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THE IMPACT OF COMPUTER TECHNOLOGY ON STUDENT ACCESS AND SUCCESS IN THE CALIFORNIA COMMUNITY COLLEGES

THE ACADEMIC SENATE FOR CALIFORNIA COMMUNITY COLLEGES

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ABSTRACT

Computer technology has permeated the fabric of American society. Computer technology affects the way people communicate, the way they learn, and the way they do business. The ability to use computer technology effectively has become a distinct advantage in school and work. As computer technology has become a crucial element in educational and vocational advancement, concerns have grown that disparities in access to such technology limit the opportunities for many. This paper focuses in particular on the issues concerning computer technology and its impact on students in the California Community College System. The paper begins with a general review of the various concerns raised in education. The paper continues with an examination of the investments the California Community College System has made in technology and how these investments have affected student access and success. The paper concludes with recommendations for senates on both statewide and local levels regarding computer technology and its role at individual colleges and districts and in the System as a whole.

INTRODUCTION

Working in the most diverse segment of higher education in the state of California, community college faculty are keenly aware of the potential issues that the use of computer technology poses to the success and learning of our students. In Spring 2001, the Academic Senate for California Community Colleges passed the following resolution:

> ***11.01 S01 Digital Divide***
>
> *Resolved, That the Academic Senate for California Community Colleges conduct research to investigate the impact of technology on student access and success in the California Community College System, particularly as it relates to ethnic and socio-economic diversity and students with disabilities; and*
>
> *Resolved, That the Academic Senate for California Community Colleges report back in a paper the research findings and recommended solutions to any problems identified.*

This resolution suggests two questions. First, how has technology increased or decreased access for students in community colleges? Implicit in this question are issues of student access to technology and whether or not the expenditures the System has made on computer technology have resulted in increased access for students. The second question asks how technology has contributed to student success in the community college.

Although the above resolution mentions "technology" in general, the focus of this paper is on computer technology, which is implied by the title of the resolution, "Digital Divide." In this paper, we discuss the issue of access to computer technology. The concept of the Digital Divide has changed over the years, and our examination of this issue reflects on how the evolving definition changes our evaluation of the System's response to this challenge. Next, we examine how the System has used computer technology to improve student access to student services and instruction. Responding to our second question, we review the extent to which investment in technology can be correlated to student success. We conclude this paper with recommendations on the statewide and local levels to address issues raised in the course of the discussion.

ACCESS TO TECHNOLOGY: THE DIGITAL DIVIDE

When discussing the disparity between those who have access to technology and those who do not, the commonly used label for this impact is the "Digital Divide." In general, those who do not have access belong to specific ethnic, socio-economic, and disability groups. In this section, we review how the concept of the Digital Divide has changed since it was coined in the early 1990s and look at how the California Community College System has responded to the challenges of closing the Digital Divide.

The first governmental report conducted by the U.S. Department of Commerce, National Telecommunications and Information Administration (NTIA), *Falling through the Net: A Survey of the 'Have Nots' in Rural and Urban America* (National Telecommunications and Information Administration [NTIA], 1995), revealed that the nation's information "have nots" were disproportionately found in rural areas and central cities. Furthermore, the report showed that generally, the lower the level of one's education, the less likely there was to be a computer in the home and if there was a computer it was probably not connected to the Internet. Therefore, this country's

rural minorities and inner city minorities were being excluded from full participation in the information age.

In 1998, the National Telecommunications and Information Administration published another Digital Divide scorecard, Falling through the Net II: New Data on the Digital Divide (NTIA, 1998). This report found that while computer penetration had increased nation-wide, there was still a significant Digital Divide based on ethnicity, income, and other demographic characteristics. The data further revealed that there was a widening gap between those at upper and lower income levels. Additionally, even though all ethnic groups owned more computers, African Americans and Hispanics were lagging even further behind whites in their levels of PC-ownership and online access.

The latest National Telecommunications and Information Administration report, A Nation online: How Americans are expanding their use of the Internet (NTIA, 2002), demonstrates that computers in our schools have substantially narrowed the gap in computer usage rates for children from high and low income families. Students are often active users of web-based technologies. The expanded presence of computer and Internet technologies in our schools makes these resources available to students who lack them at home or who have limited resources regarding other Internet connectivity. In addition, more Internet-connected computers in our schools and public libraries have resulted in more high school graduates with the skills and familiarity with the new technologies, thereby allowing them to become active participants in our digitally driven social and economic structures.

ACCESS: COMMUNITY COLLEGE EFFORTS

The California Community Colleges System has played a role in improving general student access to computer technology. The System took advantage of a 1994-96 U.S. Department of Commerce planning grant to develop the *Technology I Strategic Plan*, which funded the Telecommunications and Technology Infrastructure Program (TTIP), an effort to provide the support networks and other resources to effectively meet the needs of faculty, students, and staff in the area of computer technology. TTIP was first funded in 1996-97 (California Community Colleges Chancellor's Office [CCCCO], 2001b, p. 53). The *Technology II Strategic Plan 2000-2005* proposed a new framework for TTIP funding, including increased funding for computer technology support on local campuses. Unfortunately, this plan has not received state funding.

In 2000-2001, TTIP provided a total of $44.3 million to California community colleges. Of that amount, $11.8 million went towards Total Cost of Ownership (TCO), a concept developed by the Gartner Group in its analysis of the cost of providing technology to the California Community Colleges. TCO included not only the purchase of computer equipment but also maintenance and ongoing support. Following on the Gartner Group report, the Telecommunications and Technical Advisory Committee of the Chancellor's Office (TTAC) established computer technology baselines as a means to measure the System's progress towards achieving adequate technology resources. According to the TTAC *Total Cost of Ownership Benchmarking Report 2000-01*, 53% of colleges responding to the benchmarking survey indicated that the ratio of student computers to students was 1:12 or less. An additional 42% of the colleges had a ratio between 1:20 and 1:12. While this is still far short of

the current ratio in the California K-12 System of 1:6, 95% of colleges in the System meet the minimum baseline of 1:20 (CCCCO, 2001c, p. 36).

While colleges have expanded student access to computers, dedicated system-wide support for computer technology has been woefully inadequate. Only 22% of funds expended on computer technology came from TTIP (most of which is earmarked to be cut in 2003-2004). Seventeen percent came from Instructional Equipment (which was cut in 2000-2001, partially restored in 2001-2002, and now earmarked for a midyear cut in 2003). The bulk of funds for technology, 47% of all funds expended, came from the general apportionment (CCCCO, 2001c, p. 29).

ACCESS FOR THE DISABLED

While the 2002 NTIA report states that Internet access and computer ownership has risen for almost all groups, the simple issue of access continues to be of great concern for people with disabilities. People with mental or physical disabilities such as blindness, deafness, or difficulty walking, typing, or leaving home, are less likely than those without such disabilities to use computers or the Internet. Americans with disabilities are less than half as likely as their non-disabled counterparts to own a computer, and they are about one quarter as likely to use the Internet (Kaye, 2000, p. 14).

This situation exists even though educational institutions and businesses are paying more attention to the Americans with Disabilities Act (ADA) requirements for "effective communication" and the provision of "auxiliary aids and services" and "reasonable accommodations" to achieve access to computer technology and the Internet environment. As institutions and businesses work to meet ADA requirements, the U.S. Commission on Civil Rights makes it clear that because of the ongoing duty to remove barriers, it is not enough to respond on an ad-hoc basis to individual requests for accommodation. There is an affirmative duty to develop a comprehensive policy for providing access to people with disabilities (U. S. Commission on Civil Rights, 1998).

ACCESS FOR THE DISABLED: COMMUNITY COLLEGE EFFORTS

The California Community Colleges have made some inroads into addressing the specific concerns of access for the disabled. In 1999 and 2000, the Chancellor's Office convened task forces that produced a set of accessibility guidelines (Distance Education Access Guidelines and Alternative Media Access Guidelines) for implementation of distance education courses (CCCCO, 1999). The guidelines address accessibility with print, audio, and visual media, including use of audio files, video files, and the World Wide Web. These guidelines have provided clear direction to colleges in their distance education program development.

The Chancellor's Office Telecommunications and Technical Advisory Committee (TTAC) has established a baseline standard that 10% of student computers be equipped with additional equipment and software to enable "students with visual impairments access to print and computer-based information" (CCCCO, 2001b, p. 59). This specification stemmed from a 1996 US Department of Education, Office of Civil Rights (OCR) compliance review of the System under Title

II and Section 504 of the Americans with Disabilities Act of 1990. The TTIP benchmarking survey showed that only an average of 5.8% of student computers have been equipped with assistive technology, and only 9% of colleges have reached the baseline of 10% (CCCCO, 2001c, p. 36).

The Academic Senate has shown its concern in the area of access in a Spring 2001 Session resolution:

> ***11.02 S01 Web Accessibility***
>
> *Resolved, That the Academic Senate for California Community Colleges ensure that its website is in compliance with recognized accessibility guidelines;*
>
> *Resolved, That the Academic Senate for California Community Colleges urge local senates to ensure that their college instructional websites are in compliance with recognized accessibility guidelines; and*
>
> *Resolved, That the Academic Senate for California Community Colleges urge all those offering faculty training in website development (such as the Academic Senate Summer Technology Institute, @ONE, the California Virtual College Regional Training Center and the High Technology Center Training Unit) to incorporate recognized accessibility guidelines as a central feature of their training.*

As part of the response to the OCR compliance review, in 2000-2001, the Chancellor's Office provided approximately $70,000 in Disabled Students Programs and Services (DSPS) funding to each college to hire a hi-tech specialist whose function is to monitor and evaluate the accessibility of college technological resources, particularly college websites and online course materials, for persons with disabilities. These specialists are currently providing much-needed guidance and perspective on the issues of accessibility, serving on campus website advisory committees and curriculum review for online courses. In the same funding year, the Chancellor's Office also provided slightly under $5,500 for Braille equipment. Savings on the equipment needed to produce Braille documents were secured through the Foundation for California Community Colleges.

The Chancellor's Office has also been working with districts to comply with the 1998 amendment to the Rehabilitation Act, commonly known as Section 508. This amendment requires that all government electronic and technology purchases are accessible to people with disabilities.

ACCESS AND THE CHANGING DEFINITION OF THE DIGITAL DIVIDE

Although the Federal Government has recently issued reports showing that differential access between socio-economic groups is no longer significant, the discussion of the Digital Divide has moved beyond the concept of simple access to the quality of access. In 1998, Novak and Hoffman identified student computer access and Internet use as being quite different from that of the general population and focused their study specifically on African American students. They suggested that in the general population, whites had greater access to the Internet than African Americans. Students however, presumably had equal access at school, according to the authors. As the authors disaggregated student data, they found that students exhibited the highest levels of Web use at all of the study's defined access points. White and African American students appeared to access the Web equally from school. Nevertheless, white students appeared to be finding additional means of accessing the Internet when compared to African American students. White students were able to take advantage of access outside of school, including homes

of friends and relatives with home computers, and libraries and community centers with Internet access. Therefore, the authors strongly suggested, "in terms of students' use of the Web … race matters" (p. 7).

Novak and Hoffman (1998), therefore, identified the importance of not only creating access points in libraries, community centers, and other non-traditional places, but also finding ways to encourage use by African Americans at these locations. Equal access in the school setting did not necessarily equate to equity of access. For a variety of reasons, African American students were not accessing Internet resources as readily as other student populations. Therefore, Novak and Hoffman recommended that programs be established to encourage home computer ownership and the adoption of other inexpensive devices that enabled Internet access, especially for African Americans (p. 9).

A study by the Tomás Rivera Policy Institute (2002) on Latinos and information technology showed similar access issues for the Latino community. While access to computers and the Internet for schools with large numbers of minority students is approaching that of schools with few minority students, access in the home remains lower for Latinos at 40% than for the general population at 56.6%. For the Latino community, language is also an issue. The availability of Internet content in Spanish strongly determines use of the Internet, especially among first generation Latino immigrants with lower levels of education. Among Latinos surveyed, 10% of respondents indicated that lack of content in Spanish is a drawback to use of the Internet (p. 5). Finally, even when Latinos have access in the home, family size affects the quality of access. The Bureau of Labor Statistics shows the average non-Latino family size to be 2.4, while Latino families average 3.2 persons. With larger families, individual Latino family members have less time with home computer technology.

According to Larry Irving (cited in Young, 2002), a technology consultant who is a former U.S. assistant secretary of commerce, "As you start walking through the statistics, it's pretty clear that there's still a gap. And while growth is fastest among low-income [people] and African Americans and Hispanics, the gap is actually getting wider because they started at a lower starting point." He adds,

> *I have a real fear that the divide that exists on colleges could be exacerbated. You have major universities that are getting involved in the next-generation Internet, while you have tribal colleges, minority-serving institutions, [and] poor rural colleges that really aren't online and haven't figured out a way to elevate themselves into what the mainstream of our elite colleges are doing with regard to how to use technology for teaching, for learning, for connecting their faculty, and for a host of other purposes.*

A Pew Research Center report (Spooner, 2002) shows that Asians are among the most highly-connected of all ethnic groups. Seventy-five percent of English-speaking Asian-American adults use the Internet compared to 58% of whites, 43% of African Americans, and 50% of English-speaking Latinos (p. 2). When focusing on school-related activities, Asian-Americans are also ahead of other ethnic groups. On a daily basis, 20% use the Internet for school research or job training compared to 10% or less for African Americans, Latinos, and whites (p. 8).

Data for Native Americans is generally lacking, a deficiency cited by the Digital Divide Network in its review of the reports from the NTIA (Twist, 2003). According to Census staff interviewed for the review, the sample size for American Indians is "too small to accurately represent all of Indian Country."

While community colleges and other public institutions such as libraries have increased general access, there is less that these institutions have been

able to do to affect the quality of access. Individual colleges have opened computer centers with longer hours. College bookstores and the Foundation for California Community Colleges have worked with vendors to provide computer systems and software to students at prices lower than normally available to the public.

When discussing access to computer technology, there is also the issue of being able to use the computer technology once it is available for use. In his article, "Reconceptualizing the Digital Divide," Warschauer (2002) cites a project to provide access to computers to street children in India. No formal education was provided, and the children were left to explore the computers and learn on their own. While the children in fact used the computers, a review of the children's activities showed that they primarily played games and drew pictures. In other words, if you build it, they will come, but will they know how to do what will benefit them?

Warschauer (2002) suggests that the focus should be on the acquisition of literacy rather than on access and ownership. Implicit in this concept is the issue of information competency, an area which the Academic Senate has been addressing for many years. It its paper, Information Competency in the California Community Colleges, the Academic Senate (1998) has defined information competency as:

> *the ability to find, evaluate, use, and communicate information in all its various formats. It combines aspects of library literacy, research methods and technological literacy. Information competency includes consideration of the ethical and legal implications of information and requires the application of both critical thinking and communication skills.*

The Academic Senate goes on in the paper to emphasize that information competency is a critical skill for student success. The paper outlines key components to information competency:

- State a research question, problem, or issue.
- Determine information requirements in various disciplines for the research questions, problems, or issues.
- Use information technology tools to locate and retrieve relevant information.
- Organize information.
- Analyze and evaluate information.
- Communicate using a variety of information technologies.
- Understand the ethical and legal issues surrounding information and information technology.
- Apply the skills gained in information competency to enable lifelong learning.

While the paper stresses the vital importance of information competency for students, the paper does not neglect the very important role that faculty must play in instilling these skills. Therefore, it is also essential that faculty have the appropriate computer skills to be able to integrate these components into their curriculum.

ACCESS: THE ROLE OF FACULTY

The Academic Senate has recognized that if faculty are to help students acquire information competency, faculty, too, must be properly trained. In Fall 1999, the senate passed the following resolution:

> ***11.04 F99 TTIP Faculty Training Funding***
>
> *Therefore be it resolved that the Academic Senate for California Community Colleges urge the*

> *Telecommunication and Technology Advisory Committee (TTAC) of the Chancellor's Office to include provisions for ongoing funding for faculty training and professional development in Telecommunications and Technology Infrastructure Program (TTIP) expenditures.*

In Spring 2000, a resolution in the same vein was passed:

> ***11.04 S00 Faculty Professional Development in Technology***
>
> *Therefore be it resolved that the Academic Senate for California Community Colleges urge local senates to maintain their statutory role in overseeing faculty professional development, including faculty training in the use of technology, and*
>
> *Be it further resolved that the Academic Senate for California Community Colleges urge local senates to regard campus or district technology committees, or any such groups, as advisory to the local senate's professional development representatives rather than primary policy makers for faculty activities, and*
>
> *Be it finally resolved that the Academic Senate for California Community Colleges urge local senates to guard against the argument that lack of technical expertise among faculty justifies bypassing the local senate's right to recommend policy for faculty professional development.*

In its paper, *Information Competency: Challenges and Strategies for Development,* the Academic Senate emphasizes that "before information competency of students can be ensured, information competency of faculty must be ensured" (Academic Senate for California Community Colleges [ASCCC], 2002). Howard Strauss (2002, p. 16) of Princeton University echoes this need when he states,

> *We also need to teach teachers how to use the current technology tools to enable them to apply those tools to the pedagogical principles they've learned. The skills acquired by teachers need to be assessed and remediated as necessary and kept current. Students get no gain from a smart [technologically-enhanced] classroom or smart learning space when the teacher in that space lacks the ability to teach or use the technology effectively.*

For students to learn and use the Internet successfully, there must be adequate teacher preparation for the application and use of Internet technologies in the curriculum. Sally McLaren (2002) notes that many teachers are not proficient in the use of computer equipment, software, or appropriate instructional pedagogies. She believes this is the consequence of insufficient training and experience in the use of computer equipment and classroom presentation equipment, and the lack of time necessary for teachers to acquire relevant knowledge, skills, and abilities. Along with promoting programs to increase home computer ownership and use among the different ethnic groups, programs must be established to enhance teachers' abilities to access and use computers in their teaching if the Digital Divide is ever to be bridged. This concern over adequate teacher preparation is echoed in other reports that we reviewed (Tomás Rivera Policy Institute, 2002; Levin, 2002).

When we look at the issue of access in this regard, the State of California's response has once again been woefully inadequate. Faculty and staff development funds, first allocated in 1989, remained static for thirteen years until being eliminated altogether in 2002. The $8 million dollars specifically earmarked for computer technology training under TTIP was similarly eliminated in 2002, resulting in the current situation where there are no System funds specifically targeted to train or update faculty in the use of computer technology.

COMPUTER TECHNOLOGY: IMPROVING STUDENT ACCESS TO INSTRUCTION AND SERVICES

In the previous sections, we looked at whether or not the California Community Colleges System had increased student access to computer technology. Now we turn to the question of whether or not computer technology has improved student access to instruction and services.

Between 2000 and 2005, 500,000 new students are expected to enter the California Community College System (CCCCO, 2001a, p. 1). Given that there are insufficient state resources to build or expand physical facilities to accommodate this increase, the System turned to the use of distance education as a partial means of accommodating enrollment growth. TTIP funding under both the *Technology I* and *Technology II Strategic Plans* has emphasized the need to develop an infrastructure to support increased capabilities to offer courses via distance education.

The *Technology II Strategic Plan 2000-2005* specifically addresses the issue of access in its goals.

> *Students will be able to progress into and through the college experience more readily with the assistance of information technology. Students will utilize technology for online access to college admissions, support services, faculty, classes, and libraries, in a manner that is fully accessible for all students, including students with disabilities. Emerging technologies and learning practices extend and expand opportunities to meet the educational needs of unserved and underserved populations. Faculty will be better able to integrate technology into instruction to provide alternate educational access to students through distance learning. (CCCCO, 2000, p. 7)*

Central to this effort has been TTIP support for the California Community Colleges' high-speed connection to the Internet through collaboration with the California State University System, known as 4CNET. ''4CNet Goals reflect the need of the CSU/CCC to support the academic missions and institutional needs of campuses by increasing the intellectual productivity of students, faculty, and staff in their respective roles as learners, teachers, researchers, and knowledge workers" (CCCCO, 2000, p. 51). High-speed connectivity to the Internet has been central to the development of online distance education delivery.

TTIP has also dedicated $10 million over five years (1998-2003) to establish the California Community College Satellite Network (CCCSAT), which allows for analog and digital upload and downlink capabilities. Additional funding was also provided so that all campuses in the System would be able to connect to CCCSAT. CCCSAT has established the Community College Network, with a full schedule of educational offerings similar to those available on public television stations. What the System did not foresee was the advent of the Internet and the move to the use of computer technology to provide interactive distance education. Today, with the shift in education away from one-way video, CCCSAT is evaluating the role it is to play in the Community College System. Stipulations in the original grant that the project be self-supporting after five years have been set aside even as the System works on a new grant-cycle for the project.

TTIP funds have also been used to conduct a study exploring the feasibility of having distance education managed centrally on a statewide level, to establish a common online application process for the entire System (CCCApply), and to pilot remote access to library services and materials.

Another significant System project is the California Virtual University (CVU). In recognition of the need to respond to anticipated growth through the use of online delivery, the state gave the California Community College System a five-year $14.5 million grant (1999-2004) to provide regional distance education support centers to aid the System in its development of online delivery. The centers are known as the California Virtual Campuses (CVC).

Now in the fourth year of its grant, the CVC has been instrumental in supporting the development of online instruction in the System. The CVC has also provided accessibility training for online course developers and published guidelines for disabled student access. The CVC has also made agreements with vendors of online course development software to provide licensing for colleges just starting out in online course development. Indeed many courses are offered directly through servers hosted by the CVC. Many faculty have indicated that without the CVC's support, they would not have been able to embark on online course development (CCCCO, 2001d). As of the writing of this paper, the CVC is facing a significant reduction in its funding for the remainder of the grant period and the services provided by the CVC will be severely impacted.

In 2001, the Distance Education Technical Advisory Committee (DETAC) of the Chancellor's Office issued its summative report of seven years of distance education activity. A review of the findings of the report provides some insight into how the System's distance education efforts have increased student access.

According to the DETAC Final Report the number of distance education (DE) students in credit courses increased from 54,524 (1995-1996) to 104,153 (1999-2000). While significant as a measure of DE students alone, as a percentage of the total enrollment in the System, this was actually only an increase in students in DE classes from 2.52% to 3.96% (p 21). Interestingly, enrollment in non-credit DE courses actually declined as a percentage. In 1995-1996, enrollment was 2,681or 0.56% of total non-credit enrollment. By 1999-2000, this had grown to only 3,256, which was only 0.49% of total non-credit enrollment (CCCCO, 2001b, p. 23).

One of the primary goals of distance education was to expand access to students unable to get to a community college. However, as stated in the DETAC report, "Anecdotal evidence from the DE institutional survey suggest that most DE students are also concurrently enrolled in traditional, on-campus classes. The hope that new DE delivery technologies would attract those students living some distance from their community college campuses appears to be unfounded" (CCCCO, 2001b, p. 43). Furthermore, the DETAC report states that 71% of the students surveyed cited convenience as their primary reason for taking DE courses. This suggests that DE efforts have not lived up to their promise of significantly expanding geographical access to community colleges. However, DE can help overcome the significant barriers posed by family demands and work schedules.

Ethnographic information from the student survey, conducted by DETAC and referenced above, cannot be used for comparisons to the general student population since the survey respondents were self-selected. Of the students surveyed in 1999-2000, there were 1,961 responses. Six point seven percent (132 respondents) were African American, 1.3% (26 respondents) were American Indian, 15.6% (305 respondents) were Asian and Pacific Islanders, 60.1% (1,179 respondents) were Caucasian, Non-Hispanic, and 16.3% (319 respondents) were Hispanic (CCCCO, 2001b, p. 43).

Access to instruction is only one area that has been affected by computer technology. Colleges throughout the System have invested heavily to make a variety of student services available online. In addition to the

library catalog services, recent efforts include online applications and registration. Almost all colleges maintain sophisticated web sites that provide catalog and schedule information. Many instructors have created web pages for their courses, providing access to homework assignments, course materials, and grades. Most full-time faculty can be easily reached by e-mail.

While these services are now available online, there is no data currently collected by the System to show whether or not student access to these services has increased. Data from individual districts continues to be sparse. In addition, not all services have had a positive response. The DETAC Final Report reported that only 62% of the distance education students surveyed indicated that they were very or somewhat satisfied with counseling services (CCCCO, 2001b, p. 45). However, it is unclear whether students who were less satisfied felt this way because of the quality of services offered or because of the lack of access to such services.

Another concern that requires further investigation ties in directly with the quality of access issues mentioned above. While it is true that all community college students can access this expanding array of services through computers available on campus, there remains the question of who can access these services from home, late at night, or on holidays and weekends, and whether there is a disproportionate impact on specific ethnic or socio-economic groups. Further research is needed to show whether the expansion into online delivery of services has inadvertently created a new area of disproportionate lack of access for students of lower socio-economic groups.

COMPUTER TECHNOLOGY: IMPROVING STUDENT SUCCESS

Before we ask how computer technology has improved student success for the California Community Colleges, we face the question of how to measure student success. In the *Technology II Strategic Plan 2000-2005*, the plan lists the following student success objectives:

a. Provide ongoing training for faculty in the use of the information technology tools and provide centralized Web and multimedia hosting sites for all California Community Colleges in one of two course management systems.

b. Expand access to multi-media classrooms and student computer laboratories.

c. Establish and support a baseline of technology infrastructure at every college that will ensure that all students, regardless of disabilities, will receive the benefits from such technology in their student services and instructional programs.

d. Improve faculty and student access to automated library and learning resources including electronic information databases and administrative services.

e. Develop a centralized Web-based resource center for materials, resources and processes with full faculty access to support the best practices in curriculum and instruction.

f. Integrate technology into college offices and support areas to ensure that staff have the tools required to deliver services to students and faculty efficiently and effectively.

g. Improve and maintain systemwide networks to support telecommunication needs of the System; develop and support a technology planning guide and fund the local development of technology plans.

h. Establish a new leadership role in the California Community Colleges Chancellor's Office to carry out the body of work and expectations that are defined in this Tech II Plan (CCCCO, 2000, p. 8).

The objectives in the plan are clearly linked to the student experience in California community colleges, but these objectives in and of themselves do not measure student success. Instead, let us turn to the measurements required for the development of Student Equity Plans, required by the Board of Governors in their Student Equity Policy of 1992. The intent of achieving student equity is to ensure that the composition of students who enroll, are retained, transfer, or achieve their occupational goals mirrors the diversity of the population of the college's service area. Since this paper is attempting to assess the impact on socio-economic and ethnic groups and the disabled, the Student Equity measures are particularly germane.

As summarized in the Academic Senate paper, *Student Equity: Guidelines for Developing a Plan* (ASCCC, 2002), there are five student success indicators that need to be measured:

1. Access
2. Course completion
3. Degree and certificate completion
4. ESL and basic skills completion
5. Transfer rate

The paper suggests that such data should be easily available through college/district accountability and matriculation reports. When the California Legislature first charged the community colleges to establish Student Equity Plans in 1991, no funding to support implementation of local plans came through, and colleges had little incentive to pursue Student Equity efforts. More recently, the Board of Governors has renewed attention to Student Equity Plans and the need to address issues of equity.

The Partnership for Excellence brought additional funds to the California Community College System. In order to justify the expenditure, the System was to be measured on indicators similar to those for Student Equity:

1. Transfer
2. Degrees and Certificates
3. Successful Course Completion
4. Workforce Development
5. Basic Skills

Data gathered through Partnership for Excellence reports show what progress the System is making in these indicators, and information for the various ethnic groups is available for certain of the indicators. In the area of degrees and certificates, the number of degrees and certificates awarded has increased for all groups over the six year period of 1996-2001 (data provided at the request of the Technology Committee by the Vice Chancellor for Technology, Research and Information Services).

	1996		2002	
	Certificate	Degree	Certificate	Degree
Asian	2170	5062	5041	8534
African American	1479	2262	2942	4085
Filipino	688	1183	1618	2510
Hispanic	3169	5153	8617	14516
Native American	297	348	449	576
Other Non-White	233	496	510	1248
Pacific Islander	92	173	217	367
Unknown	672	955	2081	3562
White	10781	16902	17202	28124
Total	19581	32534	38677	63522

The above table shows that the number of degrees and certificates awarded has almost doubled for every group in the last six years.

In the area of transfer, the numbers are less conclusive. The number of women transferring to UC has increased for most groups, while the number of women transferring to CSU has increased only for Latinas. The number of men transferring to both UC and CSU appears to have declined for all groups except Latinos.

		UC		CSU	
		1996	2001	1996	2001
Asian/Pacific Islander	Men	1153	1005	2118	1774
	Women	975	1145	2403	2014
African American	Men	127	117	795	575
	Women	122	149	1175	983
Filipino	Men	143	145	586	504
	Women	139	169	639	639
Latino	Men	531	618	2496	2563
	Unknown	n/a	1	n/a	n/a
	Women	637	853	3248	4019
Native American	Men	53	29	187	136
	Women	46	46	233	162
No Response	Men	216	377	1544	1655
	Unknown	n/a	32	n/a	n/a
	Women	220	376	1688	2126
Non-Resident Alien	Men	249	313	450	599
	Women	220	328	448	708
Other	Men	84	112	503	561
	Women	82	121	568	838
White	Men	1845	1881	5728	5186
	Unknown	n/a	1	n/a	n/a
	Women	1956	2064	7560	7334
Total		8798	9882	32369	32376

It is important to note that data for in-state private institutions and out-of-state institutions are not included in the data above. The 2002 Chancellor's Office progress report on transfer showed that of a specific cohort of students tracked, 38.7% of African American and 23.1% of Native American transfers went to private or out-of-state institutions (p. 33), percentages that would clearly alter the numbers given above.

While the data show that the System is making some progress in the Partnership for Excellence indicators, the data is not conclusive, nor is there any way to link the data to the infusion of computer technology in the System. In addition, in the area of transfer, factors such as the capacity of receiving institutions and impacted majors play a significant role in transfer rates and remain outside the control of the community colleges.

Even the DETAC Final Report does not provide much information since DE encompasses more than just online instruction. Successful completion rates for all the years studied were lower than for non-DE courses for credit. For non-credit courses, the completion rate remains suspiciously high at approximately 92% until 1999-2000, when there is a precipitous drop in the completion rate to 60%. Interestingly, this drop accompanied a significant increase in the use of the Internet for DE, with courses increasing from 45 the previous year to 1,101 (CCCCO, 2001b, p. 20).

While currently the data is not available to show that the investment in computer technology has contributed to increased student success, the investment has been necessary for student success simply because the educated citizenry of the United States needs to be able to use computer technology for many jobs and to access information. In many vocational programs such as drafting and electronics, use of computer technology is inextricably tied to current workplace requirements. The number of full-time faculty in the California community colleges hired for computer-related fields (computer information science, programming, systems analysis, data processing, maintenance technician) increased from 1,629 to 4,602 between 1996 and 2002 (data provided at the request of the Technology Committee by the Vice Chancellor for Technology, Research and Information Services). This massive growth in computer-related programs shows the increased demand in the workplace. In addition, there is no question that students like to use computers. Computer labs on campuses are crowded with students. In the classroom, use of multimedia and computer presentations addresses multiple learning styles and modalities. In the end, computer technology, like other technologies such as overhead projectors, microscopes, and fitness equipment, is not easily subject to a clear causal relationship with student success. It is clearly unthinkable for computer technology not to be a part of the community college educational experience.

CONCLUSION AND RECOMMENDATIONS

Over the last seven years, the California Community Colleges have made a significant investment in computer technology. The System has contributed to increased access for all students and in particular for those who do not have the resources to own their own computers and for those who are disabled. While it is not possible to show a direct causal relationship between the investment in computer technology and student success, the System continues to strive to improve student success throughout the state, and computer technology is likely to be playing a part in that success.

As the California Community College System continues its commitment to computer technology resources for its colleges, the System needs to remain ever mindful that the ultimate goal of this investment is student access and success. With this mission in mind, the Academic Senate makes the following recommendations.

SYSTEM-WIDE

That the Academic Senate

- continue to emphasize that system-wide technology planning includes many academic and professional issues
- continue to advocate for increased funding for faculty development in order to prepare faculty to effectively use appropriate technology in instruction
- continue to advocate for the technology resources needed to provide access to a quality education for all students
- continue to advocate for resources necessary to gather the data needed on Student Equity indicators related to technology-mediated instruction
- call on the System to conduct/support further research on the efficacy of distance education
- call on the System to conduct further research on access to computer technology by all students
- call on the System to conduct further research on access to and the efficacy of online services by all students

LOCAL

That local senates

- work through their college/district technology committees to make sure that local technology plans are part of the budget and planning process, and that they address the issues of student access and success
- work through their college/district technology/ web site committees and with local high-tech specialists to make sure that ADA accessibility is being addressed in technology decisions
- encourage faculty to address ADA access issues with respect to their own web pages, using the guidelines provided by the World Wide Web Consortium (W3C) at http://www.w3c.org
- incorporate issues of equitable access to computer technology into Student Equity Plans
- work to ensure that Distance Education students have appropriate access to quality student services such as advisement and counseling services
- work with their faculty to review curriculum in order to assure that key components of information competency are addressed
- emphasize the use of faculty development funds to train faculty in the educational uses of information competency.

OTHER TECHNOLOGY PAPERS BY THE ACADEMIC SENATE

Academic Senate for California Community Colleges. (2000). *Technology in Education: A Summary of Practical Policy and Workload Language* [Electronic Version]. Sacramento, CA: Academic Senate for California Community Colleges. Retrieved February 24, 2003, from http://www.academicsenate.cc.ca.us/Publications/Papers/Technology_educationpolicysummary.htm.

Academic Senate for California Community Colleges. (2000). *Guidelines on Minimum Standards for College Technology* [Electronic Version]. Sacramento, CA: Academic Senate for California Community Colleges. Retrieved February 24, 2003, from http://www.academicsenate.cc.ca.us/Publications/Papers/Guidelines_minimum_standards.html.

Academic Senate for California Community Colleges. (1999). *Academic Freedom, Privacy, Copyright and Fair Use in a Technological World* [Electronic Version]. Sacramento, CA: Academic Senate for California Community Colleges. Retrieved February 24, 2003, from http://www.academicsenate.cc.ca.us/Publications/Papers/Intellectual.htm.

Academic Senate for California Community Colleges. (1999). *Guidelines for Good Practice: Effective Instructor-Student Contact in Distance Learning* [Electronic Version]. Sacramento, CA: Academic Senate for California Community Colleges. Retrieved February 24, 2003, from http://www.academicsenate.cc.ca.us/Publications/Papers/good_practice_distance.html.

Academic Senate for California Community Colleges. (1997). *Guidelines for Good Practice: Technology Mediated Instruction* [Electronic Version]. Sacramento, CA: Academic Senate for California Community Colleges. Retrieved February 24, 2003, from http://www.academicsenate.cc.ca.us/Publications/Papers/tech_mediated_instruction.html.

REFERENCES

Academic Senate for California Community Colleges. (2002). *Student Equity: Guidelines for Developing a Plan* [Electronic Version]. Sacramento, CA: Academic Senate for California Community Colleges. Retrieved January 24, 2003, from http://www.academicsenate.cc.ca.us/Publications/Papers/StudentEquity2002.htm.

Academic Senate for California Community Colleges. (1998). *Information Competency in the California Community Colleges* [Electronic Version]. Sacramento, CA: Academic Senate for California Community Colleges. Retrieved January 24, 2003, from http://www.academicsenate.cc.ca.us/Publications/Papers/Info_competency.html.

Academic Senate for California Community Colleges. (2002). *Information Competency: Challenges and Strategies for Development.* Sacramento, CA: Academic Senate for California Community Colleges.

Chancellor's Office California Community Colleges. (1999). *Distance Education Accessibility Guidelines* [Electronic Version]. Sacramento, CA: California Community Colleges Chancellor's Office. Retrieved September 26, 2002, from http://www.htctu.fhda.edu/dlguidelines/final%20dl%20guidelines.htm.

Chancellor's Office California Community Colleges. (2000) *Technology II Strategic Plan 2000-2005*. Sacramento, CA: California Community Colleges Chancellor's Office.

Chancellor's Office California Community Colleges. (200la). *Report on Local Investments of Partnership Funds: Investments for 20000-2001*. Sacramento, CA: California Community Colleges Chancellor's Office.

Chancellor's Office California Community Colleges, Educational Services and Economic Development Division. (2001b). *Distance Education Study Report: Fiscal Years 1995-1996 to 1999-2000*. Sacramento, CA: California Community Colleges Chancellor's Office.

Chancellor's Office California Community Colleges. (2001c). *The Implementation of the California Community Colleges Telecommunications and Technology Infrastructure Program 2000-2001*. Sacramento, CA: California Community Colleges Chancellor's Office.

Chancellor's Office California Community Colleges, Educational Services and Economic Development Division. (2001d). *California Virtual University Legislative Progress Report Fiscal Year 2000-2001*. Sacramento, CA: California Community Colleges Chancellor's Office.

Chancellor's Office California Community Colleges, Student Services and Special Programs Division and the Technology, Research, and Information Systems Division. (2002). *Transfer Capacity and Readiness in the California Community Colleges: A Progress Report to the Legislature*. Sacramento, CA: California Community Colleges Chancellor's Office. Retrieved March 4, 2003, from http://www.cccco.edu/divisions/transfer/attachments/trans_cap_%20readi_ccc.pdf.

Community College Foundation, The. (2002). *Community connect: Bridging the digital divide*. Sacramento, CA: The Community College Foundation.

Kaye, H.S. (2000). Computer and Internet Use Among People with Disabilities. *Disability Statistics Report (13)*. Washington DC: U.S. Department of Education, National Institute on Disability and Rehabilitation Research.

Levin, D. and S. Arafeh. (2002, August 14). *The Digital Disconnect: The Widening Gap Between Internet-Savvy Students and Their Schools.* Washington, D.C.: Pew Internet & American Life Project. Retrieved January 21, 2003, from http://www.pewinternet.org/rep;orts/pdfs/PIP_Schools_Internet_Report.pdf.

McLaren, S. (2002). The digital divide in the classroom. *Child Research Net.* Retrieved September 26, 2002, from http://www.childresearch.net/cgi-bin/topics/column.pl?no=00139&page=1.

National Telecommunications and Information Administration, U.S. Department of Commerce. (1995). *Falling through the Net: A Survey of the 'Have Nots' in Rural and Urban America* [Electronic Version]. Washington, D.C.: U.S. Government Printing Office. Retrieved February 25, 2003, from http://www.ntia.doc.gov/ntiahome/fallingthru.html.

National Telecommunications and Information Administration, U.S. Department of Commerce. (1998). *Falling through the Net II: New Data on the Digital Divide* [Electronic Version]. Washington, D.C.: U.S. Government Printing Office. Retrieved February 25, 2003, from http://www.ntia.doc.gov/ntiahome/net2/falling.html.

National Telecommunications and Information Administration, U.S. Department of Commerce. (2002). *A Nation online: How Americans are expanding their use of the Internet* [Electronic Version]. Washington, D.C.: U.S. Government Printing Office. Retrieved February 25, 2003, from http://www.ntia.doc.gov/ntiahome/dn/anationonline2.pdf.

Novak, T. P. & Hoffman, D. L. (1998, April 17). Bridging the racial divide on the Internet. Retrieved September 26, 2002, from http://www2000.ogsm.vanderbilt.edu/research/papers/html/manuscripts/race/science.html.

Spooner, T. (2001, December 12). *Asian-Americans and the Internet: The young and the connected.* Washington, D.C.: Pew Internet & American Life Project. Retrieved January 21, 2003, from http://www.pewinternet.org/reports/pdfs/PIP_Asians_Report.pdf.

Strauss, H. (2002, September). New Learning Spaces: Smart Learners, Not Smart Classrooms. *Syllabus, 16(2)*, 13-17.

Tomás Rivera Policy Institute. (2002). *Latinos and Information Technology: The Promise and the Challenge*. Claremont, CA: IBM Hispanic Digital Divide Task Force.

Twist, K. (2003). *A Nation Online, But Where Are the Indians?* Digital Divide Network. Retrieved January 21, 2003, from http://www.digitaldividenetwork.org/content/stories/index.cfm?key=215.

United States Commission on Civil Rights. (1998). *Helping State and Local Governments Comply with the ADA: An Assessment of How the United States Department of Justice Is Enforcing Title II, Subpart A, of the Americans with Disabilities Act* [Electronic Version]. Washington, DC: U.S. Government Printing Office. Retrieved April 6, 2002, from http://www.usccr.gov/.

Warschauer, M. (2002). Reconceptualizing the Digital Divide. *First Monday* [Electronic Version]. Retrieved September 9, 2002, from http://www.firstmonday.dk/issues/issue7_7/warschauer/index.html.

Young, J. (2002, June 4). Technology Gap Among Colleges Perpetuates 'Digital Divide' in Society, Expert Warns. *The Chronicle of Higher Education* [Electronic Version]. Retrieved January 21, 2003, from http://chronicle.com/free/2002/06/2002060402t.htm.