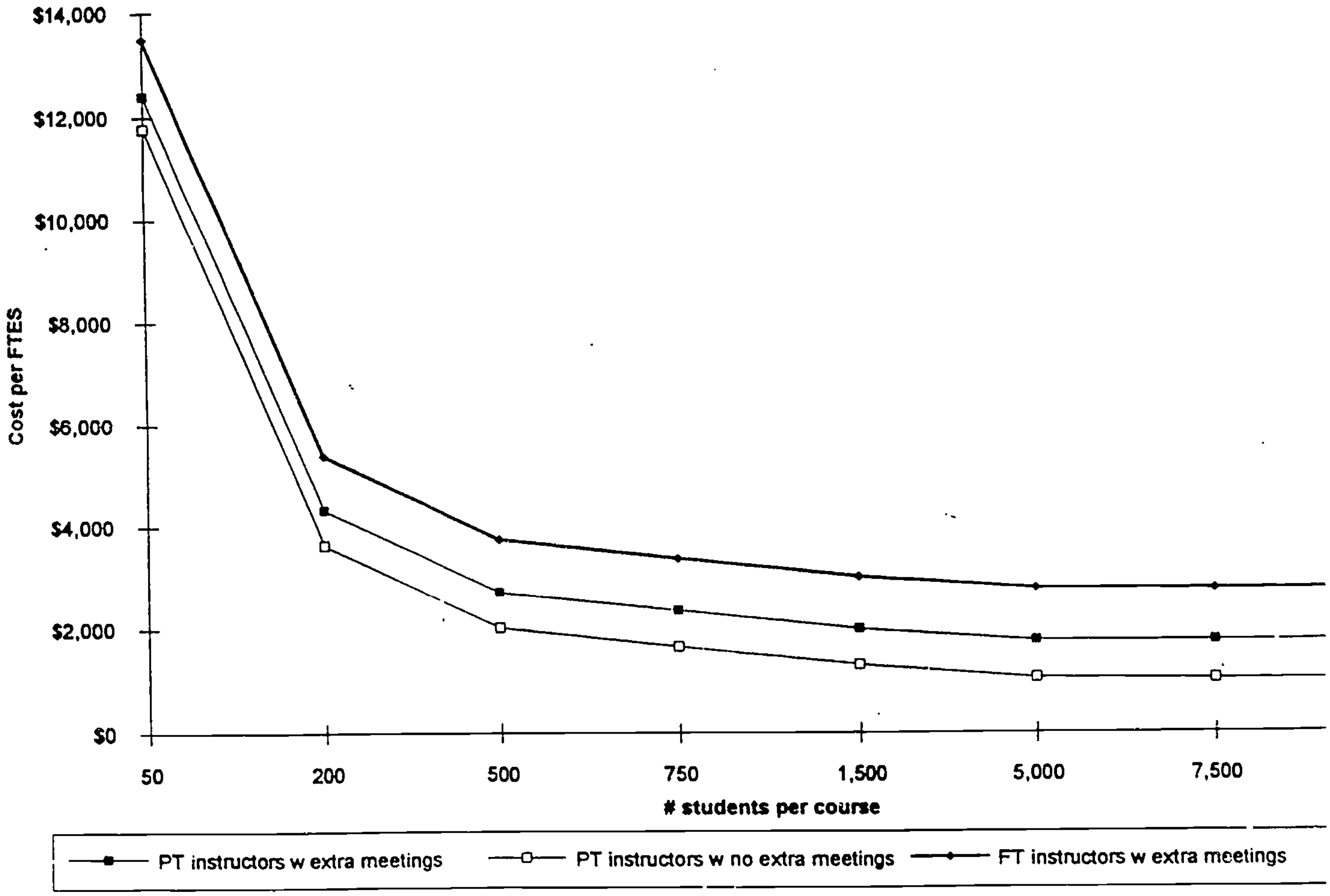


Table 2

Potential Savings Using Telecourses

	Delivering Savings per Year		Facilities Savings	
	4,500 FTES	60,000 FTES	4,500 FTES	60,000 FTES
Full-time Faculty with Medium Student Interaction	0	0	$45m	$600m
Part-time Faculty with Medium Student Interaction	$4.5m	$60m	$45m	$600m
Part-time Faculty with Low Student Interaction	$7.65m	$102m	$45m	$600m

courses were taught via distance education, then about 60,000 FTES[15] per year could be served by distance education; the cost reduction predicted by this model could range from a negligible amount for the most expensive option to about $102 million per year for the least expensive option shown in the comparison curves of Figure 9 and in Table 2.[16] If these cost reductions were applied to enrolling more students to meet the projected high enrollment demand, then with the savings from the least expensive option, about 34,000 more FTES per year could be served under the traditional model[17] or up to 78,500 additional FTES per year could be served in a distance education mode,[18] as Table 3 indicates. Since the projected enrollment growth over the next 13 years is about 400,000 FTES,[19] a maximum of about 20 percent of the new enrollment growth could be absorbed by distance education with this telecourse option.[20]

In addition to these savings, the more students enrolled in telecourses the less the need for facilities construction, *regardless of which of the above assumptions one makes regarding the use of full-time or part-time faculty or how much time instructors interact with students*. What potential savings in facilities construction might accrue if this statewide distance education program were used?

It is hard to estimate these savings because they depend so much on the facilities capacities and enrollment projections at individual colleges. Nonetheless, we can give a

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[15]The total credit FTES per year in the community colleges is about 800,000. If 300,000 are assumed to be core academic FTES, 20 percent of that is 60,000 FTES.

[16]60,000 FTES x $1,700 = $102 million.

[17]$102 million / $3,000 per FTES = 34,000 FTES.

[18]102 million / $1,300 per FTES = 78,500 FTES.

[19]For 1991, 833,000 credit FTES served 1.219 million credit students. This translates to .68 FTES per student. DOF projects an additional 600,000 credit students through 2005. This would translate to approximately 600,000 x .68 = 400,000 FTES.

[20]78,500 / 400,000 = 19.8 percent.

Table 3

Potential Capacity Increase Using Telecourses

	Additional FTES Who Could Be Served If Telecourses Were Expanded			
	In Traditional Classroom		In Telecourses	
	Low enrollment 4,500 FTES	High enrollment 60,000 FTES	Low enrollment 4,500 FTES	High enrollment 60,000 FTES
Full-time Faculty with Medium Student Interaction	0	0	0	0
Part-time Faculty with Medium Student Interaction	1,500 FTES	20,000 FTES	2,250 FTES	30,000 FTES
Part-time Faculty with Low Student Interaction	2,550 FTES	34,000 FTES	5,800 FTES	78,500 FTES

very rough estimate to indicate the order of magnitude of the maximum savings. The Chancellor's Office projects a need for approximately $4 billion in new facilities between 1992 and 2005 in order to accommodate 600,000 new students. If 60,000 FTES per year were served by distance education and if this reduced the need for facilities construction by the same number, then the maximum savings might approach $600 million in 1992 dollars.[21] The order of magnitude of savings with distance education using this model is thus about 15 percent of the estimated cost of the facilities needed to meet enrollment projections. Actual savings would be lower, since part of the projected capital expenditure of $4 billion is for renovation, remodeling, and other needs that will have to be met in any case.

Some Variations on the Base Model. One concern with the base model presented above is that it relies on the use of the public access channels for cable systems. Though about 85 percent of the state has cable, poor people even in areas that have cable may not be able to afford a subscription. To deal with this issue of equity, we simulated the additional costs of providing ten percent of all students per course with a subscription to a cable system. Tables 4-7 shows the simulated costs of this addition to the base models described above. The net additional cost per FTES is somewhat above $100, which still results in total costs well below the current rate of state support per FTES.

The model of distance education we have explored thus far relies on television courses that include varying degrees of interaction with faculty and students. Current technology also provides other possibilities. This paper does not review options that are expensive with today's technology or are still experimental, such as two-way interactive, live video transmission. Among existing technologies, some approaches might be priced comparably to telecourses. For example, distance education can be delivered by an electronic network system in which students have access to a computer, a modem and the

[21] 60,000 / 400,000 = .15 x $4 billion = $600 million.

Table 4

Results of Simulations for Different Assumptions
With One Hour Grading per Student and $15,000 License Cost per Course

Summary of Cost per FTES

Model Type/# of Students	50	200	500	750	1,500	5,000	7,500	10,000
Full-time Instructors	$12,346	$4,156	$2,536	$2,171	$1,801	$1,545	$1,519	$1,514
1 FT Instructor/course w/ TAs	$12,346	$4,111	$2,272	$1,771	$1,286	$943	$901	$890
Part-time Instructors	$11,778	$3,636	$2,024	$1,652	$1,297	$1,044	$1,016	$1,012
1PT Instructor/course w/ TAs	$11,778	$3,602	$1,923	$1,539	$1,170	$908	$879	$874

Summary of Cost per FTES (10% of all Students per course get cable allowance)

Model Type/# of Students	50	200	500	750	1,500	5,000	7,500	10,000
Full-time Instructors	$12,456	$4,266	$2,646	$2,281	$1,911	$1,655	$1,629	$1,624
1 FT Instructor/course w/ TAs	$12,456	$4,221	$2,382	$1,881	$1,396	$1,053	$1,011	$1,000
Part-time Instructors	$11,888	$3,746	$2,134	$1,762	$1,407	$1,154	$1,126	$1,122
1PT Instructor/course w/ TAs	$11,888	$3,712	$2,033	$1,649	$1,280	$1,018	$989	$984

Summary of Cost per FTES (with three meetings involving 30 instructor hrs per 50 students)

Model Type/# of Students	50	200	500	750	1,500	5,000	7,500	10,000
Full-time Instructors	$12,586	$4,396	$2,776	$2,411	$2,041	$1,785	$1,759	$1,754
1 FT Instructor/course w/ TAs	$12,586	$4,351	$2,512	$2,011	$1,526	$1,183	$1,141	$1,130
Part-time Instructors	$12,018	$3,876	$2,264	$1,892	$1,537	$1,284	$1,256	$1,252
1PT Instructor/course w/ TAs	$12,018	$3,842	$2,163	$1,779	$1,410	$1,148	$1,119	$1,114

Summary of Cost per FTES (with cable allowance and three meetings involving 30 instructor hrs per 50 students)

Model Type/# of students	50	200	500	750	1,500	5,000	7,500	10,000
Full-time Instructors	$12,696	$4,506	$2,886	$2,521	$2,151	$1,895	$1,869	$1,864
1 FT Instructor/course w/ TAs	$12,696	$4,461	$2,622	$2,121	$1,636	$1,293	$1,251	$1,240
Part-time Instructors	$12,128	$3,986	$2,374	$2,002	$1,647	$1,394	$1,366	$1,362
1PT Instructor/course w/ TAs	$12,128	$3,952	$2,273	$1,889	$1,520	$1,258	$1,229	$1,224

Table 5

Results of Simulations for Different Assumptions
With Three Hour Grading per Student and $15,000 License Cost per Course

Summary of Cost per FTES

Model Type/# of Students	50	200	500	750	1,500	5,000	7,500	10,000
Full-time Instructors	$13,246	$5,146	$3,501	$3,121	$2,758	$2,528	$2,514	$2,511
1 FT Instructor/course w/ TAs	$13,246	$4,774	$2,584	$2,092	$1,600	$1,282	$1,259	$1,249
Part-time Instructors	$12,162	$4,081	$2,475	$2,113	$1,750	$1,524	$1,514	$1,510
1PT Instructor/course w/ TAs	$12,162	$3,907	$2,237	$1,859	$1,484	$1,248	$1,237	$1,232

Summary of Cost per FTES (10% of all Students per course get cable allowance)

Model Type/# of Students	50	200	500	750	1,500	5,000	7,500	10,000
Full-time Instructors	$13,356	$5,256	$3,611	$3,231	$2,868	$2,638	$2,624	$2,621
1 FT Instructor/course w/ TAs	$13,356	$4,884	$2,694	$2,202	$1,710	$1,392	$1,369	$1,359
Part-time Instructors	$12,272	$4,191	$2,585	$2,223	$1,860	$1,634	$1,624	$1,620
1PT Instructor/course w/ TAs	$12,272	$4,017	$2,347	$1,969	$1,594	$1,358	$1,347	$1,342

Summary of Cost per FTES (with three meetings involving 30 instructor hrs per 50 students)

Model Type/# of Students	50	200	500	750	1,500	5,000	7,500	10,000
Full-time Instructors	$13,486	$5,386	$3,741	$3,361	$2,998	$2,768	$2,754	$2,751
1 FT Instructor/course w/ TAs	$13,486	$5,014	$2,824	$2,332	$1,840	$1,522	$1,499	$1,489
Part-time Instructors	$12,402	$4,321	$2,715	$2,353	$1,990	$1,764	$1,754	$1,750
1PT Instructor/course w/ TAs	$12,402	$4,147	$2,477	$2,099	$1,724	$1,488	$1,477	$1,472

Summary of Cost per FTES (with cable allowance and three meetings involving 30 instructor hrs per 50 students)

Model Type/# of students	50	200	500	750	1,500	5,000	7,500	10,000
Full-time Instructors	$13,596	$5,496	$3,851	$3,471	$3,108	$2,878	$2,864	$2,861
1 FT Instructor/course w/ TAs	$13,596	$5,124	$2,934	$2,442	$1,950	$1,632	$1,609	$1,599
Part-time Instructors	$12,512	$4,431	$2,825	$2,463	$2,100	$1,874	$1,864	$1,860
1PT Instructor/course w/ TAs	$12,512	$4,257	$2,587	$2,209	$1,834	$1,598	$1,587	$1,582

Table 6

Results of Simulations for Different Assumptions With One Hour Grading per Student and $500 License Cost per Course

Summary of Cost per FTES

Model Type/# of Students	50	200	500	750	1,500	5,000	7,500	10,000
Full-time Instructors	$9,446	$3,431	$2,246	$1,977	$1,704	$1,516	$1,500	$1,499
1 FT Instructor/course w/ TAs	$9,446	$3,386	$1,982	$1,578	$1,190	$914	$882	$876
Part-time Instructors	$8,878	$2,911	$1,734	$1,459	$1,200	$1,015	$997	$997
1PT Instructor/course w/ TAs	$8,878	$2,877	$1,633	$1,346	$1,073	$879	$859	$859

Summary of Cost per FTES (10% of all Students per course get cable allowance)

Model Type/# of Students	50	200	500	750	1,500	5,000	7,500	10,000
Full-time Instructors	$9,556	$3,541	$2,356	$2,087	$1,814	$1,626	$1,610	$1,609
1 FT Instructor/course w/ TAs	$9,556	$3,496	$2,092	$1,688	$1,300	$1,024	$992	$986
Part-time Instructors	$8,988	$3,021	$1,844	$1,569	$1,310	$1,125	$1,107	$1,107
1PT Instructor/course w/ TAs	$8,988	$2,987	$1,743	$1,456	$1,183	$989	$969	$969

Summary of Cost per FTES (with three meetings involving 30 instructor hrs per 50 students)

Model Type/# of Students	50	200	500	750	1,500	5,000	7,500	10,000
Full-time Instructors	$9,686	$3,671	$2,486	$2,217	$1,944	$1,756	$1,740	$1,739
1 FT Instructor/course w/ TAs	$9,686	$3,626	$2,222	$1,818	$1,430	$1,154	$1,122	$1,116
Part-time Instructors	$9,118	$3,151	$1,974	$1,699	$1,440	$1,255	$1,237	$1,237
1PT Instructor/course w/ TAs	$9,118	$3,117	$1,873	$1,586	$1,313	$1,119	$1,099	$1,099

Summary of Cost per FTES (with cable allowance and three meetings involving 30 instructor hrs per 50 students)

Model Type/# of students	50	200	500	750	1,500	5,000	7,500	10,000
Full-time Instructors	$9,796	$3,781	$2,596	$2,327	$2,054	$1,866	$1,850	$1,849
1 FT Instructor/course w/ TAs	$9,796	$3,736	$2,332	$1,928	$1,540	$1,264	$1,232	$1,226
Part-time Instructors	$9,228	$3,261	$2,084	$1,809	$1,550	$1,365	$1,347	$1,347
1PT Instructor/course w/ TAs	$9,228	$3,227	$1,983	$1,696	$1,423	$1,229	$1,209	$1,209

Table 7

Results of Simulations for Different Assumptions With Three Hour Grading per Student and $500 License Cost per Course

Summary of Cost per FTES

Model Type/# of Students	50	200	500	750	1,500	5,000	7,500	10,000
Full-time Instructors	$10,346	$4,421	$3,211	$2,928	$2,662	$2,499	$2,495	$2,496
1 FT Instructor/course w/ TAs	$10,346	$4,049	$2,294	$1,899	$1,503	$1,253	$1,240	$1,235
Part-time Instructors	$9,262	$3,356	$2,185	$1,920	$1,653	$1,495	$1,495	$1,496
1PT Instructor/course w/ TAs	$9,262	$3,182	$1,947	$1,666	$1,387	$1,219	$1,217	$1,218

Summary of Cost per FTES (10% of all Students per course get cable allowance)

Model Type/# of Students	50	200	500	750	1,500	5,000	7,500	10,000
Full-time Instructors	$10,456	$4,531	$3,321	$3,038	$2,772	$2,609	$2,605	$2,606
1 FT Instructor/course w/ TAs	$10,456	$4,159	$2,404	$2,009	$1,613	$1,363	$1,350	$1,345
Part-time Instructors	$9,372	$3,466	$2,295	$2,030	$1,763	$1,605	$1,605	$1,606
1PT Instructor/course w/ TAs	$9,372	$3,292	$2,057	$1,776	$1,497	$1,329	$1,327	$1,328

Summary of Cost per FTES (with three meetings involving 30 instructor hrs per 50 students)

Model Type/# of Students	50	200	500	750	1,500	5,000	7,500	10,000
Full-time Instructors	$10,586	$4,661	$3,451	$3,168	$2,902	$2,739	$2,735	$2,736
1 FT Instructor/course w/ TAs	$10,586	$4,289	$2,534	$2,139	$1,743	$1,493	$1,480	$1,475
Part-time Instructors	$9,502	$3,596	$2,425	$2,160	$1,893	$1,735	$1,735	$1,736
1PT Instructor/course w/ TAs	$9,502	$3,422	$2,187	$1,906	$1,627	$1,459	$1,457	$1,458

Summary of Cost per FTES (with cable allowance and three meetings involving 30 instructor hrs per 50 students)

Model Type/# of students	50	200	500	750	1,500	5,000	7,500	10,000
Full-time Instructors	$10,696	$4,771	$3,561	$3,278	$3,012	$2,849	$2,845	$2,846
1 FT Instructor/course w/ TAs	$10,696	$4,399	$2,644	$2,249	$1,853	$1,603	$1,590	$1,585
Part-time Instructors	$9,612	$3,706	$2,535	$2,270	$2,003	$1,845	$1,845	$1,846
1PT Instructor/course w/ TAs	$9,612	$3,532	$2,297	$2,016	$1,737	$1,569	$1,567	$1,568

network, and they register, get counseling, and receive their curriculum, class assignments, examinations, and feedback from instructors via the network.[22] In this approach, students can communicate with each other electronically. Some studies suggest that this electronic "conversation" produces a collegial relationship similar to that which can occur in the traditional classroom. The availability of the computer also provides for the transmission of data, access to library resources, and a means to engage in problem-solving activities.

Our calculations for this model indicate that a computer-based electronic network system is more expensive than a telecourse approach, if the state, rather than the students, provides the computers. The reason the state might "provide" computers, perhaps by lending them to students as a library lends materials, is to assure equity. Moreover, the productivity of instructors—that is, the number of students that a faculty member could direct—is less for an all-computer system than for a telecourse approach.

Nonetheless, the use of computers and electronic interaction would greatly enhance the learning potential of a distance education system that relied on telecourses or video transmission. Clearly, the combined use of these technologies should be the direction that a statewide approach to distance education takes as technological advances make them economically competitive with telecourses. Similarly, live instruction at a distance could be used to supplement the telecourses, and live interaction with students could be provided. Once again, these options are more expensive than the basic telecourse approach and should only be incorporated into a statewide system as technological advances and resources permit.

* * *

[22]The private Electronic University Network is an example of a fully accredited college that operates as described above.

The cost analysis above is based on preliminary assumptions in order to explore the savings that might result from an expansion of distance education. Despite their preliminary nature, the simulations suggest that distance education could save money and help maintain access if the courses had a mass audience—that is, if a statewide approach produced high enrollments for a limited number of distance education courses. Many people might argue that twenty-percent—or even ten-percent—of the general education core delivered by telecourses assumed in this model is unacceptably high; we will address this concern subsequently. Yet even these "high" numbers do not eliminate the need for new facilities. On balance, we conclude that though distance education alone is unlikely to solve the financial problems associated with increasing enrollments, it must be regarded as a major strategy for increasing productivity and helping to maintain access.

E. DESIGN OPTIONS FOR A STATEWIDE SYSTEM

We began the discussion of a statewide approach to distance education by outlining a conceptual model. It is now appropriate to consider how this model might be embodied in a design for a statewide distance education system.

Option 1: State College-without-Walls

One option is for the state to launch a new statewide community college that would be a state "college-without-walls" which would offer a complete degree-granting and transfer program via distance education for any student across California. The state college-without-walls would have a core faculty and administrators, but would make arrangements with local community colleges for additional instructors of record for telecourses and for space and other communication needs. Students could enroll in the state college-without-walls by telephone, mail, or modem and take all the telecourses necessary to transfer. Alternatively, students could be enrolled in an existing community college and take one or more telecourses from the state college-without-walls; these courses would be credited by the host institution. The faculty of the state college-without-walls would decide on the curriculum, as they do in other colleges, and articulation agreements would have to be reached with CSU and UC.

The state college-without-walls would not produce videos for the telecourses, but would rely on leasing them from suppliers—for example, from the Southern California Consortium (INTELECOM). Nor would it broadcast the telecourses directly to students. Rather, the state college-without-walls would negotiate arrangements with local cable companies and PBS stations to transmit the courses which the state college-without-walls sends to them or to local colleges (probably via satellite transmission). All this is technologically feasible using existing telecommunications and political arrangements. Within several years, advances in telecommunications could make other arrangements possible and make the transmission of a combination of voice, motion picture, and data feasible at low cost.

The great advantage of this option is that a single institution would be created whose sole focus would be on distance education. Thus, the state college-without-walls could operate in parallel with existing colleges but have its own faculty fully committed to distance education. It could realize economies of scale by attracting students across the state, and its full implementation could be speedy and cost-effective.

Its main disadvantages mirror its advantages. The state college-without-walls would not be taking advantage of existing distance education resources in the state. It would instead compete with existing distance education programs in the community colleges and could be construed as competitive with traditional courses. Moreover, unless specific regulations were enacted to require students enrolled in the state college-without-walls to take traditional courses at existing community colleges, students would matriculate without classroom experience. Questions might be raised that a degree or a transfer program solely from the state college-without-walls would be inferior to a standard program; consequently, it might be argued that the community colleges would have a two-track system with the state college-without-walls being considered inferior.

Option 2: Decentralized Distance Education

An almost opposite option to the state college-without-walls is to forgo a statewide approach and encourage community colleges to increase their use of distance education. The advantage of this decentralized approach is that a new institution—namely, the state college-without-walls—would not have to be created with all its attendant political, accreditation, and legal issues. Moreover, a decentralized approach uses current resources, rather than competing with them. Further, the existing mechanisms for deciding on curriculum and obtaining articulation agreements would not have to be reinvented. Most importantly, students would have an identifiable physical location and campus to which they (as well as four-year institutions and employers) could relate.

The disadvantages of relying exclusively on the existing decentralized approach to distance learning are apparent: Only a small percentage of courses are currently being taught this way, and at least part of the reason for its limited use lies in the resistance and disinterest of some faculty to distance education. Moreover, the geographic boundaries of a district limit the size of the potential student enrollment in a telecourse, and different colleges may choose different video presentations and curriculum for the same course content, further reducing the number of students that might enroll in any one telecourse. All these factors suggest that a decentralized approach may result in "business as usual" without the large increases in students taking distance education courses that would allow economies of scale and a reduction in the state's cost of education.

Option 3: A Statewide Coordinating Institute for Distance Education and Telecommunications

This option seeks to incorporate the advantages of both of the above options while avoiding the disadvantages inherent in each. An Institute for Distance Education and Telecommunications could be established by the Chancellor's Office to develop and implement a dramatic expansion of distance education, particularly along the lines suggested by the model outlined in the preceding section.[23] The Institute could either be established on a contract basis or become a new unit within the Chancellor's Office. That is, the Institute could work with existing community colleges to formulate an educational program consisting of a common core of telecourses that would enable a student to earn an Associate's degree or transfer to a four-year institution. The telecourses could be broadcast statewide over community access channels, and the Institute could be responsible for negotiating agreements with local cable companies and stations for the free broadcast of the courses at reasonable and regular hours.

The Institute would not be a degree-offering institution. Rather than competing, it could use existing capabilities at the community colleges, particularly drawing on the

[23]We have not developed a detailed cost model for Institute operations. The Institute could be supported with funds that would come from cost savings made possible by expanding the use of distance learning.

technological capacities, experience and expertise of such colleges and districts as Coastline, Peralta, and San Mateo. Indeed, it may be economical for the transmission of telecourses to broadcast using existing uplinks currently operational at some community colleges.[24] Further, students could enroll in telecourses at their community college, and these colleges would provide the instructors of record for the telecourses, as well as personal support services for students.

Most importantly, the Institute could administer incentives to stimulate the colleges' rapid expansion of enrollment in telecourses and collect data to hold colleges accountable for realizing target goals for such expansion. (The next section discusses policies that could provide incentives and establish accountability.) Assuming that current restrictions could be removed, the Institute could also coordinate activities to provide statewide distance education programs in areas other than the general education academic core—for example, courses in business and vocational education could have large enough statewide enrollments to become financially attractive. Moreover, the Institute could work with the community colleges' EdNet that coordinates contract education for business application to use distance education more extensively at worksites.

The Institute would not produce telecourses, but could lease courses from producers such as INTELECOM, and could work with INTELECOM and the northern consortium (NCTC) to lease additional courses and otherwise make arrangements to take advantage of economies of scale. Because transmission and enrollment would be statewide, the number of enrollments in the core general education courses indicated in the last section should be possible, and these large numbers should provide leverage for the state with telecourse providers.

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[24]Uplinks exist at De Anza, Sacramento City, and San Mateo community colleges, and other colleges have microwave links to commercial uplinks.

Finally, the Institute could be the Research and Development center on distance education and telecommunications for the community colleges. In that capacity, it could seek federal grants that are often available in this area to run pilot programs or implement technological advances. As the central authority for distance education in the community college system, the Institute could cooperate with the K-12 system and with CSU experts as they install an electronic knowledge highway, and could help coordinate CSU and community college efforts. It may be desirable for CSU and the community colleges to collaborate closely—perhaps even merging their efforts—to truly develop a statewide approach to distance education. The Institute could play a leading role in formulating such possibilities.

As a premier R&D center, the Institute could become a place where experts at the community colleges could take leaves, and the Institute's staff could work with Pacific Bell and other telecommunications entities to upgrade distance education in cost-effective ways as new technologies become available. And the last, but by no means least important, function of the Institute would be to provide professional development for faculty—perhaps through distance technologies—to help them develop and maintain their skills in working with distance learning techniques.

Despite its many advantages, the Institute approach might not achieve its purpose of giving direction and impetus to a rapid expansion of cost-effective distance education in the context of current regulations. The option for a statewide college-without-walls might be less cumbersome and less subject to local resistance. The efficacy of the Institute approach therefore depends on state policies that provide the right mix of incentives and accountability for a central coordinating function to work. The next section considers such policies.

F. POLICIES TO PROMOTE EXTENSIVE USE OF DISTANCE EDUCATION

This paper has explored statewide approaches to distance education in the form of the extensive use of telecourses. Though it would be premature to propose an exact blueprint for distance education, some conclusions can be drawn from the scenarios we have explored. First, a telecourse-based distance education system can reduce the need for new construction or the expansion of existing facilities, without sacrificing quality; it also can increase faculty productivity and introduce savings into the cost of delivering instruction. In these extraordinary times, this approach deserves serious consideration.

Second, the real cost advantage of distance education depends on large enrollments in telecourses. Also, only by having substantial enrollments can the quality and variety of productions be maintained. Therefore, current policies, practices or attitudes that prevent large enrollments defeat the purpose of a statewide approach. This section considers obstacles to the expansion of telecourses and incentives that can accelerate their use.

State Compensation and the Enrollment Cap

Under the existing system, colleges are not compensated by the state for students they enroll beyond an enrollment cap. This system limits expansion, and means that enrollment in one programmatic area always comes at the expense of enrollment in other areas. Consequently, the more students are enrolled in distance education courses the fewer students can be enrolled in traditional instruction. To resolve this conflict, the way the state compensates colleges for their enrollment needs to be examined.

Currently, the state provides approximately $3,000 per FTES for credit courses, regardless of whether the course is delivered in a traditional classroom or by distance technologies (please note that under current law telecourses can only be transferrable courses; see the discussion below). Our preceding analysis suggests that a statewide approach to the delivery of telecourses could result in costs well below the current level of compensation. This suggests a policy for expanding the use of telecourses: change the funding compensation formula so that the cap is applied in a different way for telecourses. Under this policy, districts might have strong incentives to increase their use of telecourses.

For example, if telecourses were not included in the cap at all, then districts could enroll as many students as they were able to attract, without reducing the number of traditional classes and without building new facilities or expanding existing ones. They would want to do so because they could fulfill their mission of maintaining access to meet student demand and "profit" at the same time by having a lower real cost per student of service delivery. From the state's standpoint, though the pressure for supplying state funds for facilities construction could be reduced, the increased number of students enrolled would require more state funds for enrollment growth at the community colleges.

Four alternative policy options could be considered to deal with these issues:

- **Option A.** The cap would not be changed and telecourses would be compensated at the same rate as other courses.

- **Option B.** The cap would not be changed, but telecourses would be compensated at a lower rate than traditional classroom courses.

- **Option C.** The cap would be removed or adjusted to a higher level just for telecourses and telecourses would be compensated at the same rate as other courses.

- **Option D.** The cap would be removed or adjusted to a higher level just for telecourses, but telecourses would be compensated at a lower rate than traditional classroom courses.

Option C provides the greatest incentives for districts to expand the use of telecourses. It would therefore decrease the pressure on facilities construction. However, it would increase the state's cost of paying for enrollment beyond the current cap. Option

B is the mirror image of Option C: it would provide the fewest incentives for districts to expand telecourses, but it would reduce the cost to the state for compensating districts for increasing student enrollment. The other options are variations of these alternatives. If the state cannot pay for increased enrollment growth beyond cap,[25] an extreme financial situation would be in effect and the drastic action implied by Option B might be called for because it would increase "productivity," which would allow colleges to increase their enrollment for the same amount of state funds. If the state could finance only a moderate enrollment cap increase, Option D might be the most appropriate. Thus, districts might be given an additional amount above the actual cost of a telecourse to the college—for example, if the cost were $2,000 per FTE, the state might provide $2,500, which would still be less than the $3,000 per FTES compensation for the traditional course; this policy could be enacted either for telecourses above cap or for all telecourses.

Two other relevant policies might be considered:

- The Board of Governors might not allow any facilities construction until some level of total FTES—for example, ten percent—was delivered by telecourse.
- The Board might set targets for the percentage of FTES that should be delivered at a distance, and rewards could be given to those districts that meet the targets.

Legal Obstacles

The state currently does not provide support for non-transferable telecourses—thus, telecourses must be part of an Associate Degree sequence and be accepted by UC or CSU for transfer. The legislation imposing this restriction dates from the late 70's and is now incorporated into Title 5 regulations; the theory behind this restriction was that non-transferable courses might not be up to adequate academic standards. Since the base model for telecourses we proposed earlier was only for transferable courses in the

[25] Another Policy Discussion Paper will explore alternatives to the current financing system.

general education core, the cost advantages previously reviewed are not affected by this restriction. However, some other courses—either for credit or non-credit—could attract a large enrollment. For example, non-transferable career education courses, conversational language classes, basic skills, and study skills courses are heavily subscribed, and most could be taught through telecourses. Therefore, it would seem to be a better policy to remove this restriction and trust the appropriate faculty committees to make judgements about the quality of a telecourse—whether it be transferable or non-transferable, for credit or not for credit. Such a change in policy would also be an important signal of trust in the integrity of the colleges.

We should not overstate the possible effects of removing this restriction. Courses that fall under contract education and are paid for by business could still be telecourses, as they can be today. Moreover, a large range of non-credit courses such as ESL probably cannot be delivered via video broadcast because it would be prohibitively expensive for two reasons. First, with the current state of technology, there would not be enough channel capacity for home delivery to students requiring from two to three hours per day of instruction. Future technological advances might ease this problem.[26] Second, there are currently few telecourses available to meet the variety of needs of non-English speaking people.[27] Experts in the area believe that other forms of distance education may eventually play a crucial role, particularly interactive video disks. Finally, telecourses to serve the very large non-credit remedial mission of the colleges might greatly ease the current enrollment pressure. However, many educators argue that students in need of remediation require the personal and continuous contact available only in classroom settings. Removing the current restrictions against non-transferrable telecourses could

[26]The ability to increase channel capacity through the use of compressed video technologies is close to reality.

[27]Oliver, 1992. Some telecourses produced by INTELECOM are available in Spanish, Mandarin, Japanese, Dutch, and Polish.

allow instructors to experiment with such innovations as mixing classroom tutoring with telecourses and perhaps with peer tutors.

Another current legal restriction limits the number of students per section to 125 per instructor, except by petition to the Chancellor; the number of students per instructor assumed in our base model ranged from about 30 students per instructor to about 60. Thus, this restriction currently is not an obstacle to a statewide approach to distance education. In general, other relevant Title 5 regulations could be streamlined, but pose no real restriction to a major expansion of telecourses.[28]

Attitudes

Perhaps the greatest obstacle to the expansion of the use of distance education is attitudes at the colleges about video instruction and whether it represents quality education. Some ideas for creating positive attitudes include:

- **Help with technical and procedural issues.** The colleges need resources to deal with the cable companies, producers, licensing issues, etc. The Institute for Distance Education and Telecommunications, if it helped colleges handle all this, would provide an incentive for colleges to move forward.
- **Incentives for faculty.** Rewards and recognition for faculty who are in the forefront of distance education might be advantageous. For example, faculty workshops (travel paid for), where faculty could discuss their approaches to telecourse instruction.
- **Accountability.** Insofar as the Institute had a mandate to provide a system with strong accountability, faculty concerned with the quality of telecourses would be sent a strong signal that quality would be a key component of a statewide approach.

[28]Televideo facilities and equipment are not now ordinarily available for state capital outlay funds. The transmission of telecourses on a statewide basis assumes a capital investment that is spelled out in the Appendix. However, even using exiting capabilities, an investment would have to be made and it would be desirable to use state capital outlay dollars for this purpose.

- **Other ideas.** Support from UC and CSU would add to telecourse legitimacy. Since CSU is known to support the idea of telecourses, proposals to expand community college telecourses might gain legitimacy if linked in some manner to CSU. Even modest foundation grants—if sufficiently prestigious—could elevate the visibility and prestige of the new Institute and the decision to expand. Also, Institute staff could work with community colleges and high school counselors to help them understand that a telecourse is a legitimate way to learn and telecourses could be built into current tech-prep efforts that are now reviewing the community college/high school curricula.

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This review suggests that BOG and/or legislative policies could be used to establish a statewide approach to distance education. The technological revolution will ultimately enable community colleges to operate distance education using a combination of voice, data, and video images that can radically change how instruction is delivered. For the mid-term of three to five years, it is feasible both financially and technologically for community colleges to greatly expand their use of telecourses by taking a coordinated statewide approach. At the heart of a statewide system might be an Institute for Distance Education and Telecommunications which would function to establish coherent educational programs taught at a distance for students enrolled in their local college. With the proper set of incentives and with appropriate capital investments building on current capabilities of the colleges, a much higher percentage of courses could be delivered by telecourses; in this way, the state could substantially reduce facilities needs and enroll more students for a given level of state support. By establishing a statewide approach to distance education as soon as possible, the community colleges will position themselves to make a transition to more advances uses of distance education and educational technologies before the turn of the century.

APPENDIX A

Costing Assumptions

The following cost components were used in the simulations described in the text, and they are based on taking typical salaries and other costs and translating them into units suitable for cost simulations. The models assume that telecourses are offered on a trimester system of three 16-week terms.

License Costs

(1) The base simulation assumes a $15,000 per course across the state. The license cost for a year would be $15,000 x 10 courses x 3 semesters = $450,000.

(2) A variation assumed $500 per course statewide, perhaps applicable to Option 1, a new State College-without-Walls. The license cost for a year would be $500 x # courses per year. If 10 courses were offered per semester in a trimester school, the total license cost for the year would be $500 x 10 courses x 3 semesters = $15,000.

Up-link Costs

$1,154 per hour of instruction to lease/rent satellite time to broadcast a program. Total up-link costs per year would be $1,154 x # hours of instruction. If each course had 13 instruction hours and there were 30 courses per year, the cost would be $1,154 x 30 x 13 = $450,060.

Institutional Fees for Students

Institutions pay $15 per student per course for all students enrolled in a course. Costs for the year would be $15 x sum over all courses (# students in each course). With 50 students per course and 30 courses per year, the cost would be $15 x 1,500 = $22,500.

Instructor Costs

The simulations vary instructors' time for a telecourse based on a variety of assumptions. The basic model assumes 15 instructor hours of preparation per course and 1 instructor hour per student per course for answering student questions. In addition, two variations are simulated for either 1 or 3 instructor hours per student per course for grading papers and exams, and either no extra hours for interaction with students or 3 meetings between the students and staff (the meetings would be held at a community college), in which 50 students attend a site meeting, the instructor has 6 hours of preparation and 4 hours of contact time for each meeting. We assume that the locations and facilities would be provided pro-bono by the participating community colleges or community organizations, and that the instructor is paid $40 per hour.

These assumptions combined with the number of students in a course yield the number of instructor hours needed. The model further assumes that a full-time instructor can work 40 hours per week, while part-time instructors and teaching assistants can work a maximum of 20 hours per week. The model assumes a cost of $45 per hour for a full-time instructor, including fringe benefits (which is equivalent to approximately $63,000 for a 175-day year), $20 per hour for a part-time instructor, and $13 per hour for a teaching assistant. The following scenarios were considered:

A. *Full-time instructors only*. There is at least one full-time instructor per course and any additional time needed is filled by full-time instructors.

B. *One full-time instructor per course with teaching assistants*. This is a modification of scenario A. The modification assumes 1 full-time instructor and 2 teaching assistants, one working for 20 hours per week and the other 19 hours per week. For 10 such courses a semester 3 times a year, we assume 10 full-time instructors and 60 teaching assistants—30 working for 20 hours per week and the other 30 for 19 hours per week.

C. *Part-time instructors only*. This is similar to scenario A with the exception that full-time staff are replaced by part-time instructors who are paid by the hour and cannot work more than 20 hours per week. This gives us 3 part-time instructors working for 20 hours per week and 1 part-time instructor working 18 hours per week. With 10 such courses a semester 3 times a year we would need 90 part-time instructors working 20 hours per week and 30 part-time instructors working 19 hours per week.

D. *Same as scenario B, with part-time instructors replacing full-time instructors*. This modification would require 1 part-time instructor working 20 hours per week, 2 teaching assistants working 20 hours per week, and 1 teaching assistant working 19 hours per week.

Administrative Costs

The model assumes a fixed administrative staffing cost of 5 people at $70,000 each. In addition, it assumes an administrative cost of $17 per student per course. This cost is used for additional administrative staffing brought about by increased enrollment. The model further assumes that the cost to hire an additional administrative staff person is $35,000 per year.

Supplies and Materials Costs

The model assumes that the cost to provide supplies and materials is $7 per student per course.

Counseling Costs

The model assumes that it costs $5 per student per course to provide counseling services.

Library Costs

The model assumes $2 per student per course to pay for library services.

Facilities

The model assumes that we need 225 square feet per full-time staff person at a cost of $24 per square foot per year. The number of staff = 5 + # instructors + additional administrative staff. The facilities cost for staff per year would therefore be # staff x 225 x $24.

Two part-time instructors or teaching assistant's are considered to be equivalent to 1 full-time staff person for space utilization purposes (we round up to the nearest integer in calculating the # of part-time instructors and/or teaching assistant assistants for space costing purposes). Thus, if a course used 1 part-time instructor working 20 hours per week and 1 teaching assistant working 10 hours per week, and this were true for all 10 courses in a semester, for 3 semesters, we would have 1 full-time staff assignment per course for all the courses, or 30 full-time staff for space costing considerations.

The need for additional administrative staff is computed as follows:

> Additional administrative cost = (# students per course) x (# courses per year) x $17. The number of additional administrative staff that can be hired = additional administrative cost/cost per each new administrative staff person.

Computer Costs

The model assumes that it will cost $1.5 million to set up a computer network and purchase equipment. This would yield a start-up capability of 300 full-time instructors. This start-up cost is amortized over 7 years at 12 percent interest per year. We estimate the additional cost of each full-time staff person at about $4,000.

Cable TV Subsidy

We assume that 10% of all students per course would receive a cable TV subsidy. The subsidy would consist of $30 for installation and $20 per month for 4 months (duration of the course) for a total of $110 per student who receives a subsidy.

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