How Does Technology Affect Access In Postsecondary Education?

What Do We Really Know?

Report of the National Postsecondary Education Cooperative Working Group on Access-Technology

NATIONAL POSTSECONDARY EDUCATION COOPERATIVE
NPEC

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The National Postsecondary Education Cooperative (NPEC)

NPEC is a voluntary partnership of representatives from postsecondary institutions, associations, government agencies, states, and other organizations with a major interest in postsecondary education. Its mission is to promote the quality, comparability, and utility of postsecondary education data and information that support policy development at the federal, state, and institution levels. The National Center for Education Statistics (NCES) established NPEC and provides resources to support its activities. NPEC receives guidance for its activities from various working groups and committees that are composed of individuals from throughout the United States.

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September 2004

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Suggested Citation

National Postsecondary Education Cooperative. *How Does Technology Affect Access in Postsecondary Education? What Do We Really Know?* (NPEC 2004–831), prepared by Ronald A. Phipps for the National Postsecondary Education Cooperative Working Group on Access-Technology. Washington, DC: 2004.

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FOREWORD

This report is a product of the National Postsecondary Education Cooperative (NPEC). It was undertaken as part of NPEC's ongoing efforts to explore various dimensions of access to postsecondary education.

A working group was brought together to provide guidance to a project that would examine the relationship between technology and access to postsecondary education. The resulting study identified four basic themes: technology and access to postsecondary education in general; access to technology-based learning; preparation for using technology; and the effectiveness of technology in learning. The study reviewed the more recent literature concerning each of these themes and, where possible, carried out some original analyses of available NCES and other data to provide additional insight into some of the themes. This study also identified areas where there were insufficient data and information to address important issues within these themes. It concludes with some recommendations for additional data collection through NCES surveys.

This report was reviewed and accepted by the NPEC Executive Committee as meeting NPEC's standards and policies. We hope users of this document will find it informative and useful as they consider the role of technology in the availability and delivery of postsecondary education.

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ACKNOWLEDGMENTS

The National Postsecondary Education Cooperative (NPEC) would like to take this opportunity to thank the members of the Working Group for contributing their time, enthusiasm, insights, and expertise to this project and this report. We would also like to thank all those individuals who reviewed this report. They included Brenda Albright, Executive Director of NPEC and members of the NPEC Executive Committee; Roz Korb, Nancy Borkow, and Dennis Carroll of NCES; Denise Glover and Atsushi Miyaoka of Westat; and the following individuals who were asked to provide an independent review of the report:

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EXECUTIVE SUMMARY

Because knowledge-based economies, like that of the United States, require increasing levels of education and training, augmenting access to postsecondary education is an issue of significant importance to the nation. Technology, particularly the Internet, has broadened opportunities for students to participate in postsecondary education considerably. Thousands of online courses are now available, and an increasing number of on-campus courses possess a technology component. Many colleges and universities are finding the Internet to be an effective tool for use with their admissions programs. In addition, education and training through the Internet is becoming big business worldwide.

These developments raise an important policy question. Does technology expand or serve as a barrier to access to postsecondary education, particularly to underrepresented groups? Put another way, has the advent of technology in colleges and universities and other emerging postsecondary education providers helped or hindered the ability of certain classes of people—such as racial/ethnic minority and low-income groups—from enjoying the benefits of education beyond high school?

These questions are becoming increasingly important—which prompted the National Postsecondary Education Cooperative (NPEC) to attempt to answer them. Thus, NPEC identified the relationship of access to postsecondary education and the role of technology as an important strategic area for study. This report provides commentary on a literature review of some 120 materials published since 1990 that addressed access to postsecondary education and the role of technology. In addition to the literature review, new analyses of national data were conducted to expand and further inform the knowledge base. Finally, the author offers recommendations for further actions, including revisions to current national surveys.

To provide a coherent framework for discussing this topic, four basic themes were identified: (1) access to postsecondary education in general; (2) access to technology-based learning; (3) preparation for using technology, and (4) effectiveness of technology in the learning. The following are the major highlights within each theme.

Theme I: Access to Postsecondary Education in General

This theme addresses the degree to which technology has facilitated the opportunity for students to enroll in postsecondary education.

- Technology has expanded the ability of students to participate in postsecondary education (Waits and Lewis 2003). About 127,400 distance education courses were offered in 2001–02, and there were about 3.1 million enrollments in distance education. Over one-half of all postsecondary education institutions offered distance education, and another 12 percent planned to offer distance education in the next 3 years.

- Colleges and universities are taking advantage of the Internet to enhance the admissions process and give potential students the opportunity to apply online (Green 1999).

- Technology is opening up new markets of potential students without significantly diminishing the number of students who would enroll in traditional colleges and universities (Jewett 1997a, b, c).

- Some have suggested that the federal student financial aid system is a barrier to the ability of technology to enhance access to postsecondary education. The U.S. House of Representatives passed a bill to limit regulations that inhibit students from participating in distance education (Carnevale 2001). The bill would, for some institutions, effectively eliminate the 50-percent rule, which restricts access to aid by institutions that enroll more than half their students or offer more than half their courses in distance education. It would also change the 12-hour rule, which requires certain institutions to offer a minimum of 12 hours of course work a week to be eligible for federal financial aid. The bill stalled in the Senate. However, since the 12-hour rule is a federal regulation and not a statute, the U.S. Department of Education issued a final regulation that eliminated this financial-aid restriction and replaced it with a regulation that institutions must offer at least 1 day of instruction a week to qualify for aid. The Department also urged the Congress to revise or eliminate the 50-percent rule (Carnevale 2003).

Theme II: Access to Technology-Based Learning

This theme addresses the extent to which postsecondary education students have access to technology-based learning. The term "digital divide," which refers to the perceived gap between those who have access to the latest technologies and those who do not, is a useful framework for this discussion. Digital divide can pertain to households and individuals or institutions.

- The evidence regarding whether there is a digital divide for households and individuals is somewhat mixed (National Telecommunications and Information Administration 2000). Recent data suggest that the overall level of a digital divide in the United States is rapidly decreasing. The rate of growth of Internet use is currently 2 million new Internet users per month, more than half the nation is online, and about two-thirds of the population use computers. Despite these encouraging data, the digital divide still remains, or has expanded slightly for some groups, particularly Blacks and Hispanics. Individuals 50 years and older are among the least likely to use the Internet, and two-parent households are nearly twice as likely to have Internet access as single-parent households. Also, people with a disability are only half as likely to have access to the Internet as those without a disability.

- Several analysts question whether or not there is an individual or household digital divide (Fattah 2000). The real divide, some say, is not about access but relevance. Low literacy levels are a major hindrance; the more mundane tasks of using a mouse and working on a keyboard are problems as well. The dearth of germane information, literacy barriers, and limited diversity of content are significant barriers to getting lower income users online.

- Many industry watchers have argued that a "post-PC" era, characterized by numerous computing and communication alternatives, is coming. One analyst predicted that in less than 10 years since the Internet became generally available to households, more than two-thirds of all families may be connected to the Internet at home. By contrast, 75 years elapsed between the invention of the telephone and its spread to two-thirds of American homes (Crandall 2001).

- Focusing upon the institutional digital divide, an institution's control and enrollment are closely associated with its tendency to offer distance learning. In general, public institutions are more likely to offer distance learning than private institutions, and larger institutions are more likely than smaller institutions to do so (Educause 2000).

- At minority-serving and other institutions, there is no difference in the proportion of faculty engaged in teaching distance education classes. Nevertheless, faculty in Black-serving institutions are less likely than faculty in all other institutions to look favorably upon the quality of their personal computers and local networks, their centralized computer facilities, and the availability of Internet connections.

- There were no significant differences in the percentage of faculty teaching distance education with respect to employment status (full time or part time), race/ethnicity, or gender. However, the percentage of faculty teaching distance education courses was higher in the program area of business compared to the fine arts, humanities, and natural sciences.

- Eight percent of undergraduates and 10 percent of graduate and first-professional students enrolled in distance education courses in 1999–2000. Both undergraduate and graduate/first-professional distance education students tended to be those with family responsibilities and limited time, and to be enrolled part time and working full time. For both undergraduate and graduate/first-professional students, the Internet was the most popular delivery method (Sikora 2002).

Theme III: Preparation for Using Technology

This theme targets the extent to which postsecondary education students are prepared to use technology.

- Ninety-eight percent of the schools had Internet access in 2000, regardless of the poverty concentration of the students, location, or level of the school. While 77 percent of classrooms were connected to the Internet, there were differences in school characteristics. About four out of five schools with low concentrations of poverty were connected to the Internet in classrooms, compared to 60 percent of schools with high concentrations of poverty. The ratio of students to instructional computers in public school had decreased to 5 to 1, the ratio that many experts consider a reasonable level for the effective use of computers. The ratio per computer *with Internet access* was 7. But, again, differences remain. Schools with the highest concentration of poverty had nine students per computer with Internet access, compared to six in schools with the lowest poverty concentration (National Center for Education Statistics 2000a).

- In 2000, over half of public schools with access to the Internet provided computers with access to the Internet to students outside of regular school hours. Schools with the highest minority enrollment provided Internet availability outside of regular school hours more frequently than schools with the lowest minority enrollment.

- In 1999, virtually all full-time regular teachers in the nation's public elementary and secondary schools had access to computers or the Internet somewhere in their schools, and over one-third reported that they used computers or the Internet "a lot" to create instructional materials. Two of the major barriers teachers identified in using technology were an insufficient number of computers and a lack of release time to learn how to use computers and the Internet. Teachers in schools with high poverty concentrations were about half as likely as teachers in schools with low poverty to use computers or the Internet a lot. Also, teachers in high poverty schools complain that outdated, incompatible, or unreliable computers were significant barriers to the effective use of computers (National Center for Education Statistics 2000b).

- In spite of the considerable number of computers available to teachers in elementary and secondary schools, some analysts assert that since teachers are not trained to use technology or given opportunities to develop creative uses for technology, computers are merely used as glorified typewriters. Even teachers who became serious users of computers did not change their classroom practices (Cuban 2001).

- In 2000, about two-thirds of all children ages 3 to 17 lived in a household with a computer, and about one-third of all children used the Internet at home. There were, however, differences with regard to race. About two-thirds of White, non-Hispanic and Asian and Pacific Islander children lived in households with computers, compared to 43 percent of Black children and 37 percent of Hispanic children. Also, over one-third of White, non-Hispanic and Asian and Pacific Islander children used the Internet at home, while only 15 percent of Black and 13 percent of Hispanic children did so. Finally, White, non-Hispanic and Asian/Pacific Islander *high school students* with a computer in the household were more likely than Black students to complete school assignments online (Newburger 2001).

- Most 4-year college freshmen are computer literate. Almost four out of five freshmen reported using a personal computer frequently during the year prior to entering college. Family income appeared to be a factor in computer usage. The percentage of freshmen with higher family incomes that used computers frequently was larger than freshmen with lower family incomes (Sax et al. 2000).

Theme IV: Effectiveness of Technology in the Learning Process

This fourth theme looks at the effectiveness of technology in the learning process, with particular attention to distance learning.

- The literature on this subject contains a plethora of references that conclude that technology-mediated distance learning compares favorably with on-campus classroom instruction. However, an analysis of the literature on the effectiveness of technology-mediated distance learning reveals that many of the documents are how-to articles, advocacy pieces, and second-hand reports. Original research is in short supply, and those limited studies suffer from poor methodology (Phipps and Merisotis 1999).

- There are also important gaps in the research on technology-mediated distance learning, including the dearth of studies dedicated to measuring the effectiveness of *total* academic programs, an explanation of why the dropout rates of distance learners are so high, and the inadequacy of the effort to address effectiveness of "digital libraries."

- Internet-based distance education appears to be evolving its own pedagogy with the introduction of more audio and video and broadband access. Online courses have characteristics that are unique to the technology, which allows the exploration of new and richer pedagogical models. Experimental studies comparing distance education courses with campus-based courses are based upon the premise that campus-based courses are the "gold standard," which is open to question. Therefore, it may be advisable to abandon these studies, not only because of their inherent methodological problems, but because more productive research can be conducted by addressing how students learn and focusing on outcomes assessment.

- Several organizations have developed standards and guidelines to ensure quality distance education. The study Quality on the Line: Benchmarks for Success in Internet-Based Distance Education reviewed these guidelines and identified 24 benchmarks considered mandatory for quality distance education. The benchmarks covered areas such as course development, evaluation and assessment, faculty support, and institutional support (Phipps and Merisotis 2000).

- The American Federation of Teachers issued a report critical of distance education and alleged that much of distance education is built on corporate ideas about consumer focus, product standardization, tight personnel control, and cost-effectiveness, which are not consistent with the traditional model of postsecondary education decisionmaking (Kriger 2001).

- A large-scale national study of student participation in distance education addressed student satisfaction of distance education classes (Sikora 2002). When asked how satisfied they were with their distance education classes compared to their regular classes, a majority of both undergraduate and graduate students were at least as satisfied or more satisfied with the quality of teaching in their distance education classes compared with their regular classes.

Additional Actions

NPEC identified three areas of interest for additional analysis and review: postsecondary education digital divide—the perceived gap between institutions that have access to the latest technologies and those institutions that do not; preparation for using technology—the degree of exposure to technology that students have prior to participating in postsecondary education; and the quality of distance education, which pertains to the effectiveness of technology in the learning process.

In addition to new analysis, suggestions are offered for adding new questions to national surveys. A new question is suggested for the National Study of Postsecondary Faculty related to student outcomes assessment for distance education courses. A new question is suggested for the Integrated Postsecondary Education Data System: Fall Enrollment Survey to monitor the number of student credit hours awarded for distance education courses. Finally, because of the importance of measuring the effectiveness of technology-mediated distance learning, a case study of leading distance learning institutions is suggested to address value-added outcomes assessment.

Concluding Remarks

Although this report contributes to the ongoing dialogue regarding the relationship between technology and access to postsecondary education, information becomes old news very quickly because of the dramatic pace of technology growth. Good public policy requires valid and reliable current data. Thus, these data need to be updated at regular intervals. The issues are like quicksilver, and the environment in which they exist keeps shifting. Monitoring these phenomena requires continual vigilance through periodic data collection and informed analysis.

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INTRODUCTION

The value of a college education, both to the individual and society in general, is evident. The earnings gap of Americans based on educational attainment is widening. For instance, from 1978 to 1998, inflation-adjusted annual earnings for persons with only a high school education actually declined by 4 percent, in contrast to those for persons with bachelor's degrees, whose earnings increased by 15 percent (U.S. Bureau of Census 1999). Also, those with associate's and bachelor's degrees earn 29 percent and 73 percent more, respectively, than high school graduates over the course of their lifetimes. Increased educational attainment also accrues benefits to society, including greater productivity, increased charitable giving and community service, enhanced quality of civic life, and decreased reliance on government financial support (Institute for Higher Education Policy 1998).

Because knowledge-based economies require increasing levels of education and training, augmenting access to postsecondary education is an issue of significant importance to the nation. In the United States, estimates of the proportion of future jobs requiring postsecondary education range from 70 to 90 percent (Gladieux and Swail 1999). Even though U.S. enrollments in postsecondary education are at record levels, virtually every state recognizes the need to expand access and increase enrollment in education and training programs after high school.

Compounding the issue of access is the role of technology. Particularly since 1990, when the World Wide Web was developed, the opportunities for students to participate in postsecondary education have increased considerably. Thousands of online courses are now available, and an increasing number of on-campus courses possess a technology component. Many colleges and universities are finding the Internet to be an effective tool for use with their admissions programs. In addition, education and training through the Internet is becoming big business worldwide (Waits and Lewis 2003; Green 1999).

These developments raise important public policy questions. Does technology expand or serve as a barrier to access to postsecondary education, particularly to underrepresented groups? Put another way, has the advent of technology in our colleges and universities and other emerging postsecondary education providers helped or hindered the ability of certain classes of people—such as underrepresented racial/ethnic and low-income groups—from enjoying the benefits of education beyond high school? This public policy issue engenders other corollary questions. To what extent do postsecondary education students have access to technology-based learning, including access to faculty, information, and other learning experiences? Does availability of computing resources or technology in secondary school affect access to postsecondary education? Indeed, how effective is technology in the learning process?

Because of the ever-increasing pervasiveness of technology within the postsecondary education community, and indeed all of education, these questions are becoming increasingly important. Thus, the National Postsecondary Education Cooperative (NPEC) identified the relationship of access to postsecondary education and the role of technology as an important strategic area for study. This report addresses this relationship by exploring the questions noted above.

Chapter 1 provides a commentary of a literature review that targeted sources published since 1990. Over 120 materials were examined. To further inform these issues, chapter 2 provides additional analyses of national data that have not been previously published and offers recommendations for revisions to national surveys and other actions to be taken. Finally, chapter 3 reviews and synthesizes the data from the previous chapters and presents some conclusions.

1. WHAT DOES THE LITERATURE SAY?

This chapter summarizes the literature on the relationship of access to postsecondary education and the role of technology, especially that published since 1990. Materials reviewed included journal articles, reports published by independent research organizations, testimony before government committees, books and book chapters, postsecondary education association reports, federal government studies and reports, dissertations, papers presented at association meetings, and monographs.

Four themes were developed to frame the topic: (1) access to postsecondary education in general; (2) access to technology-based learning; (3) preparation for using technology; and (4) effectiveness of technology in the learning process. Addressing each of these themes, interrelated in several respects, provides an extensive overview of technology and access to postsecondary education.

Theme I: Access to Postsecondary Education in General

This theme encompasses the degree to which technology has facilitated the opportunity for students to enroll in colleges and universities. What difference has technology made with regard to the ability of colleges to reach new or expanded constituencies? Also, are there any barriers that inhibit the ability of students to use technology when pursuing postsecondary education and training?

Distance Education Learners

To understand the breadth of the intended audience for technology-mediated distance learning,[1] the American Council on Education, in cooperation with Educause, has identified a sample set of learner segments (Oblinger, Barone, and Hawkins 2001). *Corporate learners* work for corporations and are seeking education to maintain or upgrade their skills. The purchasing decision is made by the employing corporation and not by the individual acting alone. *Professional enhancement learners* are seeking to advance their careers or shift careers. They are working adults who make the educational purchasing decision on their own. *Degree-completion adult learners* are working to complete a degree at an older age. They frequently are working adults who must balance work and family needs with their educational goals. *College experience learners* are preparing for life (the traditional student). This segment includes many of the 18- to 24-year-old residential college students for whom the coming of age process is almost as important as academic achievement.

Other sets of learners include *pre-college (K-12) learners* who are interested in doing postsecondary-level work prior to the completion of high school. This segment may be interested in getting a jump-start on college. *Remediation and test preparation learners* are focused on learning as a prerequisite to an examination or enrollment in another program. Finally, *recreational learners* are interested in education for its own sake. They enjoy learning and view additional education as a hobby or as a source of personal enjoyment.

[1] Technology-mediated distance learning involves activities where the learners are at a distance from the originator of the teaching material, and a combination of media that may be used includes television, videotapes, videoconferencing, audioconferencing, e-mail, Internet, telephone, fax, and computer software.

Institutions Participating in Distance Education and Using Technology

This array of potential students has not been lost on the colleges and universities in the United States. It seems that new programs and courses are developed virtually every day. The second edition of *Peterson's Guide to Distance Learning Programs*, published in 1998, includes programs from some 700 accredited North American institutions, in contrast to the first edition, published in 1994, when there were less than 100 such institutions (Peterson's 1998). Any hard cover publication listing distance education programs is outdated as soon as it hits the bookstores. Peterson's website, http://www.lifelonglearning.com, provides more updated information and shows that close to 3,600 academic programs were available at the start of 2003.

The National Center for Education Statistics (NCES) surveyed a sample of 2-year and 4-year Title IV degree-granting institutions and collected information for the 1997–98 academic year (Lewis, Snow, and Farris 1999) and for the 2000–2001 academic year (Waits and Lewis 2003). The following summary of the findings suggests that distance education is becoming an increasingly visible feature of the landscape of postsecondary education.

- During 2000–2001, 56 percent of all postsecondary education institutions offered distance education. The percentage of public 2-year institutions that offered distance education was 90, and the percentage for private 2-year institutions was 16. Eighty-nine percent of public 4-year institutions offered distance education, as did 40 percent of private 4-year institutions. Larger institutions tended to offer distance education more frequently than smaller institutions; 95 percent of institutions enrolling more than 10,000 students provided distance learning compared to 41 percent of institutions with fewer than 3,000 students.

- Another 12 percent of the institutions planned to offer distance education in the next 3 years, while 31 percent did not offer and did not plan to offer distance education courses in the next 3 years.

- It was estimated that 127,400 different distance education courses were offered in 2000–2001.[2] Of these, 118,000 were college-level, for-credit courses, mostly (76 percent) at the undergraduate level (89,600). Public 2-year and 4-year colleges and universities accounted for 78 percent of the total distance education course offerings and 78 percent of the college level, for-credit courses.

- The earlier NCES study (Lewis, Snow, and Farris 1999) indicated that 8 percent of all postsecondary institutions offered a college-degree or certificate program that could be earned entirely through distance education. Degree programs were most prevalent at public 4-year institutions, where 30 percent offered degrees through distance education. Eight percent of public 2-year institutions offered complete distance education programs, while 6 percent of private 4-year institutions did so. Among the institutions offering distance education courses, one-fourth offered a degree or certificate that could be completed entirely through distance education.

[2] Course offering data are unduplicated.

- In the 2000–2001 academic year, there were approximately 3.1 million enrollments in distance education courses.[3] Out of these, an estimated 2.8 million (93 percent) were in college-level, credit-granting courses. Public 2-year institutions showed the largest enrollments—1.4 million. Public 4-year colleges and universities were close behind, with 888,000. Enrollments in private 4-year institutions were 480,000.

- In examining the various technologies used in distance education, Waits and Lewis (2003) reported that 90 percent of postsecondary education institutions made use of asynchronous Internet instruction, which was the most widespread media for course delivery. Forty-three percent of institutions offered synchronous instruction over the Internet. Fifty-one percent of institutions used two-way interactive video, and 41 percent used one-way prerecorded video.

The Internet is also influencing college admissions operations. In response to a December 2000 survey to the members of National Association for College Admission Counseling (NACAC), 100 percent of the responding institutions used their institutional web site to present general and college admission information to prospective students. Ninety-five percent of the responding institutions used the Internet's electronic mail capability to respond to student inquiries. Eighty-six percent of the institutions reported the use of their web site to permit students to download, complete, and mail the admission application to the institution, while 75 percent reported that they allow students to complete their application online and transmit it electronically[4] (Burtnett 2001).

A far more comprehensive survey of 1,392 colleges and universities supports these data (Green 1999). The survey researchers found that more institutions were providing more services via their campus web sites. In 1999, more that two-thirds (70.2 percent) of the 530 responding institutions offered online undergraduate applications, up from 55.4 percent in 1998. Three-fourths (76.9 percent) made the complete course catalog available on the campus web site (up from 65.2 percent the year before), while almost one-third (30.0 percent) offered online course registration, compared to 20.9 percent in 1998.

In General, Does Technology Increase Participation in Postsecondary Education?

Policymakers have asked if the availability of technology-mediated distance learning has increased participation in postsecondary education. In a series of case studies to evaluate the benefits and costs of distance education, evidence suggests that distance learning efforts can increase the number of people enrolling in postsecondary education (Jewett 1997a,b,c). For instance, at Rensselaer Polytechnic Institute, 75 percent of the respondents indicated that that they would not have been able to participate in a course if it had not been delivered to their workplace. In a cooperative program between SUNY Brockport and the SUNY campuses in Western New York State, course sharing among campuses was found to maintain degree programs and provide adequate course offerings in a significant way, even where campus departments were relatively small. Also, a study of a collaborative distance education program effort between Old Dominion University and community colleges in Virginia estimated that participation of Virginia residents in 4-year public postsecondary education increased by over 4,000 individuals (a 3.3 percent increase in the participation rate).

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[3] Enrollments included duplicated counts of students. Institutions were instructed to count the student for each course in which he or she was enrolled.

[4] The reader should be cautioned that only 122 out of 966 (13 percent) recipients completed and returned the survey.

It appears, then, that the introduction of technology can increase participation in postsecondary education. Later in this report, a more detailed analysis is provided to examine the extent to which there may be differences in participation rates of certain classes of people.

Financial Aid for Distance Education

The ability of technology-mediated distance learning to reach new constituencies notwithstanding, it has been suggested by some that the current structure of financial aid programs in the United States is a barrier to the ability of students to participate in distance education. Title IV of the Higher Education Act, which authorizes the majority of federal student aid programs, restricts access to federal student aid programs by institutions that enroll more than half their students or offer more than half their courses in distance education (commonly called the 50-percent rule). The federal regulations also stipulate an academic year of at least 30 weeks for students to be eligible for the maximum amount of federal grants and loans, and prohibit aid to distance education students for computers or living expenses.

The U.S. Congress, recognizing the importance of financial aid in determining access to postsecondary education, mandated that the U.S. Department of Education create a pilot project that waives these regulations for some institutions and students. In July 1999 the department selected the first 15 institutions to participate in the project (Heller 2001). Ten more institutions have been added since then.

Responding to the Department's pilot project, a group of colleges and universities in Colorado convened a roundtable to discuss key issues on financial aid for distance education students. The discussion resulted in the development of the following six principles for future policy development (Institute for Higher Education Policy 1998).

- Student aid should be available without regard to mode of instructional delivery.
- Delivery of student aid should be learner-centered, with aid following the student through the academic program.
- Aid should be awarded only to those in accredited programs of study that confer a recognized credential, such as a degree or certificate.
- The awarding of student aid should be tied primarily to standards of academic progress and not arbitrary measures of time.
- Regulations should give institutions flexibility in determining how to calculate eligibility for aid to pay for direct (tuition) and indirect (living expenses) cost of attendance.
- Aid amounts and limits should be focused more on lifetime standards than on annual or institutional maximums.

In October 2001, the U.S. House of Representatives overwhelmingly passed a bill to curtail regulations that inhibit students from participating in distance education (Carnevale 2001). The bill, H.R. 1992, would, for some institutions, effectively eliminate the 50-percent rule and change the 12-hour rule. The latter requires postsecondary education programs that do not operate in a standard semester, trimester, or quarter system to offer a minimum of 12 hours of course work a week to be eligible for federal financial aid. In place of the 12-hour rule, students would have to spend at least 1 day a week interacting with

their professors, either face to face or at a distance. If the bill were to pass the Senate and be signed by the President, any institution that is currently providing federal financial aid could ignore the 50-percent rule, provided that its loan default rate has been below 10 percent during the previous 3 years.

While many distance education administrators praise the bill, some faculty groups have criticized the measure, saying that the regulations ensure quality in education and that if the rules are rescinded, students could be defrauded by illegitimate operations. Since the 12-hour rule is a federal regulation, and not a statute, the U.S. Department of Education issued a final regulation in the November 1, 2002, *Federal Register* that eliminated this financial-aid restriction and replaced it with a regulation that institutions must offer at least 1 day of instruction a week to qualify for aid. Also, the Department, in a recent report, urged the Congress to eliminate or revise the 50 percent rule during its deliberations regarding the renewal of the Higher Education Act (Carnevale 2003). This bill was referred to the Subcommittee on 21st Century Competitiveness on June 20, 2003, where it currently resides.

Theme II: Access to Technology-Based Learning

This theme focuses on the extent to which postsecondary students have access to technology-based learning. In particular, how has technology expanded access to faculty, information, and other learning experiences? Moreover, does access vary by characteristics such as race/ethnicity, age, gender, and income?

The term "digital divide" can be a useful framework for this discussion. Digital divide refers to the perceived gap between those who have access to the latest technologies and those who do not. Underlying this concept is the notion that since this is the Information Age, those not having access to information through the latest technologies are considered to be disadvantaged. The concept of digital divide achieved mass media attention when it became part of the title of the second National Telecommunications and Information Administration (NTIA) survey in 1998 (Compaine 2001). Today the term has become part of the vernacular regarding technology "haves" and "have-nots" and postsecondary education.

There are several dimensions to the digital divide. Without becoming overly complex, it is helpful to separate the concept into two basic categories: (1) *household and individual* digital divide—which refers to people; and (2) *institutional* digital divide—which refers to colleges and universities.

Household and/or Individual Digital Divide

Throughout this section, *household and individual* digital divide are defined by the degree of access to (1) a computer, and (2) an Internet connection. After exploring basic information regarding households with computer and Internet access, this section provides more detailed analyses regarding various individual demographic characteristics.

Overall Digital Inclusion. The most recent and comprehensive data on this issue when this review was written came from the latest of a series of reports by NTIA. *A Nation Online: How Americans are Expanding Their Use of the Internet* provides comprehensive information on Americans' connectivity to the Internet, broadband services, and computers (National Telecommunications and Information Administration 2002). Using data from September 2001, the report shows that use of the Internet and computers had grown substantially over the last few years. Some of the major findings are as follows.

- The rate of growth of Internet use in the United States was then 2 million new Internet users per month.

- More than half of the nation was online. In September 2001, 143 million Americans (about 54 percent of the population) were using the Internet—an increase of 26 million in 13 months. In September 2001, 174 million people (or 66 percent of the population) in the United States used computers.

- Children and teenagers use computers and the Internet more than any other age group, with 90 percent of children between the ages of 5 and 17 (or 48 million) using computers in 2001.

- Computers at schools substantially narrow the gap in computer usage rates for children from high- and low-income families.

- Between August 2000 and September 2001, residential use of high-speed, broadband service doubled—from about 5 to 11 percent of all individuals, and from 11 to 20 percent of Internet users.

The rapid adoption of the Internet is occurring among most groups of Americans, regardless of location, income, education, race/ethnicity, age, or gender, according to another recent report by the NTIA (2000). Indeed, this report suggested that groups that have traditionally been digital have-nots were making dramatic gains. Some of the findings from the report include the following:

- *Location.* The gap between the percentage of households in rural areas and the percentage of households nationwide that access the Internet had narrowed from 4 percentage points in 1998 to 2.6 percentage points in 2000. Rural households moved closer to the nationwide Internet penetration rate of 41.5 percent. In rural areas, 38.9 percent of the households had Internet access, a 75 percent increase from 22.2 percent in December 1998.

- *Income.* Americans at every income level were connecting to the Internet at far higher rates from their homes, particularly for the middle-income levels. Internet access among households earning $35,000 to $49,000 rose from 29 percent of households in December 1998 to 46.1 percent in August 2000. More than two-thirds of all households earning more than $50,000 had Internet connections.

- *Education.* Internet connectivity was expanding across every education level, particularly for those with some high school or college education. Households headed by someone with "some college experience" showed the greatest expansion in Internet penetration, rising from 30.2 percent in December 1998 to 49 percent in 2000.

- *Gender*. The disparity in Internet usage between men and women had largely vanished. In December 1998, 34.2 percent of men and 31.4 percent of women were using the Internet. By August 2000, 44.6 percent of men and 44.2 percent of women were Internet users.

- *Age.* Individuals 50 years of age and older—while still less likely than younger Americans to use the Internet—experienced the highest rates of growth in Internet usage of all age groups: a 53-percent growth rate from December 1998 to August 2000, compared to a 36-percent growth rate for individual Internet usage nationwide.

- *Race.* While Black and Hispanic households still lagged behind others, they showed significant gains in Internet access. The percentage of Black households having home access rose from 11.2 percent in December 1998 to 23.5 percent in August 2000. Hispanic households also experienced an impressive growth rate in Internet access during the same period, rising from 12.6 percent to 23.6 percent.

Digital Divides Still Exist. In spite of these changes, the digital divide still remains or has expanded slightly in some cases, even while Internet access rates and computer ownership rates are rising rapidly for almost all groups. The data for August 2000 from the NTIA study show that divides still existed between different racial and ethnic groups, old and young, single- and dual-parent families, and those with and without disabilities (NTIA 2000).

- *Race and ethnicity.* Asians and Pacific Islanders had the highest level of home Internet access at 56.8 percent; Blacks and Hispanics, at the other end of the spectrum, had the lowest household Internet penetration rates at 23.5 percent and 23.6 percent respectively. When measured against the national average, household Internet access among Blacks and Hispanics did not compare favorably with those of other racial/ethnic groups. The difference between Internet access rates for Black households and the national average rate was 18 percentage points in August 2000 (a 23.5-percent penetration rate for Black households, compared to 41.5 percent for households nationally). This gap was wider than the gap that existed in 1998. The difference between the percentage of Hispanic households with Internet access and the national average rate was virtually the same as for Black households, and the gap in 2000 was wider than in December 1998. With respect to individuals, while about a third of the U.S. population used the Internet at home, only 16.1 percent of Hispanics and 18.9 percent of Blacks did so.

- With regard to computer ownership, the divide seems to have stabilized, although it remains large. The divide between the percentage of Black households with a computer and the national average in August 2000 was 18 percentage points (a 32.6-percent penetration rate for Black households, compared to 51 percent for households nationally), about the same as the gap that existed in December 1998. Similarly, the 17 percentage point difference between the share of Hispanic households with a computer (33.7 percent) and the national average (51 percent) did not change between December 1998 and August 2000.

- *Age.* Individuals 50 years of age and older were among the least likely to be Internet users. The Internet use rate for this group was only 29.6 percent in 2000. It is interesting to note that individuals in this age group were almost three times more likely to be Internet users if they were in the labor force than if they were not.

- *Two-parent and single-parent households.* Two-parent households were nearly twice as likely to have Internet access as single-parent households (60.6 percent for dual parent, compared to 35.7 percent for male heads of households and 30 percent for female heads of households).

- *Disability.* People with a disability were only half as likely to have access to the Internet as those without a disability: 21.6 percent compared to 42.1 percent. While fewer than 25 percent of people without a disability had never used a personal computer, close to 60 percent of people with a disability were in that category. Among people with a disability, those who

have impaired vision and problems with manual dexterity had even lower rates of Internet access and were less likely to use a computer regularly than people with hearing difficulties.

Massaging the Numbers. In a study conducted in December 1999 based on data from a panel of households recruited as a random telephone sample of the U.S. population, Nie and Edbring explored the myth or reality of the digital divide (Compaine 2000). Among their conclusions, they found that 21 percent of differences in Internet access could be explained by demographic factors. According to the authors, by far the most important factors facilitating or inhibiting Internet access were education and age, not income, nor race/ethnicity or gender, each of which accounted for less than 5 percent of the change in rates of access and were not statistically significant. In contrast, a college education boosted rates of Internet access by well over 40 percentage points compared to the least educated group. Also, people over 65 showed a more than 40-percentage-point difference in rates of Internet access compared to those under 25.

Nie and Edbring also concluded that once people are connected to the Internet, they hardly differ in how much they use it and what they use it for—except for a dropoff after age 65, and a faint hint of a gender gap. Internet use increases dramatically, both in terms of amount of time and in terms of range of activities, the longer people have been connected to the Internet. The activities include communication (sending and receiving e-mail), accessing information, and shopping.

Behind the Numbers. It is instructive to review some of the interpretations regarding the digital divide. Several analysts suggest that there is no digital divide crisis in the United States. Hassan Fattah (2000) argued that if Americans really want a personal computer and access to the Internet, they can obtain them at very little cost. Technology is so cheap, if not free, that almost anyone can have access to it. Thus, access to computers alone is an incomplete measure of the digital divide. A growing chorus of community activists and educators are warning that the real divide is not about access but relevance. A different message needs to be sent about technology and its usefulness in people's daily lives. In addition, low literacy levels are a significant hindrance. Working on a keyboard can be a major hurdle and manipulating a mouse can be daunting for many. Further exacerbating the problem is the lack of online content tailored to the disadvantaged. In short, the author asserted that the dearth of pertinent information, literacy barriers, and limited diversity of content are the biggest barriers to getting lower income users online.

Another perspective from an economist reinforces these views. Robert Crandall (2001) of the Brookings Institution argued that it is hardly clear that there is a digital divide that needs immediate bridging through deliberate public policy. By examining the determinants of household PC demand in 1994, and using the results to predict the diffusion of PCs in 1998, he found that the 1994 equation substantially underpredicted the diffusion of PCs among poor households and among Black and Hispanic households. He predicted that in another 4 years, or less than 10 years since the Internet became generally available to households, more than two-thirds of all families would be connected to the Internet at home. By contrast, the author noted that 75 years elapsed between the invention of the telephone and its spread to two-thirds of American homes. The "analogue divide" was much more difficult to bridge than the digital divide!

A survey by the Pew Internet & American Life Project identified some interesting information regarding the group of people called the "Nevers," who indicated that they definitely would not go online (Lenhart 2000). Fully 81 percent of the Nevers were over 50 years of age, and when asked their opinion of the Internet, they were the most unenthusiastic of those surveyed. Nevers were strong backers of the view that the Internet is dangerous (52 percent agreed), hard to use (33 percent agreed and 42 percent said they don't know), and expensive (32 percent agreed and 51 percent didn't know).

In contrast, the "Eagers" were those people who were without Internet access and said they would definitely or probably go online. This cohort is weighted some toward women, Hispanics, and Blacks. Compared to the Nevers, Eagers had the largest proportion of relatively high household incomes and relatively high levels of education. Most Eagers were young. About 65 percent of those under age 30 who did not have Internet access said that they wanted to get it. Finally, many of the Eagers have had some experience with college. More than half of those with college degrees or with some college experience who were not online said they want to use the Internet. By comparison, just 27 percent of those without high school diplomas said they wanted to go online.

Institutional Digital Divide

Institutional digital divide pertains to the perceived gap between institutions that have access to the latest technologies and those institutions that do not. Educause (2000), in its report to the President's Information Technology Advisory Committee, asserted that the federal information technology investment in postsecondary education had resulted in a network capability at the largest universities that far outpaced that of other 4-year degree-granting institutions. These smaller institutions faced severe challenges in meeting the advanced networking requirements necessary to educate the 21st century student. The report identified the following obstacles from a technological perspective:

- Lack of campus infrastructure;
- Lack of reliable middleware (security, authentication, and network management tools); and
- Lack of cooperation from telecommunication companies in providing service.

Other significant obstacles, other than technological, to advanced network deployment included the following:

- A difficult economic environment for information technology and networking at smaller institutions because advanced networking is often a new budgetary item;
- Lack of high-level support from campus decisionmakers;
- A return on investment that is difficult to articulate; and
- Difficulty recruiting and retaining information technology staff.

A more recent report by the Institute for Higher Education Policy reinforced the conclusions offered by Educause by noting that there are gaps in access to technology capital among different types of institutions (Phipps and Wellman 2001). Large, well-financed institutions simply have greater access to information technology funding than do smaller colleges with fewer resources. Citing U.S. Department of Education studies, the report showed that larger institutions were more likely to offer distance education than smaller colleges: 87 percent of institutions with more than 10,000 students offered distance-based classes, in contrast to 19 percent of institutions with fewer than 3,000 students.

One could argue that differences in institutional approaches to distance learning may be the result of simple institutional choice rather than a lack of funding. Yet, research by Kenneth Green (2000)

revealed disparities between research universities and teaching institutions that probably reflect resource differences more than institutional choices. Green found that public and private research universities had the best ratios of information technology staff to full-time-equivalent (FTE) students; were most likely to offer admissions, financial aid, course registration, and library resources over the Internet; and had off-campus, dial-up Internet services for students and faculty.

A survey of mostly 4-year institutions that do not offer doctorates provided more evidence of a digital divide (Olsen 2001). The data from the Cost of Supporting Technology Services project (COST) show that for 2000–2001, the median spending on information technology was $1,299 for each student and employee at the most selective and wealthiest liberal arts colleges taking part in the study. By contrast, the less selective and less endowed undergraduate colleges showed a median spending of only $459 per student, professor, or staff member.

The findings of a report based on a nationally representative sample from the 1999 National Study of Postsecondary Faculty (NSOPF:99) of instructional faculty and staff that taught one or more classes for credit hinted at an institutional digital divide. Among the conclusions, the study found that the type of institution was shown repeatedly to be a key factor for access to technology. "In particular, those postsecondary instructional faculty and staff at 4-year doctoral institutions were significantly more likely to use e-mail and course-specific web sites than those at 4-year nondoctoral or 2-year institutions" (Wharburton and Chen 2002).

Although dated, a survey during the 1995–96 academic year of Hispanic-serving institutions (HSIs) revealed that less than one-half of students had institutional access to the Internet. Moreover, a review of web sites at HSIs indicated that outside the computer science department, the Internet was little used as a teaching tool by faculty. Most professors were reluctant to embrace the Internet and its associated technology. Finally, there was a critical need for regular training and support of faculty on the use of technology and adapting it to enrich their curriculum (Rodriguez, Gonzalez, and Cano 1996).

Who is Participating in Distance Education?

In its research into who enrolls in distance education, the U.S. Department of Education addressed which postsecondary students participated in distance education in 1999–2000 and what types of technology the students used (Sikora 2002). Eight percent of undergraduate and 10 percent of graduate and first-professional students reported taking distance education courses. Among undergraduates, females were more likely than males to take distance education courses (9 vs. 7 percent). Students whose primary language was English were more likely to participate in distance education than students whose primary language was not English (8 vs. 6 percent)—although there were no differences among racial/ethnic groups. Also, undergraduates age 24 and over were more likely than students under 24 to participate (10 vs. 6 percent). Married students were more likely than those who were unmarried to participate (11 vs. 7 percent), and among independent students, those who earned $50,000 or more were more likely to take distance education classes than those earned less than $50,000 (11 vs. 9 percent). Twenty-nine percent of undergraduate students who took distance education courses enrolled in distance education for their entire program.

Students at the graduate/first-professional level exhibited similar patterns of participation in distance education as undergraduates. However, unlike undergraduates, there were no gender differences, although there were racial/ethnic group differences. White students (11 percent) were more likely than Hispanic (5.8 percent) and Asian (5.5 percent) students to take distance education classes, but no differences were found between White students and either Black or American Indian students. Thirty-

eight percent of graduate/first-professional students who took distance education courses enrolled in distance education for their entire program.

Focusing on distance delivery methods, a majority (60 percent) of undergraduates used the Internet, compared to 37 percent using live, interactive TV or audio and 39 percent using prerecorded TV or audio. Among graduate/first-professional students who took distance education courses, two-thirds (67 percent) did so via the Internet, compared to 43 percent using live TV or audio and 28 percent using prerecorded TV or audio.

Theme III: Preparation for Using Technology in Postsecondary Education

This theme targets the extent to which postsecondary education students are prepared to use technology. What exposure to technology have students had prior to participating in postsecondary education? What are the characteristics of students who are prepared to use technology?

Internet Access in U.S. Public Schools and Classrooms

A fundamental question regarding students' preparation for using technology during their postsecondary education experience is the degree to which they are exposed to computers and the Internet while attending grades K-12. The National Center for Education Statistics (2000a) has been tracking these data since 1994, when the White House's National Information Infrastructure (NII) initiative challenged the nation's schools and classrooms to connect to the Internet by the year 2000. The most recent survey indicated that the percentage of public schools connected to the Internet had increased each year, from 35 percent in 1994 to 98 percent in the fall of 2000. It is important to note that by 2000, all schools, regardless of level, poverty concentration, and metropolitan status, were equally likely to have Internet access.

Looking at classrooms within schools, in 1994, only 3 percent of U.S. public school instructional rooms were Internet connected. By 2000, 77 percent were connected, but differences by school characteristics remained. Sixty percent of classrooms had Internet access in schools with high concentrations of poverty (75 percent or more students eligible for free or reduced-price lunches), compared to 77 to 82 percent of classrooms in schools with lower concentrations of poverty. A similar pattern was evident by minority enrollment. Schools with the highest minority enrollment (50 percent or more) showed a smaller percentage of instructional rooms with Internet access (64 percent) than schools with lower minority enrollment (79 to 85 percent of instructional rooms). These continuing differences notwithstanding, the percentage of instructional rooms with Internet access increased between 1999 and 2000 in these schools: from 38 to 60 percent in schools with the highest concentration of poverty, and from 43 to 64 percent in schools with the highest minority enrollment.

Another measure of students' access to technology is the ratio of students per computer. In 2000, the ratio of students per instructional computer in public schools was 5, which equals the ratio many experts consider a reasonable level for the effective use of computers within schools. The ratio of students per instructional computer *with Internet access* decreased from 9 to 7 from 1999 to 2000. Again, differences remain across schools with different characteristics. For instance, in 2000, schools with the highest concentration of poverty had 9 students per instructional computer with Internet access, compared to 6 among schools with the lowest poverty.

Making the Internet accessible outside of regular school hours allows students who would not otherwise have the opportunity to have access to the Internet for school-related activities like homework. In 2000, over half (54 percent) of public schools with access to the Internet reported that computers with access to the Internet were available to students outside of regular school hours. Secondary schools were more likely to provide this service than elementary schools (80 percent compared to 46 percent). Moreover, schools with the highest minority enrollment provided Internet availability outside of regular school hours more frequently than schools with the lowest minority enrollment (61 percent to 46 percent).

It is important to note that equal access to technology is not the same as equal access to *equal* technology. The data do not reflect the degree to which computers are not functioning, whether software is outdated, and the extent to which access to the Internet is provided. In short, the preceding information should be read with some caution.

Teacher Use of Computers and the Internet

Computer availability is, of course, essential. However, the degree to which computers are used in the instructional process is perhaps even more important. This issue has also been addressed by NCES (2000b), which commissioned a survey in the spring of 1999. The survey found that 99 percent of full-time regular public school teachers had access to computers or the Internet somewhere in their schools. Thirty-nine percent of the teachers with access to computers or the Internet indicated they used computers or the Internet "a lot" to create instructional materials, while less than 10 percent reported using computers or the Internet to access model lesson plans or to access research and best practices for teaching. Newer teachers were more likely to use computers or the Internet to accomplish various teaching objectives.

Teachers' use of computers or the Internet at school varied for some types of uses by school poverty level. Teachers in schools with a school poverty level of less than 11 percent were more likely to use computers or the Internet "a lot" for creating instructional materials (54 percent) than teachers in schools with a school poverty concentration of 71 percent or more (32 percent). Moreover, teachers in schools with the lower minority enrollments were more likely to have the Internet available in the classroom than teachers in schools with the highest minority enrollments.

Two-thirds of public school teachers reported using computers or the Internet for instruction during class time, while 41 percent of teachers reported assigning students work that involved computer applications such as word processing and spreadsheets to a moderate or large extent. Almost one-third (30 percent) reported assigning research using the Internet to a moderate or large extent. Elementary school teachers were more likely than secondary school teachers to assign students practice drills using computers (39 vs. 12 percent) and to require their students to use computers or the Internet to solve problems (31 vs. 20 percent). Secondary school teachers were more likely than elementary school teachers to assign research using the Internet (41 vs. 25 percent). Teachers in schools with the lowest poverty level were more likely to assign students work involving computer applications, research using CD-ROMs, and research using the Internet to a moderate or large extent than teachers in the highest poverty schools.

Barriers to Teachers' Use of Technology

Classroom and school characteristics, such as equipment, time, and technical assistance, may be barriers or facilitators for using technology. The following barriers were identified in a study assessing teachers' use of technology (Smerdon et al. 2000).

- In 1999, those barriers most frequently reported by teachers to be "great" barriers to their use of computers or the Internet for instruction were an insufficient number of computers and lack of release time to learn how to use computers or the Internet.

- Secondary teachers, teachers in large schools, and teachers in city schools were more likely than elementary teachers, teachers in small schools, and teachers in rural schools to report that not enough computers was a great barrier. Also, teachers in schools with more than 50 percent minority enrollments were more likely to cite outdated, incompatible, or unreliable computers as a great barrier than teachers in schools with less than 6 percent minority students.

- As would be expected, teachers who reported insufficient numbers of computers as a great barrier were less likely than teachers reporting that this was not a barrier to assign students to use computers or the Internet to a "large extent."

Cuban (2001) argued that teachers are not trained to use new technology or given a chance to develop creative uses for it in school. Thus, computers end up being merely souped-up typewriters. Teachers and students use the new technologies more at home than in the classroom and most classroom use is unimaginative. He concluded the following:

- Abundant availability of "hard" infrastructure (wiring, machines, software) and "soft" infrastructure (technical support, professional development) in schools in the late 1990s has not led, as expected, to frequent or extensive teacher use of technologies for tradition-altering classroom instruction.

- Students and teachers use computers and other technologies more at home than at school.

- When a small percentage of teachers using computers do become serious or occasional users, they—contrary to expectations—largely maintain existing classroom practices rather than change customary practices.

Others tend to agree with the above analysis. An article in *Education Week on the Web* (2001) proposed that inequities involve not so much access to computers, but the way computers are used to educate children. Although Internet access was no longer reserved just for schools in middle-class or wealthy communities, many questions remained to be answered. "How often are students using the Internet and other computer resources to learn, and for what purposes? Are young people using school computers that can handle large amounts of data and employ sophisticated communication tools or are they working with obsolete machines that do not belong in a 21st century classroom? Other questions add to the complexity of the issue. Do some schools have the technical support necessary to keep machines running while others do not? Are teachers in one district getting better training to understand how to use technology to enhance learning, while teachers in another district are left to themselves to figure it out? And lastly, do all kinds of students—low achievers and high achievers, minority and white students, girls and boys, well-to-do and poor children—benefit equally from the technology available in schools?"

Computers at Home

To what extent do children have access to computers in their home? This question has been addressed using data collected from a Current Population Survey of the U.S. Census Bureau (Newburger 2001).

Sixty-five percent of all children ages 3 to 17 lived in a household with a computer in 2000, up from 55 percent in 1998. Almost one-third (30 percent) of all children used the Internet at home, compared to just 19 percent in 1998. Girls were as likely as boys to use the Internet at home, yet children's Internet use varied with age. Seven percent of the youngest children, those 3 to 5 years old, used the Internet at home, and 48 percent of children ages 12 to 17 years used the Internet at home.

White, non-Hispanic children were more likely to have access to a computer at home or use the Internet than were Black or Hispanic children. Among children ages 3 to 17 years, over three-fourths (77 percent) of White, non-Hispanic and 72 percent of Asians and Pacific Islanders lived in households with computers, compared to 43 percent of Black children and 37 percent of Hispanic children. Additionally, 38 percent of White, non-Hispanic children and 35 percent of Asian and Pacific Islander children used the Internet at home, compared to 15 percent of Black children and 13 percent of Hispanic children.

College Freshmen

The Cooperative Institutional Research Program (CIRP) has been surveying college and university freshmen for 35 years.[5] The principal purpose of CIRP is to assess the effects of college on students (Sax et al. 2000). An overview of the 2000 freshman norms showed that student use of personal computers had escalated in the years just before the survey. A record 78.5 percent of college freshmen reported using a personal computer frequently during the year prior to entering college, up from 68.4 percent the previous year and 27.3 percent when this question was introduced in 1985. Also, the gender gap in use had nearly closed, with 77.8 percent of women and 79.5 percent of men indicating frequent use of computers in 2000.

Although the gender gap appears to be closing, a new survey item found that women lagged far behind men when asked about their computing self-confidence. Women were half as likely as men to rate their computer skills as "above average" or "top 10 percent" relative to people their age (23.2 vs. 46.4 percent). This gap in self-confidence might have contributed to the fact that in 2000, men were five times more likely than women to pursue careers in computer programming. With regard to the Internet, women were less likely than men to participate frequently in Internet chat rooms and less likely to report frequent Internet use for "other" reasons or activities (Sax et al. 2000).

Theme IV: Effectiveness of Technology in the Learning Process

This fourth theme reviews the effectiveness of technology in the learning process, with particular attention to distance learning. Many studies have been conducted comparing the effectiveness of traditional classroom instruction versus technology-mediated distance learning. Other research includes case studies and descriptive studies that attempt to explain experiences of faculty and students participating in distance education courses. What have we learned from this research? Is technology-mediated distance learning effective, and, if so, how? These are the questions that frame this section.

The Institute for Higher Education Policy explored this issue by reviewing the available evidence related to the quality and effectiveness of distance education published since 1990, including everything from original research to policy papers to how-to articles. The study focused upon the validity of the research and gaps, if any, in the research literature (Phipps and Merisotis 1999).

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[5] Institutions volunteer to participate in the annual CIRP survey; therefore, it is not a scientifically drawn sample (see http://www.gseis.ucla.edu/heri/cipr.html).

The Institute found that most reports and articles about distance learning were opinion pieces, how-to prescriptions, and second-hand reports. Since determining the effectiveness of distance learning was the major interest, the Institute targeted its inquiry on original research, including experimental, descriptive, correlational, and case studies.

A major conclusion of the report was that there is a relative paucity of original research dedicated to explaining or predicting phenomenon related to distance learning. In the limited original research that was available, three broad measures of the effectiveness of distance learning were usually examined.

- Student outcomes, such as grades and test scores;
- Student attitudes about learning through distance education; and
- Overall student satisfaction toward distance learning.

The vast majority of studies concluded that regardless of the technology used, distance learning courses compared favorably with traditional classroom instruction. For example, several experimental studies suggested that distance learning students had similar grades or test scores, or had the same attitudes toward the course as those students in campus-based courses. Case studies and descriptive analyses focused on student and faculty attitudes and perceptions of distance learning, and typically concluded that students and faculty had a positive view toward distance learning. In short, the published research strongly suggested that technology-mediated distance learning is effective.

A closer look at the research, however, suggests it may be premature to accept these findings at face value. Fundamentally, the overall quality of the research methodology is questionable, which renders the findings inconclusive. Assessing the quality of original research requires a determination that the studies adhered to commonly accepted principles of good research. These principles are essential if the results of the study are to be considered valid and can be generalized. If a study does not comply with these principles, the results can be misleading or erroneous.

Some of the key shortcomings of the Institute's research included the following:

- **Most of the research did not control for extraneous variables.** Most experimental studies of distance learning are designed to measure how a specific technology (the "cause") impacts upon some type of learning outcome or influences student attitudes toward a course (the "effect"). To assess this relationship accurately, other potential causes must not influence the measured outcomes. But, in virtually all of the experimental studies, there was inadequate control of extraneous variables. Thus, it was often impossible to rule out differences other than the technology as the causal agents.

- **Most of the studies did not use randomly selected subjects.** The best way of controlling for extraneous variables is to assign students randomly to both the experimental and control groups. Most of the published studies reviewed, however, used intact groups for comparison purposes. Thus, the studies ran the substantial risk of having a number of variables—such as student characteristics, time on task, instructional design—affect academic achievement or student satisfaction, not just the technology used to provide the education at a distance.

- **The reliability and validity of the instruments used to measure student outcomes and attitudes were questionable.** An important component of good educational research is the proper measurement of learning outcomes and/or student outcomes. A well-conducted study should include evidence of the validity and reliability of the measurement instruments—final examinations, quizzes, questionnaires, attitude scales—so that the reader can have confidence in the results. In almost all of the studies, this information was lacking.

There were also many gaps in the research concerning technology-mediated distance learning that were identified, including the following.

- **The research targeted student outcomes for individual courses rather than for total academic programs.** Perhaps the most significant gap in the research was the dearth of studies dedicated to measuring the effectiveness of total academic programs. This raises serious questions about whether a total academic program delivered by technology compares favorably with a program provided on campus. This is especially important since public policy is typically directed toward providing access to degrees or programs of study, not just a single course.

- **The research did not adequately explain why the dropout rates of distance learners are high.** A number of studies revealed that higher percentages of students who participated in distance learning courses dropped out before the course was completed compared to students in conventional classrooms. The issue of student persistence is particularly troubling because of the negative consequences associated with dropping out and because the research often excluded these dropouts, thereby tilting the student outcome findings toward only those that completed the course and were, therefore, "successful."

- **The effectiveness of "digital libraries" was not adequately addressed in the research.** Some digital libraries boast an enormous array of resources, with the implicit notion that they can provide the same service as the traditional library. Yet, do these libraries provide the necessary support of the academic programs? Anecdotal evidence seems to suggest that the curricular objectives of some distance learning courses may have been altered because of a limited variety of books, journals, and other resources online.

The study concluded, "Technology is having, and will continue to have, a profound impact on colleges and universities in America and around the globe. Distance learning, which was once a poor and often unwelcome stepchild within the academic community, is becoming increasingly more visible as a part of the higher education family. But the research and literature reviewed for this paper indicate that the higher education community has a lot to learn regarding how, and in what ways, technology can enhance the teaching/learning process, particularly at a distance."

Others agreed with these conclusions. In an analysis of comparative research on distance learning technologies at the University of Oklahoma (Smith, Dillon, and Boyce 1994), the authors asserted that designing studies, which address each of the critical factors, may be impractical in the settings accessible to most researchers. They noted that when the purpose of the research is to test hypotheses (such as the relative learning benefit of one delivery system in contrast to another), studies failing to properly address the threats to external and internal validity lead to unwarranted conclusions. They concluded that, "comparison studies in distance education are indeed limited by inadequate resources of funding to support the implementation of sufficiently controlled experimental studies."

Given the conclusions from these studies, it is tempting to infer that technology-mediated distance education may be inferior, but it would be a mistake to rush to that judgment. Some have overreacted to the report by suggesting that it was hostile to the distance learning movement because the research was found to be wanting. But, it is important to understand that the conclusions by the Institute for Higher Education Policy were simply that the *research methodology on distance education* did not meet acceptable standards, and, therefore, the vast majority of the research was inconclusive. Indeed, in other studies conducted by the Institute for Higher Education Policy, the dedication of the faculty teaching distance education at the institutions was quite apparent; they showed keen insights into the teaching/learning process, and many were considered by their peers as some of the best teachers at the institution (Phipps and Merisotis 2000).

As noted earlier in this report, it was estimated that over 50,000 different distance education courses were offered during the 1997–98 academic year, and over 1.5 million students enrolled in these courses. Undoubtedly, many more courses are being offered now. Thus, it would be difficult, and even foolish, to argue that these courses are not effective or are of poor quality. It could be argued that because of the difficulty of conducting rigorous experimental studies on distance learning, it may be advisable to focus attention on the more fundamental question on how students learn, irrespective of the delivery system. Moreover, Internet-based distance education appears to be evolving its own pedagogy with the introduction of more and more audio and video and broadband access. Online courses have characteristics that are unique to the technology—which allows the exploration of new and richer pedagogical models. Conducting experimental studies comparing distance education courses with campus-based courses is based upon the premise that campus-based courses are the "gold standard," which is open to question. Therefore, it may be advisable to abandon these studies, not only because of their inherent methodological problems, but because more productive research can be conducted by addressing how students learn and focusing on outcomes assessment.

Several organizations have developed principles, guidelines, and benchmarks to ensure quality distance education. These organizations include the American Council on Education, the National Education Association, the Global Alliance for Transnational Education (GATE), the Southern Regional Electronic Campus, the Commission on Higher Education of the Middle States Association of Colleges and Schools, and the Western Cooperative for Educational Telecommunications. The principles apply to a wide variety of institutional contexts and consist of fairly broad statements. In response to these and the findings of the report outlined above regarding the research on distance education, a study was conducted to validate these principles, with specific attention to Internet-based distance education. A case study of six postsecondary education institutions recognized as among the leaders in distance education was conducted to determine those benchmarks or principles that are *essential to the quality of distance education courses* (Phipps and Merisotis 2000).

The report describing that case study identified 24 benchmarks as mandatory to quality distance education. Benchmarks that are mandatory were defined as those for which the absence of the benchmark would detract from quality. Stated positively, the benchmark must be essential or imperative to ensure quality. The benchmarks were separated into the following categories: institutional support, course development, teaching/learning, course structure, student support, faculty support, and evaluation and assessment. Some examples of the benchmarks are technical assistance in course development is available to faculty, who are encouraged to use it; courses are designed to require students to engage themselves in analysis, synthesis, and evaluation as part of their course and program offerings; and intended learning outcomes are reviewed regularly to ensure clarity, utility, and appropriateness. It is important to note that it has become increasingly evident that interactivity—between student and teacher,

student with other students, and student with other information—is the essential element for effectiveness in distance education.

The American Federation of Teachers (AFT) has expressed concern regarding the quality and effectiveness of technology-mediated distance learning. In a recent report, the AFT is troubled by the way distance education is being organized and conducted (Kriger 2001). The report states the following:

> Much of the distance education under study here, whether non-profit or for-profit, is built on corporate ideas about consumer focus, product standardization, tight personnel control and cost effectiveness (maximizing course taking while minimizing the "inputs" of faculty and development time). These concepts are contrary to the traditional model of higher education decision-making which emphasizes faculty independence in teaching and research, academic control of the curriculum, academic freedom in the classroom and collegial decision-making.

The AFT has developed guidelines laying out 14 specific standards that address their concerns and will, they claim, ensure high-quality distance education. The guidelines advance AFT's belief that "broad academic content, high standards, personal interaction and professional control are the key elements of education quality." The standards state that faculty must retain academic control, class size should be set through normal faculty channels, and faculty should retain creative control over use and re-use of materials.

Student Satisfaction with Distance Education. The recent U.S. Department of Education large-scale study of student participation in distance education referred to earlier in this report addresses student satisfaction with distance education classes (Sikora 2002). Undergraduate and graduate students were asked, "Compared to other courses you've taken, are you more satisfied, equally satisfied, or less satisfied with the quality of instruction you've received in your distance education courses?" A majority of both undergraduate and graduate students were at least as satisfied or more satisfied with the quality of teaching in their distance education classes compared with their regular classes. Among undergraduate students, 23 percent were more satisfied with the quality of instruction in their distance education classes than in their regular classes, 47 percent were equally satisfied, and 30 percent were less satisfied. At the graduate level, 22 percent were more satisfied, 51 percent were equally satisfied, and 27 percent were less satisfied.

2. ADDITIONAL ANALYSES, REVISIONS TO NATIONAL SURVEYS, AND ACTIONS TO BE TAKEN

Although the literature review outlined in chapter 1 was relatively comprehensive, a Working Group of the National Postsecondary Education Cooperative (NPEC) identified some gaps. Specifically, they identified three areas that deserved additional analysis and review: (1) postsecondary education digital divide—the perceived gap between institutions that have access to the latest technologies and institutions that do not; (2) preparation for using technology—the degree of exposure to technology that students have prior to participating in postsecondary education; and (3) the quality of distance education, which pertains to the effectiveness of technology in the learning process.

A number of national surveys have been conducted that include data about the three areas:

- NCES Integrated Postsecondary Education Data System (IPEDS);
- U.S. Census Bureau Current Population Survey;
- Cooperative Institutional Research Program Freshman Survey conducted by the Higher Education Research Institute of UCLA;
- NCES National Study of Postsecondary Faculty (NSOPF:99); and
- NCES Postsecondary Education Quick Information System (PEQIS) survey of postsecondary education institutions.

Additional data analyses were conducted to further explore the themes of *postsecondary education digital divide* and *preparation for using technology* using the information gathered from these surveys.

To further inform these issues and expand the knowledge base, this chapter provides the results of new analyses of existing national data. In addition, it offers recommendations for other actions, including revisions to current national surveys.

Postsecondary Education Digital Divide

As explained in chapter 1, there is good evidence that the *information technology network* capacity of larger institutions far outpaces that of other 4-year degree-granting institutions. Smaller institutions face severe challenges in meeting the advanced networking requirements necessary to educate the 21st century student. Also, according to NCES, *technology-mediated distance education* was related to institutional size; distance education courses were more likely to be offered by medium and large institutions than by small institutions (Lewis, Snow, and Farris 1999).

To further inform this issue and to examine more recent information, it is useful to review recent IPEDS data.[6] In the fall 2001 Institutional Characteristics Survey, institutions were asked to respond to the inquiry if they offered "distance learning opportunities." Recognizing that not all distance learning

[6] All postsecondary institutions that receive federal financial aid are required to complete the IPEDS surveys.

opportunities are offered through technology, it is not unreasonable to assume that many are, so this question may help shed light on the extent of differences among types of institutions.

Table 1 illustrates the number and percentage distribution of all degree-granting, Title IV-eligible postsecondary institutions offering distance learning, by institutional level and control, for fall 2001. The percentage of public institutions offering distance learning opportunities is much higher than the percentage of private institutions, both not for profit and for profit. Within the 4-year sector, 71.9 percent of public institutions (493 institutions) offered distance learning opportunities, compared to 33.2 percent of private not-for-profit institutions (540 institutions) and 48.5 percent of private for-profit institutions (149 institutions). It is interesting to note that about half of 4-year private for-profit institutions compared to approximately one-third of the 4-year not-for-profit institutions offered distance-learning opportunities. At the 2-year level, the difference is striking; 75.6 percent of the public institutions (919 institutions) offered distance learning opportunities, compared to 8.2 percent of private not-for-profit institutions (23 institutions) and 6.8 percent of private for-profit institutions (54 institutions). Additionally, table 1 indicates that larger institutions, regardless of institutional level and control, are more likely to offer distance learning opportunities.

The percentage of all institutions offering distance learning opportunities ranged from 21.3 percent of institutions with an enrollment under 1,000 to 86.5 percent of institutions with an enrollment of 10,000 or more. One in four 4-year public institutions with an enrollment under 1,000 offered distance learning opportunities compared to almost 9 out of 10 (88.3 percent) public institutions with 10,000 or more students. Also, about one-fourth (24.9 percent) of the 4-year private not-for-profit institutions with an enrollment of less than 1,000 offered distance learning opportunities, compared to 57.4 percent of 4-year private not-for-profit institutions with an enrollment of 10,000 or more.

Four-year private for-profit institutions did not show quite the same linear pattern, partly because of the small number of institutions with enrollments of 5,000 or more. Nonetheless, a little under half (47.6 percent) of 4-year private for-profit institutions with an enrollment of under 1,000 offered distance learning opportunities, compared with a little over half (51.5 percent) of 4-year private for-profit institutions with an enrollment between 5,000 and 9,999. Perhaps it is more interesting to point out that the percentage of small (an enrollment under 1,000) 4-year private for-profit institutions that offered distance learning opportunities was almost twice as high as the percentage of small public and private not-for-profit institutions. Also, focusing upon differences *within* the public sector, the percentage of 2-year institutions offering distance learning was consistently higher than the percentage of 4-year institutions offering distance learning—regardless of enrollment size.

It is interesting to compare the percentage of institutions offering distance education during 1997–98 (which was reported earlier in this paper from NCES data) and 2001. Recognizing that the 1997–98 report was drawn from sample data and the IPEDS data are census figures, during 1997–98, 34 percent of all postsecondary institutions offered distance education, compared to 44.4 percent in 2001. The percentage of 2-year public institutions in 1997–98 offering distance education was 62 percent, compared to 75.6 percent in 2001. In contrast, the percentage of public 4-year postsecondary institutions offering distance education decreased from 78 percent in 1997–98 to 71.9 percent in 2001. Finally, the percentage of postsecondary institutions with 10,000 or more students increased slightly from 87 percent in 1997-98 to 88.3 percent in 2001.

Table 1. Number and percentage distribution of Title IV degree-granting postsecondary institutions offering distance learning, by enrollment, and institution level and control: Fall 2001

Institution level and control	Enrollment size														
	Total			Under 1,000			1,000 to 4,999			5,000 to 9,999			10,000 or more		
	All	Number offering distance learning	Percent offering distance learning	All	Number offering distance learning	Percent offering distance learning	All	Number offering distance learning	Percent offering distance learning	All	Number offering distance learning	Percent offering distance learning	All	Number offering distance learning	Percent offering distance learning
All institutions	4,906	2,178	44.4	2,442	521	21.3	1,568	910	58.0	466	375	80.5	430	372	86.5
4-year institutions	2,620	1,182	45.1	1,128	334	29.6	969	445	45.9	252	178	70.6	271	225	83.0
Public	686	493	71.9	92	23	25.0	220	151	68.6	152	123	80.9	222	196	88.3
Private not-for-profit	1,627	540	33.2	803	200	24.9	681	259	38.0	96	54	56.3	47	27	57.4
Private for-profit	307	149	48.5	233	111	47.6	68	35	51.5	4	1	25.0	2	2	100.0
2-year institutions	2,286	996	43.6	1,314	187	14.2	599	465	77.6	214	197	92.1	159	147	92.5
Public	1,216	919	75.6	295	119	40.3	549	457	83.2	213	196	92.0	159	147	92.5
Private not-for-profit	279	23	8.2	269	21	7.8	9	1	11.1	1	1	100.0	0	0	0.0
Private for-profit	791	54	6.8	750	47	6.3	41	7	17.1	0	0	0.0	0	0	0.0

SOURCE: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS), Institutional Characteristics Survey, fall 2001.

Is there a digital divide with regard to distance learning opportunities between historically Black colleges and universities (HBCUs), underrepresented minority-serving postsecondary education institutions, and all other institutions? Table 2 compares the number and percentage of institutions offering distance learning opportunities by institutional level and type of underrepresented minority-serving institution. The table shows that the percentages of distance learning opportunities are very similar both at the 2- and 4-year levels. In fact, although the differences are slight, minority-serving institutions tend to have a higher percentage of distance learning opportunities than all other institutions. In some instances, the differences are more substantial (i.e., 2-year HBCUs—61.5 percent, 2-year American Indian/Alaska Native serving institutions—55.2 percent, and 4-year American Indian/Alaska Native-serving institutions—29.4 percent); however, the small number of these institutions must be considered.

Table 3 addresses the question of whether enrollment size is a factor with respect to institutional level and type of underrepresented minority-serving institution. As in previous tables, there remains a relationship between enrollment size of the institution and the likelihood that the institution offers distance learning opportunities—the higher the enrollment, the more likely the institution had such offerings. The patterns are less clear, however, because of the small number of institutions in several categories. Four-year Hispanic-serving institutions and American Indian/Alaska Native-serving institutions with enrollments under 1,000 have smaller percentages of distance learning opportunities than other types of institutions with enrollments under 1,000 (11.6 percent and 7.7 percent, respectively).

As a corollary to the percentage distribution of types of institutions offering distance education, another question relates to the proportion of *faculty* who teach distance education classes. Using a sample survey, the 1998–99 National Study of Postsecondary Faculty, new analyses were conducted to determine the percentage of faculty and staff who taught distance education classes at HBCUs, underrepresented minority-serving, and all other institutions.[7]

Faculty were asked if they taught any for-credit class "through a distance education program," but no definition for "distance education program" was provided. The new analyses shown in table 4 provide the percentage of faculty and instructional staff who taught at least one class through a distance education program by type of underrepresented minority-serving institution. The percentage of faculty and instructional staff at all institutions who taught any for-credit class through a distance education program was 4.9 percent. There were no significant differences regarding faculty and instructional staff teaching distance education classes among Black-serving and Hispanic-serving institutions, and all other institutions.

[7] The analysis was limited to HBCUs and Black- and Hispanic-serving institutions because (1) Asians are not considered underrepresented in postsecondary education, and (2) since the NSOPF:99 sample excluded tribal colleges, it would not be appropriate to include American Indian-serving institutions because the number of institutions would be too small.

Table 2. Number and percentage distribution of Title IV degree-granting postsecondary institutions offering distance learning, by institutional level and type of underrepresented minority-serving institution: Fall 2001

Type of institution	Institutional level								
	Total			4-year			2-year		
	All	Number offering distance learning	Percent offering distance learning	All	Number offering distance learning	Percent offering distance learning	All	Number offering distance learning	Percent offering distance learning
All institutions[1]	4,906	2,178	44.4	2,620	1,182	45.1	2,286	996	43.6
Black-serving institutions[2]	637	267	41.9	235	115	48.9	402	152	37.8
Historically black colleges and universities[3]	102	44	43.1	89	36	40.4	13	8	61.5
Hispanic-serving institutions	338	152	45.0	125	56	44.8	213	96	45.1
American Indian/Alaska Native-serving institutions	46	21	45.7	17	5	29.4	29	16	55.2
All other institutions	3,931	1,751	44.5	2,256	1,014	44.9	1,675	737	44.0

[1]Underrepresented minority-serving institutions refers to institutions that have a Black student enrollment of 25 percent or more (Black-serving); 25 percent or more Hispanic student enrollment (Hispanic-serving); or 25 percent or more American Indian/Alaska Native student enrollment (American Indian/Alaska Native-serving institutions). Historically Black colleges and universities are a subset of Black-serving institutions.

[2]The number of minority institutions does not add up to the total number of institutions because some types of institutions are overlapping. For example, all HBCUs are Black-serving institutions, and some Black-serving institutions may also be Hispanic-serving institutions.

[3]The Higher Education Act of 1965, as amended, defines an HBCU as "...any historically black college or university that was established prior to 1964, whose principal mission was, and is, the education of black Americans, and that is accredited by a nationally recognized accrediting agency or association determined by the Secretary [of Education] to be a reliable authority as to the quality of training offered or is, according to such an agency or association, making reasonable progress toward accreditation."

SOURCE: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS), Institutional Characteristics Survey, fall 2001.

Table 3. Number and percentage distribution of Title IV degree-granting postsecondary institutions offering distance learning, by size of enrollment, institutional level, and type of underrepresented minority-serving institution: Fall 2001

Institutional level and type of institution	Enrollment size														
	Total			Under 1,000			1,000 to 4,999			5,000 to 9,999			10,000 or more		
	All	Number offering distance learning	Percent offering distance learning	All	Number offering distance learning	Percent offering distance learning	All	Number offering distance learning	Percent offering distance learning	All	Number offering distance learning	Percent offering distance learning	All	Number offering distance learning	Percent offering distance learning
All institutions[1]	4,906	2,178	44.4	2,442	521	21.3	1,568	910	58.0	466	375	80.5	430	372	86.5
All 4-year institutions[1]	2,620	1,182	45.1	1,128	334	29.6	969	445	45.9	252	178	70.6	271	225	83.0
Black-serving institutions	235	115	48.9	92	32	34.8	101	54	53.5	29	20	69.0	13	9	69.2
Historically black colleges and universities[2]	89	36	40.4	26	6	23.1	47	20	42.6	14	9	64.3	2	1	50.0
Hispanic-serving institutions	125	56	44.8	43	5	11.6	46	21	45.7	18	15	83.3	18	15	83.3
American Indian/Alaska Native-serving institutions	17	5	29.4	13	1	7.7	3	3	100.0	1	1	100.0	0	0	0.0
All other institutions	2,256	1,014	44.9	984	297	30.2	821	369	44.9	207	145	70.0	244	203	83.2
All 2-year institutions[1]	2,286	996	43.6	1,314	187	14.2	599	465	77.6	214	197	92.1	159	147	92.5
Black-serving institutions	402	152	37.8	259	35	13.5	102	81	79.4	23	20	87.0	18	16	88.9
Historically black colleges and universities[2]	13	8	61.5	7	2	28.6	5	5	100.0	1	1	100.0	0	0	0.0
Hispanic-serving institutions	213	96	45.1	107	13	12.1	45	26	57.8	22	20	90.9	39	37	94.9
American Indian/Alaska Native-serving institutions	27	16	59.3	22	12	54.5	4	3	75.0	1	1	100.0	0	0	0.0
All other institutions	1,675	737	44.0	946	127	13.4	453	356	78.6	172	158	91.9	104	96	92.3

[1]The number of minority institutions does not add up to the total number of institutions because some types of institutions are overlapping. For example, all HBCUs will be Black-serving institutions, and some Black-serving institutions may also be Hispanic-serving institutions.

[2]The Higher Education Act of 1965, as amended, defines an HBCU as "...any historically black college or university that was established prior to 1964, whose principal mission was, and is, the education of black Americans, and that is accredited by a nationally recognized accrediting agency or association determined by the Secretary [of Education] to be a reliable authority as to the quality of training offered or is, according to such an agency or association, making reasonable progress toward accreditation."

NOTE: Underrepresented minority-serving institutions refers to institutions that have a Black student enrollment of 25 percent or more (Black-serving); 25 percent or more Hispanic student enrollment (Hispanic-serving); or 25 percent or more American Indian/Alaska Native student enrollment (American Indian/Alaska Native-serving) institutions. Historically Black colleges and universities (HBCUs) are a subset of Black-serving institutions.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS), Institutional Characteristics Survey, fall 2001.

Table 4. Number and percentage distribution of all faculty and staff teaching various types of distance education classes, by type of underrepresented minority-serving institution and all other institutions: Fall 1998

Type of minority- and non-minority-serving institution	Number of faculty teaching distance education classes[1]	Percent faculty teaching distance education classes
All institutions	52,603	4.9
Black-serving institutions	3,430	4.1
Hispanic-serving institutions	2,993	4.8
All other institutions[2]	43,857	4.9

[1]Weighted numbers.

[2]All other institutions category excludes American Indian- and Asian American-serving institutions.

NOTE: For purposes of this report, minority-serving institutions refers to Title IV postsecondary institutions with 25 percent or more Black student enrollment (Black-serving), 25 percent or more Hispanic student enrollment (Hispanic-serving institutions), and 25 percent or more American Indian student enrollment (American Indian-serving).

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1999 National Study of Postsecondary Faculty (NSOPF:99).

Again using the NSOPF:99 data, a new analysis was performed to describe more fully the characteristics of faculty who participate in distance learning, and, in addition, the academic program areas for distance education faculty. As shown in table 5, 4.9 percent of the full-time faculty and 4.8 percent of the part-time faculty reported that they taught at least one distance education class, as did 4.4 percent of male faculty and 5.7 percent of female faculty. With respect to race/ethnicity, 5.0 percent of nonminority faculty and 4.2 percent of underrepresented minority faculty taught a distance education course.

There were no significant differences in the percentage of faculty teaching distance education with respect to employment status (full time or part time), race/ethnicity, or gender. However, the percentage of business faculty teaching a distance education course was higher than the percentage of faculty in the fine arts, the humanities, and the natural sciences.

Because technology is becoming more and more important for both institutional administrative operations and distance learning, it is informative to learn about faculty and instructional staffs' opinions of the quality of computer resources at both underrepresented minority-serving institutions and other institutions.

Table 5. Number and percent of all faculty and staff teaching various types of distance education classes, by employment status, race/ethnicity, gender, and program area: Fall 1998

Faculty/staff characteristic	Number of faculty teaching distance education classes[1]	Percent of faculty teaching distance education classes
Total	52,603	4.9
Employment status		
Full time	30,500	4.9
Part time	22,103	4.8
Race/ethnicity[2]		
Non-minorities	48,217	5.0
White, non-Hispanic	45,124	4.9
Asian, non-Hispanic	3,093	6.1
Underrepresented minorities	4,386	4.2
Black, non-Hispanic	1,756	3.4
Hispanic	1,728	4.4
American Indian, non-Hispanic	506	9.3
More than one race, non-Hispanic	396	5.9
Gender		
Male	27,552	4.4
Female	25,051	5.7
Program area[3]		
Agriculture/home economics	846	5.0
Business	5,881	8.1
Education	4,414	5.3
Engineering	2,081	5.6
Fine arts	2,244	3.0
Health sciences	7,782	5.2
Humanities	6,925	4.2
Natural sciences	7,238	3.8
Social sciences	6,383	6.1
All other areas	8,139	5.5

[1]Weighted numbers.

[2]Asians are not an underrepresented group in postsecondary institutions.

[3]Numbers do not sum to totals due to nonresponse.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1999 National Study of Postsecondary Faculty (NSOPF:99).

Table 6 shows the number and percentage distribution of all faculty and instructional staffs' ratings of computing resources by type of underrepresented minority-serving institution and for all other institutions. Faculty in Black-serving institutions were less likely than their counterparts in all other institutions to rate their personal computers and local networks as excellent or good. Faculty in Black-

serving institutions were also less likely than their counterparts in all other institutions to rate their centralized computer resources as excellent or good, and more likely to rate their centralized computer resources as poor. Further, faculty in Black-serving institutions were less likely than faculty in all other institutions to rate the availability of Internet connections at their institutions as excellent or good, and more likely to rate availability of Internet connections as poor.

Table 6. Number and percentage distribution of all faculty and staffs' ratings of computing resources, by type of underrepresented minority-serving institution, and all other institutions: Fall 1998

Various computing resources and their ratings	All institutions		Black-serving institutions		Hispanic-serving institutions		All other institutions	
	Number faculty[1]	Percent faculty	Number faculty[1]	Percent faculty	Number faculty[1]	Percent faculty	Number faculty[1]	Percent faculty
Personal computers and local networks								
Excellent or good	715,865	75.1	53,427	71.9	38,518	72.0	599,133	75.6
Fair	165,349	17.3	13,821	18.6	10,238	19.1	135,190	17.1
Poor	72,578	7.6	7,047	9.5	4,712	8.8	58,355	7.4
Centralized computer facilities								
Excellent or good	550,157	73.5	39,393	69.7	30,496	71.6	459,587	73.8
Fair	138,178	18.5	10,585	18.7	8,111	19.0	115,381	18.5
Poor	60,325	8.1	6,500	11.5	4,009	9.4	47,829	7.7
Internet connections								
Excellent or good	758,872	81.4	55,515	77.6	41,195	78.0	635,903	82.0
Fair	116,604	12.5	8,811	12.3	7,208	13.7	96,309	12.4
Poor	57,128	6.1	7,218	10.1	4,391	8.3	43,545	5.6
Technical support for computer-related activities								
Excellent or good	575,197	62.7	42,010	60.5	31,856	62.3	481,984	63.1
Fair	229,080	25.0	17,688	25.5	11,784	23.1	191,134	25.0
Poor	113,020	12.3	9,797	14.1	7,471	14.6	90,536	11.9

[1]Weighted numbers.

NOTE: For the purposes of this report, minority-serving institutions refers to Title IV postsecondary institutions with 25 percent or more Black student enrollment (Black-serving); 25 percent or more Hispanic student enrollment (Hispanic-serving), and 25 percent or more American Indian student enrollment (American Indian-serving) institutions.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1999 National Study of Postsecondary Faculty (NSOPF:99).

The reader should be cautioned that although there were statistically significant differences in the ratings of faculty in Black-serving institutions and the faculty in all other institutions, the differences may or may not be substantially different in a policy sense. That is, although one can be reasonably assured that the differences of the rating percentages are real and not because of sampling error, judgments need to be made by policymakers whether the percentage differences are wide enough to require action.

Preparation for Using Technology

As noted earlier, in 2000, about two-thirds of all children 3 to 17 years of age lived in a household with a computer, although the percentages of White, non-Hispanic and Asian and Pacific Islander children were

higher than those of Black and Hispanic children. However, *if* a K-12 student lived in a household with a computer, to what extent did he or she use the computer to complete school assignments online—therefore enhancing preparation for using technology in postsecondary education? Did students who have a computer in their household and complete class assignments online differ from those who did not, by race and ethnicity?

Data from the September 2001 Population Survey provide a picture of the degree to which race/ethnicity was related to use of the Internet. The survey asked respondents in elementary and secondary school to indicate if they "completed school assignments online." As shown in table 7, over 80 percent of all high school students with a computer in the household completed school assignments online: White, non-Hispanic students, 91.9 percent; Black students, 84.5 percent; Asian/Pacific Islander students, 94.3 percent; and Hispanic students, 87.3 percent. There was no significant difference between White high school students and Asian Pacific Islander and Hispanic high school students with regard to completing school assignments online. Likewise, there was no significant difference between Asian/Pacific Islander and Hispanic students. However, Black high school students with a computer in the household were less likely than White and Asian/Pacific Islander students to complete school assignments online. Again, the reader is alerted to the caveat that a distinction should be recognized between statistical significance and whether a difference is wide enough to require policy action.

Table 7. Of high school students who had a computer in the household, number and percentage who said they completed school assignments online, by race/ethnicity: 2000

Race/ethnicity	Number with computer in household	Number completing assignments online	Percent completing assignments online
White, non-Hispanic	10,321,905	9,486,385	91.9
Black	1,384,039	1,169,981	84.5
Asian/Pacific Islander	746,934	704,567	94.3
Hispanic (of any race)	1,278,522	1,116,848	87.3

SOURCE: U.S. Census Bureau, Current Population Survey, September 2001.

We do not know how many high school students who responded that they completed school assignments online will eventually attend college. However, the Cooperative Institutional Research Program (CIRP) conducted by the Higher Education Research Institute at UCLA provides data regarding the computer literacy of college freshmen. The study surveyed over 400,000 freshmen from a voluntary national sample of 704 4-year colleges and universities during the fall 2001. Table 8 shows the percentage of freshmen, by race and family income, who responded that they "used computers frequently" the year prior to entering college. As the table shows, a majority of college freshmen had used computers frequently. Over four out of five White and Asian freshmen in this study (84.0 and 87.0 percent, respectively) reported that they used computers frequently. Almost three-fourths of Black and Hispanic freshmen (71.9 and 72.4 percent, respectively) reported that they used computers frequently. Focusing on family income, the results suggest that the higher the family income, the more likely a freshman used computers frequently in the year prior to entering college. The percentage of freshmen in this sample with a family income under $15,000 that used a computer frequently was 65.9 percent compared to 78.7 percent of freshmen with a family income of $30,000 to $39,999 and 87.3 percent of freshmen with a family income of over $75,000.

Table 8. Percentage of freshmen from selected 4-year institutions responding about the degree to which they used computers, by race/ethnicity and family income

Race/income	Used frequently	Used occasionally	Not at all
Race			
White	84.0	13.0	3.0
Black	71.9	20.1	8.0
Hispanic	72.4	19.3	8.4
Asian American	87.0	10.1	2.9
Other	79.6	15.1	5.3
Family Income			
Under $15,000	65.9	22.6	11.5
15,000-24,999	73.6	18.7	7.7
25,000-29,999	77.1	17.4	5.6
30,000-39,999	78.7	16.0	5.4
40,000-49,999	80.2	15.6	4.3
50,000-74,999	83.2	13.7	3.1
75,000+	87.3	10.6	2.1

SOURCE: Cooperative Institutional Research Program, American Council on Education and the University of California, Los Angeles.

It is important to caution that community colleges are not included in the CIRP, and that the sample of 4-year colleges is a voluntary one and may not be nationally representative. Since most community college students live at home and the majority are employed, issues of access to computers may be different for them—and for other commuter students who are employed—than for residential students.

Revisions to National Surveys

Several national surveys could be revised to gather more information about access to postsecondary education and technology by adding questions to expand the knowledge about this important topic. Two criteria were used to suggest revisions: to enable the data to be more current, and to provide for a better understanding of the issues. The suggestions here are offered with attention to limiting the burden upon both those who complete surveys and those who are obliged to compile the data. These suggestions are placed under the following two categories: *postsecondary education digital divide* and *effectiveness of distance education.*

Postsecondary Education Digital Divide

Distance Education Courses. In December 1999, NCES reported on a nationally representative sample of distance education at postsecondary education institutions, *Distance Education at Postsecondary Education Institutions: 1997–98*, which showed that distance education is "becoming an increasingly visible feature of postsecondary education in the country." The report updated a 1995 report by NCES. Because of the importance of distance education to policymakers at both the national and state level, it would be very helpful to collect these data on an annual basis and expand the sample to *all* degree-granting and Title IV-eligible postsecondary education institutions. Thus, the number of student credit

hours offered through technology-mediated distance education could be added to the Integrated Postsecondary Education Data System (IPEDS) surveys by adding the following illustrative question.

National Survey: Integrated Postsecondary Education Data System: Fall Enrollment Survey

Sample Questions:

- Under Part E – Additional Information

  Total number of student credit hours awarded in technology-mediated distance education courses. _____
  Undergraduate _____
  Graduate _____

As noted earlier in this paper, the IPEDS Institutional Characteristics survey asks institutions to indicate if they offer "distance learning opportunities." Although of some utility, the question and resulting data fail to distinguish between correspondence courses that are not facilitated by technology and courses using computers, the Internet, television, etc. By slightly altering this question and providing a clear definition of technology-mediated distance education, a wealth of additional information could be gleaned. Given the widespread use of some forms of technology in many classes, the definitional problems related to distance education are great. But given an appropriate and clearly understood definition, policymakers could better understand the extent to which technology-mediated distance education is part of the overall curricular offerings of postsecondary education institutions and how technology-mediated distance learning is apportioned among sectors. Appendix A provides a list of definitions of technology-mediated distance education used by various sources.

Resources for Technology Infrastructure. Although the landscape of postsecondary education is being dramatically altered by technology, relatively little attention has been given to what technology costs and how to pay for it. This information gap persists despite the fact that technology costs are widely perceived to be high and growing. Determining technology infrastructure costs is significant for policymakers at the national, state, and institutional levels. A major obstacle in determining cost is the lack of standard terminology for describing the components of technology infrastructure. A recent report by the Institute for Higher Education Policy, *Funding the "Infostructure," A Guide to Financing Technology Infrastructure in Higher Education*, provides a definition, or at least the beginnings of one, that organizes technology infrastructure into three broad clusters: building infrastructure, systems infrastructure, and personnel infrastructure. The definition, which is found in appendix B, was field-tested through focus groups with state financial officers and campus information officials. It is important to note that the definition includes *human* resources at the insistence of technology practitioners.

Before any such data are considered for collection, a group of affected parties should be convened to review the definition of technology infrastructure to determine its utility. Although it would be desirable to add a question related to technology expenditures to extant surveys, the different accounting standards of public and private postsecondary institutions would prohibit them from responding to questions on this topic.

Effectiveness of Distance Education

As noted earlier, despite the surfeit of descriptive studies, case studies, opinion pieces, policy papers, and how-to articles, there is little rigorous research about the effectiveness of technology-mediated distance learning. In addition, there are serious research gaps in several areas of distance learning. A significant contribution, therefore, would be to ascertain the degree to which faculty are appraising the effectiveness of distance education as part of the ongoing operations of the campus, particularly the assessment of student outcomes. A vehicle for such an inquiry might be the National Study of Postsecondary Faculty, but determining effectiveness is difficult for any medium of instruction, especially distance education.

This issue draws attention to the policy debate regarding distance education in postsecondary education. One school of thought is that distance education courses are essentially no different than traditional courses and, therefore, do not require different methods for assessing effectiveness. Another asserts that distance education courses, particularly asynchronous Internet courses, are fundamentally different than traditional in-class courses. This obliges the institution to develop methods for assessing outcomes for distance education courses.

Because of the importance of this subject, NPEC may want to consider case studies of institutions in the United States and internationally that focus on outcomes assessment of distance learning courses and programs. In particular, it is recommended that value-added assessment be the focus of case studies. Value-added assessment instruments look at the difference between what students know when they arrive and what they know when they leave—providing a measure of what the institution did or did not teach or what the student did or did not learn.

The efforts thus far to determine the effectiveness of distance education have been scattered and less than systematic. In addition, a substantial majority of the published information strives to compare classroom-based education with distance education. It may be time to abandon those comparisons and focus instead on if and how students learn, regardless of delivery of instruction. As discussed earlier in this report, Internet-based distance education in particular is evolving its own pedagogy. By adopting a value-added approach to the study of outcomes, solid evidence can be developed to ascertain the effectiveness of distance education.

Thus, it is recommended that several postsecondary education institutions be identified that are leaders in technology-mediated distance learning for participation in the case study. The case study approach would focus particularly on outcomes assessment for distance education courses and programs. Many of these institutions are performing exciting research on student outcomes assessment and can contribute to the knowledge base and dialogue.

3. WHAT DO WE KNOW

This report addresses the nexus between access to postsecondary education and technology, specifically, how technology affects access to postsecondary education and how technology is used in postsecondary education. In considering what we know based upon published literature and new information generated from the additional, unpublished analyses of national data, it is helpful to return to the four original themes that provided a framework for this paper.

Theme I: Access to Postsecondary Education in General

It is increasingly clear that technology has expanded the ability of students to participate in postsecondary education. Virtually every type of learner can benefit from technology, particularly the Internet. In addition to the rapid proliferation of new courses and programs, colleges and universities are taking advantage of the Internet to enhance the admissions process and give potential students the opportunity to apply online. There is also evidence that a portion of those students who participate in postsecondary education in their homes or workplace would not otherwise enroll in postsecondary education. Thus, it appears that technology is opening up new markets of potential students without significantly diminishing the number of students who would enroll in traditional colleges and universities, many of which also are offering technology-mediated distance education.

Distance learning advocates have suggested that a barrier to the ability of technology to enhance access to postsecondary education is the student financial aid system, particularly Title IV of the Higher Education Act. Title IV restricts access to federal student aid programs by institutions that enroll more than half their students or offer more than half their courses in distance education (commonly called the 50-percent rule). Although Congress is aware of the obstacles of the various regulations and has introduced legislation to ameliorate the barriers, concerns remain that loosening the restrictions will reintroduce the fraudulent enterprises that plagued the Title IV program in the 1980s and early 1990s and resulted in unacceptable default rates. In a recent report, the Department urged the Congress to eliminate or revise the 50-percent rule during its deliberations regarding the renewal of the Higher Education Act (Carnevale 2003).

Theme II: Access to Technology-Based Learning

The evidence regarding whether or not there is a digital divide for households and individuals is somewhat mixed. On one hand, recent data suggest that the overall level of a digital divide in the United States is rapidly decreasing. More than half the nation is online, and about two-thirds of the population use computers. Internet users increase by 2 million a month. Moreover, the rapid adoption of the Internet is occurring among most groups regardless of location, income, education, race/ethnicity, age, or gender. In particular, the groups that have traditionally been identified as the have-nots are making extraordinary gains.

Although these data are encouraging, the digital divide for households and individuals still remains, and has expanded slightly for some groups. Blacks and Hispanics continue to experience the lowest household Internet penetration rates of any demographic group. In fact, the gap between access to the Internet for Black and Hispanic households and the national average access rate widened from 1998 to 2000. Also, with respect to computer ownership, Black and Hispanic households have the lowest

penetration rate. Individuals 50 years of age and older continue to be the least likely to be Internet users. Two-parent households have a much higher rate of Internet access than single-parent households. Finally, people with a disability are only half as likely to have access to the Internet as those without a disability.

Some researchers have concluded that the most important factors facilitating or inhibiting Internet access are education and age. A college education increases rates of Internet access by over 40 percent compared to the least educated group, and people under 25 use it more than 40 percent more than those over 65.

These data notwithstanding, several analysts question whether there actually is a digital divide for households and individuals. Because technology is so inexpensive, if not free, almost anyone can have access to the Internet. The real divide, some say, is not about access but relevance. Low literacy levels are a major hindrance, in addition to the more mundane tasks of using a mouse and working on a keyboard. The dearth of pertinent information, literacy barriers, and limited diversity of content are significant barriers to getting lower income users online. Also, many observers claim that a "post-PC" era is set to dawn that will be characterized by many computing and communication alternatives. Another analyst suggests that in less than 10 years since the Internet became generally available to households, more than two-thirds of all families will be connected to the Internet at home. In contrast, 75 years elapsed between the invention of the telephone and its spread to two-thirds of American homes.

Focusing upon the institutional divide, it appears that there is strong evidence to support the conclusion that institutional control and enrollment are closely associated with the tendency of institutions to offer distance learning. That is, public institutions and larger institutions are more likely to offer distance learning than private institutions and smaller ones. With respect to types of minority and other institutions, there is no difference in the proportion of faculty engaged in teaching distance education classes. Nevertheless, faculty in Black-serving institutions are less likely than faculty in all other institutions to look favorably upon their personal computers and local networks, their centralized computer facilities, and availability of Internet connections.

There are no differences in the percentage of faculty teaching distance education with respect to employment status (full time or part time), race/ethnicity, or gender. However, the percentage of faculty teaching distance education is higher in the program area of business compared to the fine arts, humanities, and the natural sciences.

In 1999–2000, 8 percent of undergraduates and 10 percent of graduate and first-professional students were enrolled in distance education courses. Both undergraduate and graduate/first-professional distance education students tended to be those with family responsibilities and limited time. Also, they were more likely to be enrolled part time and to be working full time while enrolled. For both undergraduate and graduate/first-professional students, the Internet was the most popular delivery method.

Theme III: Preparation for Using Technology

The United States has come a long way since 1994 in providing computer and Internet access to students in public elementary and secondary schools. Ninety-eight percent of the schools, and 77 percent of classrooms, enjoyed Internet access in 2000, regardless of the poverty concentration of the students, location, or level of the school. Yet, differences in school characteristics remained. About four out of five schools with low concentrations of poverty compared to three out of five schools with high concentrations of poverty had Internet access in classrooms. By the fall of 2000, the ratio of students to

instructional computers in public school had decreased to 5 to 1, which equals the ratio that many experts consider a reasonable level for the effective use of computers. The ratio of students per computer *with Internet access* was 7. But, again, differences remained. Schools with the highest concentration of poverty had 9 students per computer with Internet access, compared to 6 in schools with the lowest poverty concentration.

Making the Internet accessible outside of regular school hours allows students who would not otherwise have the opportunity to have access to the Internet for school-related activities like homework. In 2000, over half of public schools with access to the Internet reported that computers with access to the Internet were available to students outside of regular school hours. Secondary schools were more likely to provide this service than elementary schools. Also, schools with the highest minority enrollment provided Internet availability outside of regular school hours more frequently than schools with the lowest minority enrollment.

In 1999, virtually all full-time regular teachers in the nation's public elementary and secondary schools had access to computers or the Internet somewhere in their schools, and over one-third reported that they used computers or the Internet "a lot" to create instructional materials. However, teachers in schools with high poverty concentrations were about half as likely as teachers in schools with low poverty concentrations to use computers or the Internet a lot. Barriers identified by teachers to using computers or the Internet for instruction included an insufficient number of computers and lack of release time for teachers to learn how to use computers or the Internet. Moreover, teachers in high poverty schools complained that outdated, incompatible, or unreliable computers were significant barriers to the effective use of computers.

In spite of the considerable amount of computers available to teachers in elementary and secondary schools, some commentators suggest—or state unequivocally—that since teachers are not trained to use technology or given opportunities to develop creative uses for technology, computers are used as glorified typewriters. Even teachers who become serious users of computers do not change their classroom practices. Several questions remain. How often do students really use computers and the Internet and for what purpose? Are the computers in the schools up to date? Do the schools have the appropriate technical staff to maintain new technology? Do teachers have sufficient training to use computers and the Internet effectively?

In 2000, about two-thirds of all children 3 to 17 years of age lived in a household with a computer, and about one-third of all children used the Internet at home. Girls were as likely as boys to use the Internet at home. Differences remained, however, with regard to race. About two-thirds of White, non-Hispanic and Asian and Pacific Islander children lived in households with computers, compared to 43 percent of Black children and 37 percent of Hispanic children. Also, over one-third, of White, non-Hispanic and Asian and Pacific Islander children used the Internet at home, while only 15 percent of Black and 13 percent of Hispanic children did so. Finally, White, non-Hispanic and Asian Pacific Islander *high school students* with a computer in the household were more likely than Black students to complete school assignments online.

Results from a survey of 4-year college freshmen revealed that most are computer literate. Close to four out of five men and women freshmen in the sample reported using a personal computer frequently during the year prior to entering college. Family income, however, appears to have been a factor. The percentage of freshmen with higher family incomes that responded that they used computers frequently was larger than freshmen with lower family incomes.

Theme IV: Effectiveness of Technology in the Learning Process

The determination of the effectiveness of technology in the learning process is an area of inquiry that is somewhat elusive. The literature on this subject contains a plethora of references that conclude that technology-mediated distance learning compares favorably with on-campus classroom instruction, and many find that students and faculty have a positive view of their distance education learning experience. However, an analysis of the literature on the effectiveness of technology-mediated distance learning reveals that it may be too early to reach these conclusions. Reviews of the body of literature on effectiveness reveal that many of the documents are how-to articles, advocacy pieces, and secondhand reports. Original rigorous research is in short supply, and those limited studies suffer from poor methodology, which renders their findings questionable. Some of major shortcomings of the research include the following:

- Most of the research does not control for extraneous variables, which makes it difficult to identify cause and effect.

- Most of the studies do not use randomly selected subjects, which is the best way to control for extraneous variables.

- The reliability and validity of the instruments used to measure student outcomes and attitudes are questionable, which can render a lack of confidence in the findings.

There are also important gaps in the research on technology-mediated distance learning. Perhaps the most important is the dearth of studies dedicated to measuring the effectiveness of *total* academic programs. Virtually all of the studies focus on individual courses. Another gap is that the research does not adequately explain why the dropout rate of distance learners is so high, which often skews the results when comparing distance learning with classroom instruction. Finally, there is some evidence that curricular objectives may be altered because of a limited variety of books and periodicals online.

The research on the effectiveness of technology-mediated distance learning notwithstanding, it would be erroneous to conclude that distance learning is not effective or of poor quality. These studies found fault with the *research methodology on distance education*, not distance learning itself. There were well over 50,000 different distance education courses offered to over 1.5 million students in 1997–98. Undoubtedly many more courses were being offered in 2003, and more students were enrolled in them. The vast majority of the institutions offering distance education courses are accredited, and a substantial portion of faculty teaching distance education courses are full-time regular faculty who are also teaching on-campus courses.

Perhaps it is time to focus attention on the more basic question of how students learn, regardless of the delivery system. Technology-mediated distance learning is evolving its own pedagogy, and with the introduction of more audio and video and broadband access, new and richer models can be explored. Because experimental studies comparing distance education courses with campus-based courses have been based upon the premise that campus-based courses are the "gold standard," which may be open to question, it may be advisable to abandon these studies. It appears that addressing how students learn and focusing on outcomes assessment would be more productive.

Several organizations have developed standards and guidelines to ensure quality distance education, including the Southern Regional Electronic Campus, the National Education Association, and the Western Cooperative for Educational Telecommunications. In 2000, Phipps and Merisotis reviewed

these guidelines and attempted to validate them through actual experience of postsecondary education institutions recognized among the leaders on distance education. Focusing specifically on Internet-based courses, the report identified 24 benchmarks considered mandatory for quality distance education. The benchmarks covered areas such as course development, evaluation and assessment, faculty support, and institutional support. Among the benchmarks, interactivity—between student and faculty, student and student, and student and information—is the essential element for effectiveness in distance education.

In a report critical of the way distance education is being organized and conducted, the American Federation of Teachers alleged that much of distance education is built on corporate ideas about consumer focus, product standardization, tight personnel control, and cost-effectiveness, which are not consistent with the traditional model of postsecondary education decisionmaking. Fourteen standards are advanced that address their concerns and include key elements revolving around faculty independence in teaching and research and collegial decisionmaking.

A recent large-scale study of student participation in distance education addressed student satisfaction with distance education classes. When asked how satisfied they were with their distance education classes compared to their regular classes, a majority of both undergraduate and graduate students were at least as satisfied or more satisfied with the quality of teaching in their distance education classes compared with their regular classes.

Because the efforts thus far to determine the effectiveness of distance education have been scattered and less than systematic, NPEC may want to consider a case study using institutions, both within the United States and internationally, that focuses upon outcomes assessment of distance learning courses and programs using a value-added paradigm. Comparisons of classroom-based education and distance education should be replaced by a focus on how students learn, irrespective of the delivery of instruction. Internet-based distance education in particular is evolving its own pedagogy. By adopting a value-added approach to the study of outcomes, solid evidence can be developed to ascertain the effectiveness of distance education. It is time that researchers identify several postsecondary education institutions, both within the United States and internationally, that are leaders in technology-mediated distance learning and are conducting research on outcomes assessment, for participation in the case study.

Because of the dramatic pace of technology growth, information on the relationship between technology and access to postsecondary education becomes old news very quickly. Thus, the data need to be updated at regular intervals. The number of distance education courses and programs requires continuous monitoring. The number and type of postsecondary education institutions providing technology-mediated distance learning should be assessed on a regular basis. Looking at the broader picture, the issue of computer and Internet access in the general populace, the elementary and secondary schools, and among postsecondary educational institutions needs persistent observation. Also, understanding the extent to which faculty in K-12 and postsecondary education use computers and the Internet is an area that requires updating.

While this report has comprehensively reviewed the research, it has become evident that other questions need to be addressed to paint a more complete picture of access and technology. The following issues are recommended for future research and data collection.

Access to Technology-Based Learning

- Given the growth of immigrants, especially Hispanic students, the number of students with limited English skills is increasing. A number of these students with limited-English-speaking and writing-skills reside in the rural agricultural areas of the country. Is distance learning an

option for this population? Are any online materials being developed that can assist this group of students?

Preparation for Using Technology

- Equal access to technology is not the same as equal access to *equal* technology. Although the data show that computers and Internet access are available to most students, the quality of that access needs additional exploration. How often are K-12 students using the Internet and other computer resources to learn, and for what purposes? Are K-12 students using school computers that can handle large amounts of data and employ sophisticated communication tools or are they working with obsolete machines? Is there a difference in types and levels of K-12 schools with regard to adequate technical support? Are teachers in one district getting better training to understand how to use technology to enhance learning, while teachers in another district are left to themselves to figure it out?

Effectiveness of Technology in the Learning Process

- In addition to determining the effectiveness of technology in the learning process by measuring learning outcomes and student satisfaction, attention should be directed to the notion of "social capital." An important component of a college education is the on-campus socialization and the social capital that is shared among faculty and peers. To what extent is socialization taking place through distance education? Is distance learning facilitated from home or at the workplace different in its impact than distance learning that is accessed from a campus site? Also, does increased access come at the expense of the quality of the experience in terms of noncognitive gains?

- In the fall of 2000, the Association of College and Research Libraries Board of Directors and the American Library Association Standards Committee approved new guidelines. Recognizing the proliferation of distance education courses and programs, the guidelines state that library resources and services must meet the needs of faculty, students, and support staff wherever they are located; in courses attended in person or by means of electronic transmission; or any other means of distance education. To what extent are virtual and traditional libraries providing appropriate and sufficient support to the curricula offered by distance education providers?

- More students are receiving a certificate or degree totally through distance education. What are the likely implications for economic returns for credentials that are achieved from distance coursework, compared to credentials awarded based on traditional courses?

Good public policy requires valid and reliable current data. Much has been written about access to postsecondary education and technology. Yet, because of the striking pace of technological advances and the proliferation of new players in the postsecondary education community, the issues are like quicksilver, and the environment in which they exist keeps shifting. Monitoring these phenomena requires continual vigilance through periodic data collection and informed analysis.

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APPENDIX A

DEFINITIONS OF DISTANCE EDUCATION AND DISTANCE LEARNING

National Center for Education Statistics

Distance education refers to education or training courses delivered to remote (off-campus) location(s) via audio, video (live or prerecorded), or computer technologies, including both synchronous and asynchronous instruction. Courses conducted exclusively on campus, as well as classes conducted exclusively via written correspondence, are not included in this definition of distance learning (although some on-campus instruction or testing may be involved, and some instruction may be conducted via written correspondence). In addition, distance education does not include courses in which the instructor travels to a remote site to deliver instruction in person, although courses may include a small amount of on-campus coursework or labwork, on-campus exams, or occasional on-campus meetings.

Institute for Higher Education Policy, *Assuring Quality in Distance Learning: A Preliminary Review.* April 1998.

Distance learning possesses the following characteristics:

- The teaching/learning process involves activities where the learners are at a distance from the originator of the teaching material;
- A combination of media may be used, including television, videotapes, audiotapes, videoconferencing, audioconferencing, e-mail, telephone, fax, Internet, computer software, and print;
- Knowledge and content is available through a variety of sources, not necessarily only from the teacher; and
- Course delivery can be offered anytime and anyplace, and direct interaction is available between teacher and student, student and student, and groups of students.

Distance learning includes synchronous communication, which occurs when teacher and student are present at the same time during instruction, even if they are in two different places. Distance learning also includes asynchronous communication, which occurs when students and teachers don't have person-to-person direct interaction at the same time or place, such as through home computer-based study with student-faculty communication via e-mail, including comments on homework assignments.

American Council on Education

Distance learning is a system and a process that connects learners with distributed learning resources. While distance learning takes a wide variety of forms, all distance learning is characterized by

- Separation of place and/or time between instructor and learner, among learners, and/or between learners and learning resources.

- Interaction between the learner and the instructor, among learners, and/or between learners and learning resources conducted through one or more media; use of electronic media is not necessarily required.

American Federation of Teachers

The term distance education is commonly used to describe courses in which nearly all the interaction between the teacher and student takes place electronically. Electronic communication may take the form of audio, video, e-mail, chat, teleconferencing, and, increasingly, the Internet. Distance education courses range from short-term training workshops to undergraduate and graduate programs for college credit.

United States Army Research Institute for the Behavioral and Social Sciences, Technical Report 1095, *Training Through Distance Learning: An Assessment of Research Findings.* June 1999.

Distance education is planned learning that normally occurs in a different place from teaching and as a result requires special techniques for course design, special instructional techniques, special methods of communication by electronic and other technology, as well as special organizational and administrative arrangements.

APPENDIX B

DEFINITION OF TECHNOLOGY INFRASTRUCTURE FOR POSTSECONDARY EDUCATION INSTITUTIONS INSTITUTE FOR HIGHER EDUCATION POLICY

Technology Infrastructure is comprised of three broad clusters, *building infrastructure, systems infrastructure,* and *personnel infrastructure.*

Building Infrastructure describes those components that need to be incorporated into a facility to make any technology operate effectively. These components include: 1) the conduits/raceways in which computer and network cables are laid in the building; 2) the cables and electric wiring for computers and other communications technology; and 3) the electrical power and related building features such as electric outlets.

Systems Infrastructure connects various technology components. For example, computer network infrastructure consists of the software that runs the networking function linking all computers in a class or college, or the external computers. It also includes hardware that runs the network, such as servers (computers with large information-storage capabilities that allow many users to share information). Modems—devices that allow computers to communicate with each other through telephone lines—are another basic component of systems infrastructure, in addition to routers, switches, and hubs. Systems infrastructure links data, voice, video, and multimedia systems. Wireless technology would also be included in this category.

- **Data Systems** include computers connected to peripheral devices, such as printers. In addition to administrative purposes, a baseline data system enables instructional computers to communicate with similar devices in the classroom or institution (local area networks). Optimally, a data system also encompasses computer networks compatible with outside sources (wide area networks), such as the Internet, computers within the system office or at other institutions, home computers and a variety of databases. In addition, data systems include a set of software applications and services from external providers, such as licensed library and research services, Internet services and other outsourced network sources.

- **Voice Systems** include two-way voice communication and messaging (telephone) systems. An optimal system includes sufficient outgoing and incoming lines and capacity to allow for technologies such as voice processing and voice mail.

- **Video and Multimedia Systems** provide accessibility to televised communication and all forms of video transmission within and outside the institution. An optimal system includes capacity to send and receive instruction (i.e., two-way interactive video classes) within the institution and other institutions.

Personnel Infrastructure includes the human resources necessary for the efficient operation of the overall technology infrastructure. Specifically, personnel infrastructure encompasses the human resources included for: 1) network management, 2) training and technical assistance, 3) course content development, 4) administrative support, and 5) student support services related to technology-aided instruction.