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ABSTRACT

This paper, which focuses on technology planning by community colleges, is part of a series published by the Center for Community College Policy, designed to support state and local policymakers, as well as educational leaders who are interested in policy issues related to the two-year postsecondary sector. State policymaker's enthusiasm for increasing the level of information technology (IT) at all levels of higher education is at an all-time high. Colleges and universities are also making investments in IT, yet despite financial commitments and new developments in IT products, technology has not been a part of restructuring how instruction takes place. Provided in the document are discussions about how IT will affect new roles for both campus and community. Five issues in particular are addressed: (1) state goals and priorities; (2) statewide networks; (3) new organizational structures; (4) cost-effectiveness; and (5) financing and investment strategies. Recommendations are given on how to meet policy challenges regarding the capital for IT development and the holistic integration of IT into the classrooms and curriculum. A sidebar highlights results of a 1997 survey of 605 colleges regarding campus technology use. (AF)

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POLICY Paper

September 1998

TECHNOLOGY PLANNING: STATE AND SYSTEM ISSUES

by James R. Mingle and Sandra S. Ruppert

INTRODUCTION

Developments in information technology (IT) — including more powerful computers, high-speed networks and modems, easier-to-use applications and richer content offered via the World Wide Web and the Internet — are dramatically redefining nearly every aspect of where, when and how learning and research takes place. But a learning environment based on IT offers the potential for more than simply expanding access to education-as-usual on the Internet. At its best, it also offers a set of extraordinary new tools designed to enhance student learning:

- Self-paced, multimedia modules that deliver leading pedagogy
- In-depth outcome assessments
- Online interaction with fellow students and teachers that facilitates continuous feedback and improvement.

For most colleges and universities, access to the best that technology has to offer remains more a vision than a reality. Although technology use is on the rise, the majority of courses offered at public and private two- and four-year institutions do not yet make use of either email or Internet or multimedia resources for instructional purposes, according to the most recent Campus Computing survey.

The survey also reveals that the rate at which colleges and universities are integrating and using technology resources is unevenly distributed. Community colleges, which remain heavily invested in instructional television, lag behind public four-year colleges and universities in the use of computing and Internet technology. And, across the board, planning for and strategically investing in educational technology represent significant challenges for most institutions.

In managing the transition to the digital age, most colleges and universities likely will face considerable competition from new providers in the corporate sector which also rely on information technology for delivering instruction. Postsecondary education today operates in a more open, competitive and market-oriented environ-

inside...

ment, and it is also one in which the state's role has changed. State policymakers rely less on regulatory mechanisms to control the postsecondary marketplace and more on the use of incentives and other financial measures as well as information sharing to ensure that the market works effectively and fairly.

This policy brief is designed to help state - and system-level policymakers plan wisely and invest strategically in the postsecondary educational uses of information technology given the changing landscape of today's economy. Although determining the appropriate choices and uses for IT will depend on the particular state context, the guide addresses five issues in which states will need to play a leadership role in fostering innovation and technological advances:

I. **State goals and priorities:** A first step in establishing state goals and priorities for information technology is understanding its potential impact on the way postsecondary education operates. This section addresses the role of IT in meeting states' education and training needs and what outcomes technology should achieve.

II. **Statewide networks:** Many states are investing in the creation of statewide networks that are designed to link various public agencies and services, including colleges and universities. This section examines how such networks function and are organized.

III. **New organizational structures:** Technology is often touted as a means for addressing the growing demands for postsecondary

THE STATUS OF CAMPUS TECHNOLOGY USE

The Use of Technology Resources in Instruction:

- *Email:* 40% of courses at public four-year; 20% at community colleges
- *Resources available on the Internet:* 28% of courses at public four-year colleges; 18% at community colleges
- *Some form of multi-media (voice, video or data) resources:* 12% of courses at public four-year colleges; 15% at community colleges

Integrating Technology into the Mainstream of Instruction:

- 47% of public four-year colleges and 38% of community colleges report some type of computer instruction or IT competency requirement for all undergraduates.
- "Assisting faculty to integrate IT into instruction" and "providing adequate user support" are the top IT challenges for both two-year and four-year institutions.
- 20% of the survey respondents identify "financing the replacement of aging hardware and software" as the most pressing IT issue.

Financing Campus IT Investments:

- *Charge mandatory user fees:* 59% of public four-year colleges (avg. = $131); 34% of community colleges (avg. = $55)
- Vast majority (70%) of campuses continue to fund most of their equipment, network and software expenses with one-time budget allocations or special appropriations.
- Majority (52%) continue to operate without a strategic or financial plan for IT.

NOTE: Based on a mid-1997 survey of 605 public and private two-year and four-year colleges and universities in the U.S.

Source: Green, Kenneth C., Campus Computing 1997. Encino, CA: Campus Computing, 1997.

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education and training without incurring the costs normally associated with traditional "bricks and mortar" construction. This section describes aspects of a new organizational type — the virtual university — and some of the challenges it poses for state policy.

IV. **Cost-effectiveness:** Different technology-based instructional approaches have different cost dynamics. Achieving economies of scale and choosing the most cost-effective approaches to "interaction" are among the challenges facing colleges and universities. This section provides some general conclusions drawn from recent studies about the costs and benefits associated with technology-based instruction.

V. **Financing and investment strategies:** Scarce resources and competing demands in most states require that policymakers plan wisely and invest strategically. This section looks at a range of related issues, including investment goals, identifying funding sources, pricing policies and funding collaborative efforts.

I. State Goals and Priorities

State policymakers' level of enthusiasm for the application of information technology to higher education systems is at an all-time high. In state after state, legislatures are increasing their support for higher education technology initiatives. It is not unusual for a state to appropriate in the tens of millions of dollars a year specifically for postsecondary education technology purposes.

Colleges and universities also are making their own substantial technology investments by reallocating existing funds, establishing student technology fees and seeking additional support through grants and business alliances. But, for the most part, both states and campuses have not used technology to restructure the organization or instructional process. This "bolt-on" approach can add costs and fail to capitalize on the advantages of information technology.

There is much speculation as to the "revolutionary" nature of information technology on higher education. But keep in mind Bill Gates' admonition that "people often overestimate what will happen in the next two years and underestimate what will happen in 10." Educom, a nonprofit consortium of higher education institutions that facilitates the introduction, use, and access to and management of information resources, offers one compelling scenario of what the digital future has in store for higher education. They suggest that this environment is one that could not have existed five years ago — but it is one that will be pervasive five years from now.

- **Technology enables us to unbundle the instructional process.** It allows us to desegregate the place, the content, the delivery and judgments about the quality of education. By separating instruction from assessment, teaching from degree granting, and content development from content delivery, traditional roles are redefined and new ones emerge.
- **The Internet expands learning opportunities.** Distance learning technologies, such as the Internet, and to a lesser extent, cable and satellite-based systems, enable learners to access education whenever and wherever they want. Online experiences offer educational opportunities to millions of learners previously constrained by time, location and other factors.
- **The Internet enhances choice and challenges regulation.** The Internet lowers the threshold of entry to the higher education marketplace for new

commercial and nonprofit educational providers by eliminating many barriers. Geographic and political boundaries will be eroded, and new challenges will confront state regulatory bodies. Students will be more likely to select educational institutions based on offerings, convenience and price than on geography.

- **Interactive multimedia and other technologies will change how we think about providers and whom we regard as providers.** Learning resources that were once only available through education institutions will now be widely available in the form of multimedia software and other computer-based courseware. Consumers will be able to purchase learning products independently and learn at their convenience, collectively spending millions of dollars on education each year. This purchasing power will have a tremendous impact on who controls learning.

- **Education will no longer take place within individual institutions (or even their virtual equivalents).** Instead, education will occur within a dynamic global marketplace of customers and suppliers. With its emphasis on creativity and competition, this marketplace will enable a wide range of players — universities, media, publishers, content specialists and technology companies — to market, sell and deliver educational services online.

POLICY CHALLENGES

The key to sustaining political and legislative support for IT at the state level lies in its relevance to important statewide goals. Among the basic questions state policymakers will want to ask about the role of IT in meeting statewide goals for higher education are these:

1. Do states want to support the explosion of adult learning that will occur because of global digital networks or will these programs need to be self-supporting?
2. Will states with growing minority populations see IT as relevant to access and learning goals that will increase minority success in higher education?
3. Will a technology-based solution satisfy the demands for local economic development and access to facilities that drives much of public higher education policy?

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II. STATEWIDE NETWORKS

Several states have established networks and organizations to develop, contract and manage integrated telecommunications infrastructure and services. Participants in these networks often include state and local government agencies, public schools, libraries, universities and colleges, and community hospitals. For the most part, these networks are not state-owned, but consist of partnerships with private

telecommunications companies. They use a mix of technologies to establish connections between and among participating entities that allow data, voice, video and images to be transported from place to place.

State investments are often used to extend existing fiber backbones and to establish dispersed hubs that, in turn, link various individual user sites such as colleges and universities, public schools, courts, libraries, hospitals and government agencies to the statewide network. By aggregating demand, these networks are able to provide services well below market rates and to extend service to areas that are not being served by private telecommunications companies or Internet service providers.

Among the activities and services provided by these networks are the following:

- Full motion and compressed video connections between and among institutions
- Internet access
- Dedicated data connections
- Equipment discounts
- Installation / training / technical assistance
- Video scheduling
- Joint software purchases (e.g. library databases)
- Standard setting in order to ensure intrastate compatibility and quality.

Some networks, such as the Utah Education Network, provide substantial training opportunities for both K-12 and higher education faculty and serve as a repository for curriculum materials. OneNet in Oklahoma (which has among the lowest user charges in the nation) provides modems and dial-up access services. Intelenet — a part of Access Indiana — administers the K-12 School Grant Program, which provides funds to schools for statewide network and Internet connectivity.

Benefits and Costs of an Intercampus Instructional Television Network

In Virginia an instructional television network delivers the upper-division coursework for baccalaureate programs to community college sites in the state. A primary objective of the network, Teletechnet, is to provide a cost-effective means to serve a large number of additional students who are unable to move to a university campus. Through Teletechnet, the second two years of university instruction are provided to the community college sites via the network. Thus, students attending a community college can complete their lower-division studies and move directly to upper-division coursework without relocating.

By 1996-97, more than 5,000 students were enrolled in over 20 programs distributed to 40 sites (23 were community colleges; the remainder were hospitals, military installations and corporate sites). Programs included nursing, engineering technology, human services counseling and criminal justice.

To help assess the quality of the academic experience offered to distance students, the benefits of Teletechnet were compared with the regular on-campus classroom instructional program. The study found:

- The quality of instruction provided via Teletechnet is essentially equivalent to that provided by on-campus classroom instruction.
- Teletechnet increases student access and provides incentives and opportunities for faculty development and for institutional renewal and growth that are superior to classroom instruction.
- For high-demand courses (200 students) and, in some cases, for medium-demand courses (100 students), Teletechnet costs are competitive with classroom costs.

Source: *Teletechnet – Old Dominion University and "Two-Plus-Two" Programs at Community Colleges in Virginia: A Case Study in the Benefits and Costs of an Intercampus Instructional Television Network.* Frank Jewett, Information Resources and Technology, Chancellor's Office, California State University, Seal Beach, CA. No date.

Among the critical questions often raised by policymakers about statewide networks are these:

1. **What is the difference between statewide networks and the Internet?** Statewide networks often provide advanced services, such as video connections, at much higher quality and lower costs than are currently available on the Internet, although those connections are

limited to participating institutions and locations within the state. Statewide networks also provide significantly greater amounts of security because of their dedicated nature — an important advantage in data transmission among administrative units.

2. **Will statewide networks be replaced by developments in the private sector?** In many ways, statewide networks have encouraged private-sector response to increased telecommunications services by aggregating demand and employing state-of-the-art technology such as asynchronous transfer mode or ATM networking, which allows for more sophisticated forms of information to be delivered at very high speeds. As technology advances and more advanced services are available to the home and to the desktop, functions of statewide networks may change or disappear.

3. **Why do prices for services vary so much from state to state?** Prices can vary for such basic services as T-1 lines by as much as 100%. (A T-1 is a leased line capable of carrying data at 1.5 million bits-per second — fast enough for many uses but not for full-screen, full-motion video.) These differences most likely reflect the competitive environment in the private sector more than the efficiency of the statewide network.

4. **What is Internet2?** With the commercialization of the Internet, "high-end" users such as research universities and hospitals have found the quality and speed of their Internet access deteriorating. Internet2 is a voluntary effort among research universities to reestablish high-speed Internet connections for their exclusive use. In this way they can develop applications such as multimedia delivery over the Net, desktop video connections and collaborative research projects. Internet2 is being developed with a combination of institutional, state and federal funds.

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Intelenet — http://www.ai.org/intel/index.html

III. New Organizational Structures

Historically, new challenges to higher education have been met through the creation of new institutional types. The land-grant university of the 19th century was a response to the industrialization of the American economy; the community college movement emerged out of the demands for access in the two decades following World War II. Now the digital age is creating a similar response. The "virtual university" —still more a concept than a defined organizational type — is emerging as one response to the needs of "anytime, anyplace" education.

The virtual university comes in a variety of forms:

- **The "virtual" library.** By integrating bibliographic databases and designing common user interfaces, states and systems are providing access through the Internet and statewide networks to entire library collections, and the future holds increasing access to digital materials that can be delivered to the desktop. Virtual library initiatives also provide widespread access to commercial databases, which are especially beneficial to smaller and more isolated libraries.

- **Electronic student services.** Many campuses are reorganizing their student services (e.g., admission, registration, bookstore, bursar and career services) so that they are accessible online. In this way, students avoid the hassle of going from office to office, and the institution can realize savings in personnel.
- **"Virtual" catalogs.** Through such initiatives as the Western Governors University, the California Virtual University and the Electronic Campus of the Southern Regional Education Board, students, regardless of location, will have access to the electronic offerings of hundreds of colleges and universities. Sophisticated search engines will assist students in finding just the right course to meet their needs.
- **Competency-based credentialers.** Institutions like Empire State College and the British Columbia Open Learning Agency have long provided a means of obtaining a degree through alternative assessment arrangements. Now the opportunities of the digital age have allowed an expansion of this activity. The Western Governors University plans to offer degrees, but have no faculty. Rather, it will develop a set of assessments that can be taken to achieve the degree.
- **Distance-learning degrees.** The explosive growth of the Internet and two-way video has greatly expanded the range and number of distance-learning degree programs available from traditional institutions, especially in an asynchronous (time-delayed) mode.
- **Curriculum development centers and other collaboratives.** New entities are being created by states and systems to jointly develop curriculum and to partner with the commercial sector. In this way, the upfront costs of content development can be shared and economies of scale achieved. All 13 colleges of the Colorado Community College and Occupational Education System are collaborating to offer an Internet-based associate degree program in business that will enable them to share in development costs and subsequent revenues (see Colorado Community College on next page).

A NEW ROLE FOR COMMUNITY COLLEGES

Not only are new organizational structures being created, but the role of existing institutions also is being altered. For example, community colleges are becoming "receive sites" for imported curricula, often at the baccalaureate level or higher (see Benifits & Cost on page 5). As neutral receive sites, they may provide access to several external providers and add value through access to facilities, technical assistance and mentoring and tutoring.

POLICY CHALLENGES

These developments challenge nearly every aspect of the state policy environment: the manner in which colleges and universities are funded, the policies governing faculty contracts, and the nature of the quality assurance process at the state and system level. Among the important questions to be addressed are these:

1. What should the state's role be in "sponsoring" or supporting new organizational structures that may compete with existing institutions?
2. How can states and systems leverage their size to gain economies of scale?
3. What quality assurance methods will work best in a more open and global environment of educational providers?
4. How can states support curriculum and faculty development to support the virtual university? How should the flow of dollars change to support the receive-site functions of community colleges?

COLORADO COMMUNITY COLLEGE ONLINE: DEGREES VIA THE INTERNET

In late 1997, the Colorado Community College and Occupational Education System announced the availability of Colorado Community College Online (CCC Online), a collaborative effort to deliver the degrees and certificates of the state's 13 community colleges via the Internet. Although other colleges have developed degrees that enable students to learn online, CCC Online is among the few in which every course required for a degree will be offered over the Internet. All courses will be accredited and are expected to transfer to four-year colleges and universities in Colorado and other states.

CCC Online is a single-location site for students to earn an associate degree in business administration. The new degree program includes the following features:

- Instructors will use a combination of video, animated graphics, online chat rooms, email and World Wide Web pages.
- Students will be able to register, complete financial aid forms, order textbooks and take quizzes via the Web. They also may choose which college they wish to be registered through.
- Professors and students will communicate using electronic mailing lists, chat rooms and a toll-free number.

The state's community colleges are sharing costs of the production and delivery of CCC Online courses. CCC Online is also noteworthy because one of the 13 campuses is a "virtual" campus.

Source: Colorado Community College and Occupational Education System – http://www.cccoes.edu/. Guernsey, Lisa, "Colorado Community Colleges Plan Degree to Be Offered Entirely Over the Internet," The Chronicle of Higher Education, *November 28, 1997.*

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IV COST EFFECTIVENESS

One of the most frequently asked questions from policymakers regarding technology-based instruction, including distance learning, is: Will it save money over traditional modes of delivery? The answer depends on a variety of factors including the technologies used, the nature of the student-faculty interaction, the location of the learner, the size of the investment in content development, the number of students using the course materials and the life of the course. Cost dynamics in technology-based instruction are also in constant flux as new mixes of technologies are used and prices of transmission and send/receive equipment change.

The following general conclusions can be drawn about the benefits and costs of technology-based instruction based on documented case studies compiled by the California State University System as well as other recent research efforts:

- The primary cost of traditional on-campus classroom instruction is the cost of the instructor. Capital costs are relatively insignificant.

- Instructional costs tend to rise proportionately with enrollments (i.e., doubling course enrollments doubles the cost of instruction).
- If technology is "bolted on" to existing course structures (e.g., a computer-tutorial supplement to a lecture/lab format), costs will rise. If computer tutorials are used in a self-directed mode and replace faculty time in lecture or lab, cost savings are possible.
- Technology-based instruction tends to require substantial start-up or fixed costs (e.g., studio costs, equipment, communications, course production) that are independent of the number of students who enroll in the course. Once these initial costs have been incurred, incremental costs of enrolling more students rise more slowly than in traditional delivery modes.
- As a consequence, electronic courses offered to small numbers of students are usually more expensive than classroom instruction (e.g., live two-way interactive video courses in low-enrollment courses — a common distance-learning application).
- At the other extreme, distance-learning programs that invest heavily in content development and expensive transmission media such as satellite delivery must make up these costs through large enrollments. The British Open University (BOU) spends millions of dollars on course development, but these courses can reach thousands of students and last several years. Per-student costs at BOU are significantly lower than at traditional universities.
- Internet-based courses, which depend upon asynchronous interactions between students and faculty, can be designed to be less expensive than courses that depend upon live (real-time) interactions. Some savings are also realized because users are responsible for their own computing equipment.
- Savings and benefits in technology-based instruction often accrue to the individual student in the form of convenience, expanded opportunity and reduced travel costs to a campus. This is especially true if an entire degree program can be obtained through distance learning. Other social benefits also may accrue (e.g., reduced traffic and air pollution from commuting).
- Additional costs of technology-based instruction can be justified if there are demonstrable improvements in quality — e.g., in student performance and achievement — or if no traditional alternatives exist for providing access.

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Financing and Investment Strategies

Approaches to financing technology acquisition are as diverse and varied as the states. They are also in considerable flux. For the most part, technology support from state governments reflects the "bolt-on" strategy of technology application found at the campus level. In good budget years, legislators tag on "technology funds" to base budget appropriations aimed at a potpourri of statewide and campus infrastructure initiatives. Seldom are these funds part of a comprehensive plan, nor is there much agreement as to the appropriate sources of revenue for different types of expenditures.

Among the policies and issues state policymakers should consider in developing a strategic plan for the financing and investment in information technology are the following:

SYSTEMWIDE GOALS

Financing plans should start with important state objectives which might include:

- **Equity across the system.** Information technology is applicable to all institutions and all types of programs; thus equitable access to technology resources remains an important criterion for states. But special technology appropriations should not be used to compensate for the lack of institutional commitment to this priority.
- **Strategic investment.** States cannot assume that the market and institutional initiatives will take care of all of the state's needs. Technology investments that enhance systems' competitive advantage in particular areas or are linked to important economic development priorities of the state will be needed.
- **Choice.** By expanding citizen opportunity to access a global set of providers, states will be creating a consumer-driven higher education system and acting as a competitive spur to their own institutions' response to market needs.

SOURCE OF FUNDS

A first step in developing a financing plan should be to outline mutual state, institutional and student obligations for funding. The source of funds for technology purchases and applications are several: base budgets, revenues from tuition and product sales, productivity savings, student technology fees and earmarked funds from the legislature. But what revenue streams should support what purchases? If the state is going to invest earmarked funds in technology development, these funds should accomplish objectives that might not otherwise be undertaken by individual campuses. Too many states are financing the purchase of desktop equipment and other campus infrastructure initiatives with special appropriations, while neglecting strategic investments in important programmatic and learning objectives.

Beyond the issue of sorting out the various revenue streams and setting priorities for technology investments, a number of other questions confront states:

1. What purchases should be funded from current revenue? From debt financing or leasing?
2. How should replacement costs be built into budget and financing models?
3. What opportunities are there for systemwide purchasing?

4. How should strategic statewide goals such as economic development be supported through technology investment?

5. What should be the size and use of student technology fees?

PRICING POLICIES

A market-driven system of higher education for electronic delivery suggests that the price charged to students be set according to market factors. With the choices for Internet delivery growing daily, students can choose between price and quality (or reputation) or try and maximize each. They may ask, for example, "What is the highest level of quality I can get for the lowest price?" Or, "What additional price am I willing to pay for the convenience of not having to go to campus?" Current practice appears to be evolving toward a distance-learning rate that is somewhat higher than in-state public rates, but lower than out-of-state tuition. As more and more providers enter the market and quality improves, one would expect this distance-learning rate to fall significantly.

Unfortunately, this pure market approach may have serious shortcomings that will necessitate specific state intervention. Individual consumer responses do not necessarily add up to state need. For example, curriculum development may be skewed by the willingness of third-party payers to cover the costs (more electronic curricula for engineers, doctors and high-tech employees, little or none for government employees, childcare workers etc.). Such programs and their students will need to be subsidized.

FUNDING COLLABORATION

States need funding mechanisms for developing joint courses and programs. While the traditions of campus autonomy have often constrained joint program development, the competitive factors brought about by global learning networks may be enough to push institutions to collaborate out of economic necessity. States can reinforce this objective through changes in their program approval criteria and by providing funds directly to new collaborative structures. "Receive-site" funding is also needed since currently most dollars flow directly to the "credit grantors."

Residency policies and nonresident tuition also constrain collaboration. One stimulus for the elimination of such policies in the West, spearheaded by Governors Roy Romer of Colorado and Michael Leavitt of Utah, may be the emerging Western Governors University.

COST ACCOUNTING AND RELATED POLICIES

As noted earlier, educational functions are in the process of being desegregated. Different individuals and organizations may be involved in content development, marketing, delivery, transmission, student support and assessment. Our accounting and allocation systems need reform to accurately calculate cost and appropriately allocate dollars to these functions. Our decisionmaking processes should begin to explicitly incorporate cost/benefit analysis when choosing among delivery systems and the nature of student/faculty interaction.

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