Faculty use of instructional technology and distributed learning

Chapter Five

Introduction

Community colleges are increasing the distributed learning options offered to students in an effort to respond to new markets for networked and remote learning. Educational technology has grown and evolved from correspondence in the early 1900s to more sophisticated delivery systems including videotapes, television, satellite and eventually the Internet and the WWW (Moore, 1990). Through the 1990s, however, colleges and universities underwent a major change: a shift in emphasis from the computer as a desktop tool to the computer as the communications gateway to colleagues and "content" (databases, image and text libraries, video, and more) made increasingly accessible via computer networks (Green & Gilbert, 1995). These distributed learning developments are expected to continue in the next decade, as profound and unavoidable advances in technology, particularly in computing capability, connectivity, bandwidth, software development, and digitized content, will continue to be change agents for higher education (Tuller & Oblinger, 1998).

In this chapter, we examine the utilization of technology in instruction by faculty at community colleges. Reflecting the theme of this book, we will argue that one must consider the context of the new economy in performing such an examination. For example, economic pressures will influence how much and which technology is chosen. In addition, these pressures will influence where the technology is situated within the community college, and which faculty members actually staff courses using technology.

In addition to outlining the possible influences of the new economy on how technology is integrated into instruction at community colleges, we also provide some empirical evidence

using the 1998-99 National Study of Postsecondary Faculty (NSOPF). We start by describing the level of use of technology among two-year faculty. Such descriptions are important because, as we will later discuss in more detail, technology structures the work life of faculty in important ways (Roe, 2002). In addition, we examine differences in technology use across faculty to see whether their work reflects pressures from the new economy. In particular, we are interested in differences by the disciplinary field and work status of two-year faculty.

Distributed Learning

As a prelude to our discussion of how the new economy influences the utilization of distributed learning at community colleges, we introduce the concept of distributed learning. Distributed learning is a broad category of activity descriptive of the intersection between instructional processes and technology. This intersection has produced an instructional model that allows instructors, students, and content to be located in different, non-centralized locations so that instruction and learning can occur independently of time and place.

Such a model deviates from the traditional classroom model that has historically dominated instruction. The traditional model consists of one instructor and students within the same physical space. The customary reliance upon this method of instruction is one reason why there is debate and discussion indicating that higher education faces a "cost disease" relative to other industries (Baumol, 1967; Baumol and Blackman, 1995; Bowen, 1967). Similar to dramatic and orchestral performances and excellent restaurants, higher education has experienced slow growth in productivity due to the labor requirements of instruction. In the traditional classroom, the quality of instruction is difficult to maintain if the amount of labor is reduced over time. A rather different setting exists for the production of automobiles and food

where technological improvements have allowed the same number of workers to produce a larger number of goods. Consequently, these other industries are able to offer their products at much lower costs and increase the wages of their workers, which forces higher education institutions to also increase wages to attract quality personnel to the profession (Baumol, 1967; Baumol and Blackman, 1995; Bowen). If colleges simply rely upon the traditional classroom model of instruction, then their costs will rise as salaries increase and the size of the workforce does not decrease.

The use of technology, however, allows community colleges to fundamentally change the production process in instruction. A discussion of distributed learning in the aggregate, however, hides the diversity of options available within this category. In Table 5.1 below, Diaz (2004) describes eight different forms of distributed learning constructed from various sources of both professional and other literature descriptive of the growth and transformation in this area. Each of these categories utilizes varying degrees of institutional resources, technical skill, instructional and curricular expertise, and involves various constituents.

TABLE 5.1
The distributed learning continuum.

Distributed learning activity	Example/Description	Use of institutional resources	Technical expertise required
Basic technology used for instructional purposes	ELMOs (project cameras), electronic presentations, Internet, email, or video.	Low (varies depending on medium)	Low/ Medium
Instructional labs	Discipline-based labs in which faculty members develop (commercially unavailable) software to be used in converted instructional environments (from lecture to a self-paced, online format).	High	High
Online courses (faculty-produced/hosted)	Courses conducted using faculty-developed web pages/hosted on faculty or institutional site	Low/ Medium	Very High
Online courses (institutionally-hosted)	Courses conducted using commercially-developed course management systems (i.e., WebCT, Blackboard) or institutionally-developed products	High	Medium

Learning Management Systems (LMSs)	An LMS typically provides capabilities for all types of learning events: home pages for students, classroom resource management, online student enrollment, records and content keeping, integration of third party content, testing, and delivery of electronic courses.	High	Very High
Content Management Systems (CMSs)	The CMS's objective is to simplify the creation and administration of online content (articles, text, images, audio) used in the instructional process.	High	High
Learning Content Management Systems (LCMSs)	The LCMS (mostly web-based) is used to author, approve, publish, and manage learning content (more specifically referred to as learning objects).	High	Very High
Digital Repositories	MERLOT: Multimedia Educational Resource for Learning and Online Teaching: a free and open resource designed primarily for faculty and students of higher education with links to online learning materials along with annotations, such as peer reviews and assignments. Available at http://www.merlot.org.	High	Very High

The first category, basic technology used for instructional purposes, mostly supplements the traditional classroom model through the use of the internet and an ELMO (project camera) within the classroom or the use of e-mail and course websites outside of the classroom. The latter tools allow additional communication and instruction to take place independent of time and location. Because these forms of technology are not used to replace the classroom model but simply to augment traditional instruction, the primary benefit is increased quality of instruction, not cost savings. Indeed, expenses will rise due to the cost of the technological infrastructure required to support such activities. These infrastructure costs are likely to be non-trivial if community colleges intend that course websites be used widely. A course management system, which requires an investment of institutional resources, will be needed for faculty members to upload documents or enter content directly into a web template, with ease.

Another type of distributed learning, on-line courses, is a more substantial deviation from the traditional classroom model of instruction. In this setting, most if not the entire course takes place on-line, and thus the method of instruction is less dependent upon time and location. This mode of instruction is more far reaching in its implications. Perhaps, the principal impact occurs through increased access by students who find the available traditional classroom instruction

difficult to attend due to geographical or time constraints. Consequently, community colleges can reach additional students and gain access to a different set of revenues through the use of on-line courses (Dixon, 1999).

Producing instruction at a distance using on-line courses has a substantial impact on the production process for instruction. In this setting, course materials take on greater importance than in a traditional one. In a physical classroom, an instructor can meet with students without instructional materials beyond the lecture and continue to be able to deliver the course. In cyberspace, this becomes more difficult, so course materials begin to embody or encapsulate many of the processes of the physical classroom. Because creating course material for an online course can be a time-intensive endeavor, community colleges will likely seek to avoid the high costs of course development by using the same material for numerous courses. Consequently, when community colleges establish their distance education programs to the point where efficiency-saving adjustments can be instituted, these courses will often have separate instructors for the development of the course materials and the actual instruction of the students.

This alternative production process may have important financial implications for community colleges. First, the costs of instruction may change. The digitization and standardization of content may allow institutions to rely upon fewer full-time faculty members to develop the course material and then supervise numerous adjunct instructors who teach the courses. Such staffing patterns may reduce labor costs due to the greater reliance on adjunct instructors. On-line courses can also reduce expenditures by decreasing the need for physical classrooms to house instruction. The extent to which overall cost savings are realized, however, depends upon the degree to which these savings are outweighed by the labor and equipment costs needed to maintain the technological infrastructure required to support on-line courses.

The potential high costs of this infrastructure is demonstrated by the proliferation of learning technology managers and support staff housed in centers with teams of highly skilled professionals including instructional technologists, media technicians, visual and web designers, web programmers, and accessibility specialists (Diaz, 2004; Slaughter & Rhoades, 2004).

Without a substantial investment in the required infrastructure, community colleges may have difficulty creating a large number of distance education courses. An institution could not make a substantial investment and rely upon individual faculty members to produce, develop, and host the on-line courses, but such a strategy requires faculty with a high level of technical expertise. Indeed, if an institution desires widespread implementation of online courses or programs, it will need to provide commercially-developed course management systems or institutionally-developed products along with support personnel so that faculty with lower levels of technical expertise can participate (Diaz, 2004). Such an approach may generate greater revenue and increase access for certain types of students through the widespread use of technology, but it may be expensive and not significantly reduce the costs of instruction.

Online education can also impact the revenue generated by a community college. Because some students cannot enroll in on-campus courses due to time and geographical considerations, online courses allow community colleges to gain access to a new set of students and their associated tuition and state appropriation dollars. Community colleges may also generate revenues from the creation of standardized course material that can be sold to other schools. Institutions of higher education are increasingly purchasing already established on-line courses from other institutions or from for-profit businesses rather than develop their own on-line courses (Carnevale, 2005). To facilitate this activity, the Monterey Institute for Technology and Education is developing the National Repository of Online courses. In addition, the League

for Innovation in the Community College helps institutions trade courses through its Specialty Asynchronous Industry Learning project (Carnevale, 2005). The extent to which community colleges can generate revenue through selling their courses is not clearly established, but this opportunity will likely interest many resource-stressed schools.

The Role of the New Economy

A central theme of this chapter is the important influence of the broader sociopolitical context on the use of instructional technology within community colleges. At the same time that technology was reshaping the instructional options available to community colleges, the rapid rate of technological progress was also reshaping the broader economy in several ways that have important effects on community colleges. Rapid reductions in transportation and communication costs resulted in companies becoming much more geographically mobile, pressuring federal and state governments to reduce government spending to attract employers. At the same time, institutions of higher education face greater student demand because the return to education has grown substantially. The growth in the payoff to education is part of a general trend towards greater income inequality, which some economists partially attribute to rapid technological change (Autor, Katz, & Kreuger, 1998). In addition to increasing the general return to education, the fast pace of technological change rapidly alters the skills required to compete in the workforce. Consequently, more students seek to take courses periodically for specific training, which is especially important for community colleges who often provide these services. Together, these trends suggest that pressures from the new economy have forced community colleges to educate more students without increased resources from the government.

Castells (2000) identifies the new economy as informational in that the productivity and

competitiveness of units or agents in this economy fundamentally depend on their capacity to generate, process, and apply knowledge-based information efficiently. Because higher education institutions are the greatest knowledge-based producers, the new economic context will provide several opportunities. At the same time, increased global competitiveness and increasing focus on productivity can fundamentally alter community colleges in important ways. Castells (2000) notes "The generalization of knowledge-based production and management to the whole realm of economic processes on a global scale requires fundamental social, cultural, and institutional transformations" (2000, p. 100).

In *Globalizing the community college: Strategies for change in the twenty-first century*, Levin (2001) echoes Castells' perspective in discussing the role of globalization on the actions of community colleges. Consistent with the trend of stagnant government funding along with greater student demand, community colleges are asked to serve more students without being provided with more resources. At the same time, the mission of the community college has shifted from student and community betterment to a workforce development model that seeks to serve the "global economy" (Levin, 2000). In such an environment, increased emphasis on productivity and efficiency and increasing restructuring, marketization, and commodification is expected. Levin (2001) notes numerous changes, such as the increased participation in contract training partnerships with local and foreign businesses and governments, rising tuition and fees, increased reliance upon donations from the private sector, new focus on vocational programs (that is, allied health, business technology, and manufacturing), and a greater reliance on part-time faculty.

Levin (2001) also presents evidence suggesting that the implementation of distributed learning is spreading rapidly in public community colleges and suggests that this growth reflects

pressures from the greater economy. Roe (2002) outlines three factors that impact the selection and implementation of information technology within community colleges. The first involves government policies that provide incentives for community colleges to generate revenue, become more efficient, and meet the needs of business and industry for skilled labor. In terms of the last goal, community colleges are under pressure to produce graduates who are employable (Deden & Carter, 1996) especially in the many jobs recently created that require midlevel or technical skills (Grubb, 1999). Levin (2001) finds that state and provincial governments directly promoted the use of information technologies in teaching and learning because their officials and leaders make a number of assumptions about students and the needs of the economy.

> [T]here are new students with different learning styles and needs from the past; there are fewer or at least not increasing funds available for public institutions, and therefore higher productivity or greater efficiencies or both must be realized by institutions; and the world of work – business and industry – requires well-trained and technologically savvy workers.(p. 87)

As discussed earlier, the general infrastructure costs associated with the use of technology in instruction cast doubt on the proposition that greater use of technology will result in greater efficiencies and lower costs. However, little doubt exists that the hope of possible efficiencies partially drives the increasing use of technology in instruction.

The second factor driving the use of information technology identified by Roe (2002) is the demands by community college constituents who want training in specific areas and flexibility in terms of time, location, and pedagogical methods. These demands are both for greater use of technology within the classroom as well as increased offering of courses via distance education, and they are especially important when considered in combination with two

additional trends. First, community colleges are also increasingly making instructional decisions based on the preferences of their "consumers" (Levin, 2001). Second, the number of individuals desiring additional education is growing steadily. As discussed earlier, the growing financial return on education as well as the increasing importance of updating one's skills to meet the changing requirements of the labor market should increase the number of students seeking enrollment. In addition, demographic trends in many states (especially those in the southeast and southwest) are resulting in a significant increase in the number of high-school graduates (Hebel, 2004). Given the limited availability of space at four-year institutions, great pressure will be placed on community colleges to accommodate these additional students.

The final factor driving use of technology identified by Roe (2002) is the response by community colleges to the expanding demands of their socioeconomic environment. Of special interest is the movement within community colleges to a more managerial or business-like culture, and the focus of community colleges on the needs of business and industry rather than the local community (Levin, 2001). Within that context, the promise of a new instructional approach that can increase efficiency and improve workforce development will be attractive.

To this point, we have discussed the community college as a whole rather than an organization that contains multiple departments that differ in important ways. This aggregate analysis hides several complexities regarding how the use of instructional technology is impacted by the increasing focus on workforce development, consumer (student) preferences, and the needs of business and industry. Within community colleges, these trends should result in growth for those fields that teach courses that provide skills rewarded in the marketplace; this growth occurs at the expense of those fields that teach courses less directly tied to the workplace.

Fields closer to the market, however, may enjoy an even greater advantage in distance

education courses. First, community colleges seeking to use technology to reach the goal of improved workforce development will invest resources in those courses that provide material viewed as vital to the greater economy (Levin, 2001). For example, fields that teach skills in demand by business and industry will be considered for investment, especially if community colleges can establish profitable contracts with employers to train their workers at a distance. In addition, fields that support industry such as education and nursing, which are required for future workforce development and lower health care costs, will likely also be favored. A second reason for substantial differences across fields involves varying student demand. Students seeking courses containing content more directly tied to the workplace may be constrained by time and place as a result of being currently employed.

Several practical considerations may also contribute to differences across disciplinary fields in the use of instructional technology. For example, course content in some subject areas may be more or less amenable to the use of technology. For instance, students may require technology in engineering courses where its use facilitates and enhances the learning process and employability in the future. In addition, the faculty within certain fields may have greater knowledge about and training in technology, which would make it easier for these faculty members to use technology in instruction. Green (2001) finds evidence that among community college faculty, those in occupational programs, business, and biological and physical sciences are better prepared to participate in distributed learning activities while those in education, humanities, and social sciences are the least prepared. These differences across fields exist for three reasons. First, the nature of undergraduate and graduate education likely varies across subject areas with some fields more likely to utilize and consequently expose future faculty members to technology. Second, the self-selection of individuals interested and experienced in

various forms of technology into fields of study where technology is more heavily used will also contribute to differences. Third, community colleges may exert greater effort into training faculty in some fields relative to others.

Some limited evidence suggests that important differences across fields do exist. Early distance education programs served high-technology professionals who could not attend courses on campus but needed to stay current in their field (McGill & Johnstone, 1994). Levin (2001) finds that technology was not used in traditional arts and sciences fields, but was more common in fields such as nursing and business. Rhoades (1998) provides additional evidence that faculty in the humanities and social sciences fared poorly as resources in these fields were diverted towards investment in educational hardware and software.

We end our discussion on how pressures from the new economy influence the use of instructional technology by examining which employees produce distance education courses. On-line courses could be staffed in ways similar to those in the traditional classroom setting where the instructor plays an important role in all aspects of producing the course. But as discussed earlier, the enhanced importance of course materials within distance education increases the likelihood that the production of instruction will be unbundled with different instructors handling different aspects of the course. Paulson (2002) disaggregates instruction into five activities: designing the course and curriculum, developing the course and curriculum, delivering the subject material, mediating the learning process, and assessing individual student learning. In Table 5.2 below, we illustrate how instruction may be disaggregated and how distributed learning mechanisms discussed in Table 5.1 are used to facilitate this function.

TABLE 5.2
The disaggregation of the instructional function via distributed learning.

Instructional Function (Paulson, 2002)	Distributed Learning Tool/Service
Designing the course or curriculum	Instructional designers, learning technologies centers, faculty

	members
Developing the course or curriculum by selecting appropriate instructional methods and course materials, or creating those course materials	Learning technologies centers (designers, media specialists, graphic artists), digital repositories, faculty members
Delivering the subject matter previously selected either in person (lectures, etc.) or through the use of various forms of media	Basic technology used for instructional purposes (traditional classroom technology), online courses, LMSs, CMSs, or LCMSs, faculty members
Mediating (also called "tutoring") the learning process, which helps students understand materials in ways tailored to their individual learning styles and levels of understanding	Instructional Labs, Online courses, LMSs, CMSs, or LCMSs
Assessing individual student learning through appropriate methods and assignments designed to certify the attainment of a given level of competence	Instructional Labs, Basic technology used for instructional purposes (traditional classroom technology), LMSs, CMSs, or LCMSs

The first two activities could be unbundled from the last three so that an instructor could perform the first two steps and then supervise numerous adjunct instructors who staff separate sections of the course and perform the final three steps. Similarly, an institution could outsource some of the instructional activities (Paulson, 2002).

Given the movement towards a more managerial and business-like culture, the pressure to reduce labor costs is considerable at community colleges (Levin, 2001). These institutions have increasingly relied upon part-time faculty to reduce costs for education in general (Wagoner, 2004; Roueche, Roueche, & Milliron, 1995), but much less evidence exists regarding the use of part-time faculty for distance education specifically. However, heavy reliance upon part-time faculty for online education is likely for the reasons provided in the previous paragraph as well as for the geographic flexibility inherent in distance education. For the part-time faculty member, whose only activity on campus is a single course, options that eliminate the time and cost of commuting are attractive, especially if that faculty member holds positions at multiple institutions.

The Impact of Technology Use on Faculty

We use data from the 1998-99 National Study of Postsecondary Faculty to provide empirical evidence on the use of instructional technology by community college faculty. Our

first contribution is to describe the share of faculty who use technology. Such a description is important because the use of technology alters the work life of faculty members in several important ways. The literature describes and promotes a shift from delivering instruction to facilitating learning (Barr & Tagg, 1995; Dixon, 1999; Quick & Davies, 1999). Although subtle in definition, this trend has had major implications in the institutional expectations placed on faculty members and the way that they participate in the instructional process. New instructional roles proposed for faculty include instructional designer, coach or facilitator, classroom instructional researcher, interdisciplinary team member, and broker of educational experiences (Barr & Tagg, 1995; Cooper, Robinson, & McKinney, 1994; Davis, 1995; Ludwig, 1996).

Through interviews with community college faculty, Roe (2002) finds evidence that the use of technology in instruction has a complicated effect on the workload of faculty. Specifically, the responses of faculty members suggest a paradox:

> [A] common thread can be discerned running through most of the comments in the efficiency and time/workload subcategories. This thread is that, on the one hand, computer technology creates more work for faculty, and that, on the other hand, it facilitates the accomplishment of the extra work. Respondents in both these subcategories insisted that they had more work to do since incorporating technology into their work lives, yet they also found that the technology permitted them to accomplish more in a shorter amount of time.(p.139)

One reason why many instructors felt that technology increased workload was the absence of release time granted to most faculty members to develop a technology-enhanced course. Another workload related concern was the increasing disintegration of the boundary between work-time and free-time. Responses to e-mail were often made at home rather than at work.

The use of instructional technology can impact community college faculty in other areas besides workload. For example, the autonomy and power of faculty can be changed fundamentally (Rhoades, 1998; Vallas, 1993). Roe (2002) finds limited evidence supporting such concerns, but several implicit attributes of the use of technology in instruction suggest that these concerns are valid. First, the use of e-mail (which some community colleges claim they can monitor as a managerial prerogative) and course websites make the instruction process more public, allowing colleges to monitor their faculty more closely than in the past (Levin, 2001). Second, as discussed earlier, distance education increases the likelihood that the instructional role will be unbundled with different instructors delivering specific aspects of the instructional process. If the roles were unbundled, the few faculty members who design and develop the course curriculum and the computer technicians who design the software that will house the content will likely see their roles expanded within the institution. However, other faculty members who actually staff individual courses will have less control over the content of the courses and may become more marginalized as a class of employees (Levin, 2001b).

In order to understand how much faculty work life is changing, estimates of the extent to which faculty are using instructional technology are needed. Grubb (1999) found very little technological innovation in his study of thirty-two colleges in eleven states while Roe (2002) found much more activity at several community colleges in the southwest, although her sample contained a disproportionate share of early adopters. Past research, however, has not produced national estimates of technology use at community colleges, and we fill this void using the most recent National Study of Post-Secondary Faculty (NSOPF). This survey contains a large sample of community college faculty – 3,968 reported information on the use of technology – that is nationally representative. However, the most recent NSOPF survey only covered courses in the

Fall of 1998, thus the estimates we present likely underestimate current levels of instructional technology use.

[Table 5.3 approximately here]

Table 5.3 contains estimates for three types of technological activity: use of e-mail to communicate with students, course websites, and distance education. Consequently, we can examine the use of technology that supports classroom-based education (e-mails and course websites) and technology that allows much of the class to be taught independent of time and location (distance education). The results in Table 1 indicate that slightly more than a third of faculty use technology to support classroom instruction. Thirty-nine percent of faculty members used e-mail to communicate with students in their classes and thirty-three (33) percent used a course website. These figures are substantially lower than corresponding figures from Diaz and Cheslock (2004) for four-year faculty, which were seventy (70) and forty-one (41) percent, respectively. In general, one should expect this different level of technology use at four-year institutions because four-year schools employ faculty members with more education, have stronger technological infrastructures due to research activities, and employ smaller shares of part-time faculty. Therefore, the greater use of technology to support classroom instruction at four-year institutions may simply reflect the above disparities rather than differences in institutional effort to promote technology.

The estimates for distance education indicate that while only a small percentage of community college instructors teach distance education courses, the share is substantially higher than found by Diaz and Cheslock (2004) for four-year institutions (7.6% versus 5%). Given the greater resources enjoyed by four-year institutions mentioned above, this finding suggests that community colleges may be more aggressively encouraging faculty members to engage in

distance education.

Table 5.3 also contains information on the intensity of e-mail and website use, rather than simple descriptions of the share of faculty engaged in those activities. The results for e-mail indicate that faculty members who do use e-mail in instruction interact with twenty-two (22) percent of their students using that technology. The results for course websites demonstrate that most faculty members simply post general information or provide links to other websites. A smaller percentage of faculty (10%) use course websites to post exams and exercises, but those estimates are identical to figures for four year institutions found by Diaz and Cheslock (2004) indicating that no difference exists across institutional type in more meaningful utilization of course websites.

Differences across faculty in their use of technology

Table 5.4 contains the share of faculty participating in distributed learning activities for different groups of faculty. The first set of results displays differences across various demographic characteristics such as gender, race/ethnicity, and age. Given the important manner in which a faculty member's work life is altered by the use of technology, these results indicate which types of faculty members are most affected.

[Table 5.4 approximately here]

No differences by gender exist for the use of e-mail, but female faculty members are less likely to utilize course websites (30% relative to 36%) and more likely to teach distance education courses (8.8% to 6.5%) than their male counterparts. No consistent pattern exists across the racial or ethnic groups in terms of the two categories of technology that support classroom instruction. In terms of distance education, white faculty members have the highest

participation rates while African- and Asian-American faculty members have the lowest.

Age is often assumed to be an important determinant of technology use because younger cohorts of faculty received much greater instruction in technology during their education. The results for e-mail and course websites provide evidence that such differential educational experiences may result in different patterns of the use of technology. Starting with the age category of 35-39 year old faculty, the participation rates almost always drops as one examines older and older groups of faculty. Surprisingly, the opposite relationship exists for distance education, as faculty over fifty years of age have some of the highest participation levels.

We now turn to examining differences across faculty by field, education level, and work status. Our earlier discussion suggested that pressures from the new economy, as well as other factors, might drive differences across these faculty characteristics. To examine the differences by field, we use the field classification system developed by Wagoner (2004) that allocates faculty into groups that should experience similar pressures from the greater economy. The seven groupings (with the two largest fields following in parenthesis) are arts and humanities (general and composition English and creative writing), social and behavioral sciences (Psychology, History), physical and biological sciences (Mathematics, Biology), computing and technology (Computer and Information Sciences and Allied Health Technologies and Services), professional (Business Administration/Management and Accounting), trades and services (Protective Services/Criminal Justice and Vehicle Equipment Mechanics), and lesser-status professionals (Nursing, Physical Education).

We turn first to the results for distance education because much of our earlier discussion of differences by field focused on technology that reduces constraints associated with time and place. We do find some evidence indicating that community college faculty members are more

likely to teach distance education courses when the content of the course is more closely tied to workforce development. Of the four groups showing the highest participation rates, three are in areas considered important in the new economy: physical and biological sciences, professional, and lesser-status professional. Additional evidence supporting the importance of workforce development concerns includes the low levels in arts and sciences, which have weak ties to workforce development in the new economy, and trades and services, which contain fields that are not currently in ascension.

Not all of the results by field, however, support the claim that differences in the use of distance education are driven by workforce development concerns. Faculty members in computing and technology, a growing area within the new economy, demonstrate the second lowest rate of participation. This result is especially surprising because faculty members in this area are likely to possess strong computing skills, which would make conducting a distance education course easier for the instructor. A second surprising result is the extremely high participation rates within social and behavioral sciences, which is almost twice as large as any other field. Such a finding may indicate that many of the students who are using distance education are seeking general education courses towards a specific degree, such as the Associate's, or a program requirement rather than a few specific courses to update their skills. Because physical and biological sciences contain large numbers of Mathematics faculty within Wagoner's classification scheme, the high levels of technology use in that field also partially support this conclusion.

The differences across the fields in faculty use of e-mail and course websites indicate the importance of faculty skills, course content, and student preferences. Computing and technology faculty members have the highest participation rates, which is expected given the likely

technological preparedness among these instructors, the preference for technology among their students, and the need to use technology to deliver some of the instructional material. Additionally, lesser-status professional and trades and services, two fields that probably have less-technologically savvy faculty and course content that does not require the use of technology, have the lowest participation rates.

Earlier, we discussed the ability of community colleges to unbundle the role of faculty into separate activities. If a premium is placed upon lowering costs, two-year institutions may rely upon less educated and part-time faculty to implement distance education courses. The results in Table 5.4, however, demonstrate that a larger share of full-time faculty members participates in distance education courses than part-timers. In addition, less educated faculty are not more likely to participate in distance education. Such a finding may indicate that community colleges place special importance on distance education courses, and consequently staff them with full-time faculty.

But other explanations for this finding do exist, most notably the possibility that by the fall of 1998, community colleges were in the early stages of adopting distance education courses. At that moment, "early adopters" who were producing and hosting their own courses taught most online classes. As community colleges increasingly host the distance education courses themselves, different models of instruction may emerge. When future NSOPF surveys become available, longitudinal analysis can determine the extent to which part-time faculty members increasingly deliver online courses.

For both e-mail and course website use, more educated and full-time instructors have higher participation rates, although the difference is not very substantial for course websites. The differences across education level may simply represent the knowledge gained in graduate

school about technology. For work status, the differences may be due to part-time faculty being less integrated into the campus community and receiving less professional development (Wagoner, 2004). In some instances, part-time faculty may not have access to campus e-mail as Levin (2001) observed. In addition, part-time instructors may have less of an incentive to learn about existing instructional technology if their expected employment is short or unpredictable.

To this point, we have simply examined the correlation between each faculty member characteristic and instructional technology use. Some of these relationships, however, may simply be due to a third variable that is correlated with the faculty characteristic as well as with the level of instructional technology use. To examine this possibility, we turn to estimates of logistic regressions that include all of the variables in Table 2, as well as several characteristics of the institution. The institutional characteristics reflect that the use of technology in instruction likely varies by the institution's wealth, location, control, and size. The regression sample of 3645 two-year faculty members is slightly smaller than the sample used in Tables 5.3 and 5.4 because some data are missing for key institutional variables. The results in Tables 5.3 and 5.4 are very similar when this smaller sample is used.

[Table 5.5 approximately here]

Table 5.5 contains results for three logistic regressions that are identical except for the different dependent variables: use of e-mail to communicate with students, course websites, and distance education. For each regression, odds ratios are reported in addition to the coefficient and standard error to provide meaningful estimates of the size of the relationships with each independent variable and the use of technology. In general, the results indicate that most of the main findings from Table 5.4 are not altered once controls are added for other determinants of technology use. Some of the differences, however, are not statistically significant at

conventional levels because of large standard errors, especially in the case of distance education.

Female faculty members continue to use course websites at lower levels and distance education at higher levels, although the latter result is insignificant due to high standard errors. Male faculty members are 1.35 times more likely than females to use course websites, but female faculty members are 1.4 times more likely to participate in distance education. Similar patterns also exist for the race or ethnicity of the faculty as white faculty members are 2.21 and 1.92 times more likely to participate in distance education than Asian-American and African-American faculty members, respectively.

The results for age change slightly when examined in the regression format, partially because we use a continuous measure rather than the age categories used in Table 5.4. For both course websites and distance education, age appears to have little effect on the use of technology with regards to the size of the relationship or statistical significance. Age continues to be an important predictor of e-mail usage, however.

The education of a faculty member is similar to age in that the only substantial differences appear to be in the use of e-mail, where those with a doctorate are two times more likely and those with a master or first professional degree are 1.4 times more likely to use that form of technology than those without a graduate degree. The much lower rates of technology usage among part-time faculty continue once controls are added for other determinants. Full-time faculty are 2.2 times more likely to use e-mail to communicate with students, 1.3 times more likely to use course websites, and 1.9 times more likely to participate in distance education.

The results are similar for field, as well. For e-mail and course websites, computing and technology faculty members continue to demonstrate much higher participation rates that other fields; in many cases, they are twice as likely to use technology to support classroom instruction.

For distance education, social and behavioral science faculty members continue to demonstrate substantially higher participate rates than other faculty, and faculty in the physical and biological sciences as well as those in professional fields demonstrate slightly higher rates.

Conclusion

As discussed throughout this chapter, the growth of distributed learning activities has the potential to substantially change the production of instruction. Relative to the traditional classroom model that relies upon one instructor, a greater number of personnel will be involved in the creation of a course using instructional technology. A community college may now employ workers in a variety of new positions such as instructional technologists, media technicians, visual and web designers, and web programmers.

Because extensive course materials are required for online courses and costly to create, community colleges will sometimes find it less expensive to separate the tasks of creating the material and directly instructing the class. Such a division of labor would substantially alter the nature of work for many instructors. For those faculty members who simply instruct a course using materials created by others, their job will be reduced in status. Donald Wagner, the chairmen of the AAUP distance-education committee, highlights this point when discussing the implications for faculty when community colleges purchase course materials from another organization.

> "If it's something you haven't developed yourself, you're simply a talking head. It may be a cost-saving measure in the short term, but in the long term it reduces what the faculty member is. (Carnevale, 2004, p. A29)"

Of course, community colleges are not solely concerned with reducing costs and may

staff online courses with other goals in mind. For example, our results for the Fall of 1998 do not demonstrate that community colleges were more likely to rely upon low-cost part-time faculty for distance education courses. The unanswered question for future research is whether such staffing patterns have changed since 1998 and whether they will change in the future as distributed learning activities become more commonplace.

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Table 5.3: Average Faculty Distributed Learning Activity in Fall 1998.

Percentage of faculty who	
used electronic mail to communicate with students in their class	38.9%
used a course website	33.2%
taught a distance education course	7.6%
Average percentage of their students, a faculty member communicated with over e-mail	
Full Sample	8.7%
Sample reporting any e-mail activity	22.4%
Percentage of faculty who used their course website for:	
Posting general classroom information, such as the syllabus and office hours	24.9%
Posting information on homework assignments or readings	21.5%
Posting practice exams or exercises that provide immediate scoring	10.3%
Posting exams or exam results	8.8%
Providing links to other information	26.7%
Other uses	7.9%
Number of Observations	3968

Notes: All figures are weighted.

Table 5.4: Percentage of Faculty Reporting Use of Technology in Instruction

	# Obs.	E-mail	Website	Dist. Ed
All	3968	38.9%	33.2%	7.6%
Male	1922	38.8%	36.3%	6.5%
Female	2046	39.0%	30.0%	8.8%
American Indian	33	49.9%	35.9%	6.1%
Asian-American	126	49.6%	23.8%	5.1%
African-American	329	32.9%	41.7%	4.8%
Hispanic	298	42.7%	43.7%	7.0%
White	3182	38.7%	32.4%	7.9%
Age: <35	381	44.4%	28.8%	8.8%
Age: 35-39	391	45.0%	41.2%	4.8%
Age: 40-44	513	43.9%	36.5%	7.0%
Age: 45-49	739	39.9%	35.2%	6.2%
Age: 50-54	806	41.2%	32.6%	8.9%
Age: 55-59	625	34.4%	29.9%	8.8%
Age: >=60	513	24.6%	28.4%	8.6%
Arts & Humanities	908	40.0%	36.3%	5.7%
Social & Behavioral Sciences	451	39.0%	33.1%	14.7%
Physical & Biological Sciences	602	42.8%	27.8%	8.4%
Computing & Technology	367	56.5%	42.4%	5.4%
Professional	562	37.7%	37.7%	7.8%
Trades and Services	338	24.8%	33.2%	3.7%
Low Status Professionals	609	30.2%	25.0%	8.2%
Doctorate	567	50.5%	34.9%	7.4%
Masters or 1st Professional	2469	39.8%	33.4%	8.5%
Baccalaureate, Associate, or No Degree	932	31.1%	31.9%	5.6%
Full-Time	2141	48.5%	34.1%	10.1%
Part-Time	1827	33.0%	32.7%	6.1%

Notes: All figures are weighted.

Table 5.5: Logistic Regressions Explaining Faculty Use of Technology in Instruction

	E-mail			Course Websites			Distance Education		
	Coeff	Std Err	Odds Rat	Coeff	Std Err	Odds Rat	Coeff	Std Err	Odds Rat
Female	-0.084	0.103	0.919	-0.302**	0.135	0.740	0.336	0.238	1.400
American Indian	-0.026	0.405	0.974	-0.514	0.560	0.598	-0.209	0.771	0.812
Asian-American	0.329	0.259	1.390	-0.347	0.304	0.707	-0.794*	0.453	0.452
African-American	-0.219	0.185	0.803	0.495**	0.174	1.640	-0.653*	0.361	0.521
Hispanic	-0.081	0.237	0.922	0.344	0.268	1.411	-0.094	0.455	0.910
Age	-0.033**	0.005	0.968	-0.009	0.006	0.991	0.002	0.011	1.002
Doctorate	0.729**	0.173	2.073	0.169	0.193	1.184	-0.102	0.321	0.903
Masters or 1st Professional	0.309**	0.134	1.362	0.078	0.164	1.081	0.190	0.268	1.210
Part-Time	-0.796**	0.095	0.451	-0.239**	0.119	0.787	-0.621**	0.261	0.538
Arts & Humanities	-0.786**	0.194	0.456	-0.346	0.211	0.708	0.177	0.267	1.194
Social & Behavioral Sciences	-0.710**	0.231	0.492	-0.710**	0.244	0.492	1.418**	0.410	4.130
Physical & Biological Sciences	-0.737**	0.213	0.479	-0.798**	0.236	0.450	0.606*	0.352	1.833
Professional	-0.806**	0.210	0.447	-0.253	0.215	0.776	0.388	0.358	1.475
Trades and Services	-1.474**	0.224	0.229	-0.639**	0.260	0.528	-0.224	0.461	0.799
Low Status Professionals	-1.091**	0.222	0.336	-0.813**	0.232	0.443	0.146	0.389	1.157
Other Fields	-0.650*	0.374	0.522	-1.120**	0.429	0.326	0.499	0.495	1.647

Notes: N = 3645. All regressions include the appropriate weights and robust standard errors with clusters. In all regressions, the omitted race/ethnicity group is white, the omitted education group is Baccalaureate, Associate, or No Degree, and the omitted field is Computing and Technology. All regressions also include an intercept, a private dummy, location dummy variables, educational expenditures per student, and full-time equivalent enrollment as independent variables. **, * indicates significance at the 5 and 10 percent level of significance, respectively.