Distance Education: Assessing Costs and Benefits

by David Garson

Virtual universities, online learning, distance educa-tion––the new world of high-er education virtual reality is misty and elusive to the grasp. This new world means different things to dif-ferent people. It's a grab-bag of costs and benefits, the contents of which are most often unknown to those who travel down this particu-lar yellow brick road.

At one extreme, some argue that virtual education will spell the end of the traditional university as we know it. George Mason University's Peter Denning, speaking before the National Science Foundation, recently speculated:

- The library as a physical place is soon to be replaced by digital libraries accessible worldwide by almost anyone.
- The "community of scholars" around the library is soon to be replaced by communities of specialists linked electronical-ly, divorced from geographical location.
- The ideal-typical small under-graduate class has become unaffordable and cannot com-pete with commercially provid-ed education on the same sub-jects, such as computer science, nor can universities compete with the glitz and entertain-ment production values of com-mercial courses.
- Job structure has changed such that universities can no longer promise students a "lifelong career," the central selling point of higher education until recently.

Denning then asked, "What roles can universities fulfill that people would find valuable?"

The answer, Denning argued, was Internet-based distance educa-tion for adult professionals.

Denning is not alone. Futurists see an inevitable economic shift from local material goods to global knowledge services, forcing educa-tion to move toward electronically mediated education.[1]

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What is happening by virtue of this cyber-revolution is indeed exciting. Today, every student can access the Library of Congress and analyze census data online. Everyone, some propose, should be able to receive individualized learning experiences worthy of college credit, delivered at their convenience right into their home or workplace.

Online education has the potential to distribute education more widely than has heretofore been possible in the history of the world. Right now, once a faculty member's course materials are on the Web, any student with Internet access can get at them—if they are allowed. With access selling for around $20 per month, this is actually less than textbook costs.

Online instructors are not restricted to their own materials but may link to manuals by other faculty, to guides provided by government agencies, to corporate information, or to an ever-increasingly impressive array of other types of resources.

Online education, its advocates hope, will do for the masses in the twenty-first century what the public library movement did in the nineteenth and the expansion of public universities did in the twentieth.

With the erosion of job security, moreover, the challenge of twenty-first century university education will more and more have to do with dispersed adult learners who must remain at work and may be reachable primarily and often only through online education. Moreover, computer-mediated learning offers the potential to reduce parochialism by exposing students to a wider range, even international range, of fellow learners.

Online education is also unsurpassed in another area: the providing of the most timely information. True scholarship deals with the communication and collaboration of researchers at the cutting-edge of their fields, and online discussion is already the preferred mode for obtaining peer interest and support for work in progress.

The material in online courses can be updated frequently, even daily, as the instructor encounters new information and as student needs change. Students can read working papers from scholars and new policy reports from think tanks of all types, obtaining them as soon as they are posted.

If "staying on top of one's discipline" is a paramount academic virtue, online courses represent a new era in conveying this virtue to students.

Another plus: Online education is inherently interactive, and interactive education is far preferable to passive education. Students who

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would be reticent in a face-to-face situation may feel freer to "speak out" when "protected" by the semi-anonymity of online education.

Interactive educational activities can include real-time polls, computer simulations, virtual tours, individualized audio and video, intelligent tutoring, student-teacher E-mail, online archives, real-time chat rooms, research tools, and more.

In a course on journalism, for instance, instructors can use the Internet to teach real reporting, editing, and international communication skills.[2] Economists can analyze up-to-minute data and let students simulate economic decision making on micro and macro levels.[3] The Internet lends itself to student research projects ranging from online surveys to small group experiments to ethnographic research,[4] just to scratch the surface.

Online methods are also simply better at handling today's massive flows of information. Online work enables "data mining." Intelligent "infobots" can search the Web, news services, and libraries of the world for relevant information, storing what is found in searchable "infobases" that make electronic information retrieval swift and powerful. Everything retrieved can wind up as a permanent, search-able database on one's own computer.

Online education is also multi-media education. The instructor can incorporate color graphics, sound, and movies, as well as text, in materials presented online. Grease-pen transparencies give way to impressive graphical visualizations of data and concepts, even in the hands of novice faculty, with presentation packages such as the increasingly ubiquitous Microsoft PowerPoint slideshow software.

Multimedia is not a matter of pandering to the "TV generation." Rather, it is multisensory learning, which has routinely been found to be more effective pedagogically than unisensory learning such as reliance on texts alone.

Clearly, the voices extolling the benefits of online education have powerful arguments. They are also often the only voices heard. But we may need a reality check on the cost side of the distance education equation.

Others have written extensively about the high up-front costs of the technology itself.[5] What I'd like to focus on here are five other costs of online education: time and resources, teamwork, expectations, equity, and educational content—all directly affecting the quality of education.

Putting quality materials on the Web takes significant time. The

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learning curve for graphics and multimedia is time-consuming. More important, in online education, instructors place themselves open to the kind of time pressures described by Noble:

> the use of technology entails an inevitable extension of working time and an intensification of work as faculty struggle at all hours of the day and night to stay on top of the technology and respond, via chat rooms, virtual office hours, and e-mail, to both students and administrators to whom they have now become instantly and continuously available.[6]

The time invested to mount an online course must be recaptured in some way. One way is to sacrifice production values and accept low-quality offerings. This approach is widely evidenced today in slapped-together Web courses.

Another obvious way is to spend less time with students, also common. Electronic education is cost-efficient when it is used in conjunction with less overall instruction time.[7] This approach works better if the educational goal is training rather than liberal education.

Combine this time consideration with the "customer service" orientation increasingly characteristic of distance education,[8] and faculty may well find themselves under strong pressure to provide less content in their courses—in essence, exchanging broad educational missions for narrow learning objectives.

In another area, quality online education will in all probability increase labor cost. It's unrealistic to expect individual faculty members to be content specialists, learning technologists, graphic artists, media specialists, database consultants, programmers, and whatever else it takes to produce quality online course material.

These kinds of skilled labor costs will only escalate when online courses have to compete in the national and international marketplace for a limited market of paying students. Given the resources of private sector, profit-oriented investors, quality standards will inevitably rise beyond what is reasonable to expect of a single faculty member working alone.

While an online course, like a CD-ROM or a video production, can be mounted on the proverbial shoestring, the trend is in the opposite direction.

The costs of quality distance education relate directly to even more significant costs: those associated with the "expectation gap." Students who raise no questions

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about using a two-year-old textbook tend to think all Web documents should always be as up-to-the-minute as the evening news.

Students who accept pictureless books of readings expect multimedia when they come online. Perhaps because the Web comes via a television screen, students (and faculty!) tend to think graphics is better and multimedia is better yet. But faculty aren't equipped to produce "programs" on the level of a TV station.

The best students are most apt to be vocal in demanding traditional as well as Web-based course components. Many distance education plans recognize this. They seek to use interactive videoconferencing, for instance, to substitute for face-to-face discussions; to use online collaborative writing software for feedback on papers; to use chat rooms to simulate social aspects of the classroom.

Teleconferencing, online chatting, individualized feedback, and so on face much the same constraints, whether online or traditional. You cannot easily conduct good class discussions with a class of 400, whether that class is face-to-face or synchronously online or held asynchronously by E-mail.

Moreover, research strongly suggests students want E-mail as a supplement to, not replacement for, face-to-face discussion.[9] Administrators must face the reality that online education requires teaching assistants to handle discussion sections and E-mail as well, once classes pass a certain size.

But if distance education incurs these added costs on top of those already mentioned, and we still have to have the same faculty size, as well as additional online education teams, then the economics driving online education are shattered. Lowering quality becomes the only way out.

Online education shifts onto the student a considerable financial burden, in the form of technology investment.[10] On the world scene, the separation into information "haves" and "have-nots" is so great that present solutions do not even promise to stay the trend toward increased inequality.

Bias against women and minorities is also a well-documented problem of computer technology.[11] It is rare to encounter a funding plan for online education that funds efforts to overcome such biases.

Questions around the ownership of intellectual property rights also raise equity concerns, as universities assert ownership of whatever course materials a faculty member puts online.

Again, as David Noble notes:

the knowledge and course

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design skill embodied in that material is taken out of their [faculty] possession...the administration is now in a position to hire less skilled, and hence cheaper, workers to deliver the technologically prepackaged course.[12]

There is a very real threat that faculty will be stripped of their traditional equitable share of the royalties and revenues from their writing, and that an inequitable two-tier system of instructorship will come to characterize university teaching.

The New School for Social Research in New York City, for instance, has online courses designed for a flat fee by outside contractors—typically unemployed Ph.Ds —that the New School offers for credit: providing a full-credit course without ever hiring a traditional faculty member at all.

Everyone from deans to state legislators is looking to educational technology as a way to "deliver education" with "downsized" budgets.

The popular press frequently touts online education as a cost-saving way for government to cope with spiraling enrollment projections.[13]

Done properly, online education actually costs more, not less, than traditional learning approaches, but the–usually unspoken–agenda of online proponents is cost reduction.

Faculty often start out creating online courses as a creative, satisfying endeavor. But universities cannot long allow faculty to make investment in online education a matter of personal, creative choice.

The largest purveyors of distance education have implemented systems of performance indicators to control distance education by adopting outcome-based assessment.

That is, the instructor must formulate clear learning objectives for a course, and students must be tested on them before and after they take the course. But something is lost when the rich complexity of what faculty teach and inculcate is reduced to a printed list of learning outcomes and test items used to assess each outcome. Education is narrowed toward training.

When online education is part of a cost-reduction effort, it is all but assured that faculty will succumb to the training mentality of outcome-based evaluation. There's tremendous pressure to teach to the test.

What's fueling higher education's fascination with distance education? Partly, it's a belief that online instruction had been a boon to corporate America. It is commonplace that the rise of computer-mediated multimedia training in the corporate world is attributable

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in no small part to the fact that "multimedia training can be less expensive than bringing employees and instructors together in one classroom."[14]

As Denning[15] notes, over half of all states froze or cut high educational expenditures in the mid-1990s, and, more recently, when funds have been restored, this restoration has come with strings attached.

The technological strings reflect the increasingly popular belief among legislatures that higher education's problems can be solved by applying technology and business methods to education, avoiding the need to appropriate funds commensurate with an increasing demand for higher education.

Carole Barone[16], associate vice chancellor for information technology at the University of California-Davis, recently wrote that teaching the old traditional subjects in the old traditional way just doesn't cut it anymore.

"Can our campuses afford to teach those disciplines in the same manner as they have for decades or centuries?" she asked. "I would argue that most cannot ... Technology costs money, lots of money ... To pay for it planners and managers, at all levels, must engage in the unpalatable exercise of budget reallocation."

Thomas West[17], associate vice chancellor for the California State University System Office, extends this cost-benefit argument to its logical conclusion. He notes that major cost savings can be achieved by not building new campuses and instead relying on networked delivery of education.

Utah's Michael Leavitt envisions electronic systems where the faculty member plays no role at all after the authoring stage. His proposal:

> Entire courses should be obtainable on compact disk. For that matter—entire majors could be placed on disk. The lectures could be filmed live, spliced with video clips, enhanced with pop-up graphics. Students could be prompted and quizzed by interactive exercises throughout.

But, with apologies to the corporate world, the economic imperative behind computer-mediated education is less compelling than might appear at first sight. For instance, take the case of the much-cited Price-Waterhouse study that found the cost per learner over a five-year period was $760 for traditional training but only $106 for computer-mediated multimedia training.

This study is often cited to make the case that universities must undergo radical surgery in order to compete with the corporate inroads

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into education. But the savings found by the Price-Waterhousereport basically came in just two areas: travel and learning time, with computer instruction reduced by 40 to 60 percent.

To put the Price-Waterhouse study in perspective, we must acknowledge the difference between training and education. Studies of computer-mediated education in university settings do not find they "speed up" learning or make students "perform better." Typically, evaluation studies find no difference between computer-mediated and traditional education in these regards.

For colleges and universities to match the cost savings of Price-Waterhouse's training division, they would have to cut course lengths by 40 to 60 percent (actually more, since, in academia, there are no travel savings to be had) or slash faculty costs equally deeply in some other way.

Addressing the cost issue, Carol Twigg,[18] vice-president of Educom, writes:

> the more you replicate the traditional campus model, the more your operating costs will resemble or exceed traditional campus costs... if you use site-based delivery methods (versus desktop delivery to the home or office), you will encounter the same borrow-rent-buy facilities issues as you do on campus. You will save money only if you substitute one function for another function at less cost. This isn't a matter of research: it's a matter of logic and common sense.

In the United States, the leading example of a virtual university is the Online University of the University of Phoenix, a for-profit institution. The University of Phoenix is the sixth largest private university in the United States, with 25,000 students and 4,500 staff. This cyber university offers three undergraduate and three graduate degrees in business administration entirely online.

What is not often highlighted in the Phoenix model is its budgetary logic. The university depends on part-time faculty earning $750 to $1,000 per course. Paying instructors even $3,000 a course would plunge the Phoenix model well into the red.

Whole new university professions and administrative units have already grown up around educational technology. Professionals in these areas have skills marketable in the corporate world and command salaries higher than most faculty. Proposals for electronic teaching, in effect, require diverting limited university resources from traditional areas into new

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academic empires based on educational technology.

But the administrative vision of the cyberspace higher education institution of the future may turn out to be one that—like other revolutions—eats its own babies.

In any new industry, there is at first an explosion of new entrepreneurship. Competitors enter the market in great number, and competitive confusion reigns.

Over time, the industry will shake out, as a smaller number of vendors become preeminent and consolidate their gains. Toward the end of the process, in a mature industry, few new players can afford the huge capital investments required to get into the game.

Throughout this process, many early competitors withdraw from the market, are consigned to a marginal positions, or go out of business altogether. This is the pattern repeated in industry after industry. The economics of education are not so unique as to avoid these long-term trends.

Popular works such as *The Monster Under the Bed*[19] and *The Digital Economy*[20] portray education as slipping out of the hands of universities and into the hands of business organizations better able to make the hard economic choices involved in exploiting online tech-

nology to its potential.

Yet as noted by Martin Ringle [21], "Being able to read an electronic text, examine a digital image, or conduct a video-conference on the Internet is not the same thing as sitting in a circle on the lawn and reading passages of *The Iliad* aloud."

As a supplement to face-to-face education, online technology is wonderful. As a replacement, it is a threat to liberal education.

It is small wonder that online education is now arousing academic resistance. The American Federation of Teachers, for instance, has gone on record against distance education unless and until there is assurance that faculty standards will be upheld.[22]

The NEA doesn't reject distance education but is concerned about the quality of distance offerings. The Association's policy insists that quality distance education include interaction between faculty and students, easy access to laboratories and libraries, technical support and training for students and faculty and that courses to be offered online go through the same curriculum review process as traditional courses before they're offered.

In another example of faculty caution around distance learning, the head of the University of Maine system was ousted a cou-

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ple of years ago when he proposed that a distance learning operation receive full-blown degree-granting status as an additional "university" within the Maine system.

More recently, in 1997, the faculty at York University, Canada's third largest college, went on strike for two months. The settlement of the dispute included formal contractual protection against mandatory engagement in online education.

Not surprisingly, there is skepticism in academia that online education is pedagogically sound. A strategic forecasting exercise involving 80 university administrators at the University of Pennsylvania concluded that "academic brilliance is fostered in the social ambience of the university which cannot be replaced by computer teleprograms."[23]

This is consistent with the findings of authors such as Shields [24] and Noble, who argue that computer-mediated learning is exacerbating cross-institutional inequalities, compromising the traditional autonomy of universities vis-a-vis the corporate sector, and therefore should not be substituted for traditional methods of education. These two authors condemn universities like UCLA in the United States and York University in Canada for establishing for-profit, online education alliances.

In 1998, the journal *Computers in Human Services* devoted a double issue to distance education. Many of those writing champion distance education in their individual fields. But the picture painted by these experts is revealing. They describe educational results from online education on a par with traditional education in a narrow, testing sense, but with widespread dissatisfaction. Ultimately, they express a commitment to keep Internet and other distance education as an add-on to the core of traditional education.[24]

It is clearly naive to view distance education as a strategy for quality education, unless you're willing to support increased costs.

This is not to say it's not possible to deliver cheap online education. The Open University has an online cost per student about half the traditional course rate. But class sizes at the Open University usually exceed 200.

We should note also that, in the Open University, higher-paid regular faculty are replaced on a widespread basis by lower-paid tutors. This university, in addition, tailors its curriculum by cost rather than academic criteria, avoiding, for example, computer applications that would be expensive to implement.

A Rand report on "what higher

education can learn from business" lauds as the best examples of distance education online corporate training in spreadsheets, word processors, and other specialized equipment.

This Rand report urges universities to replace traditional courses with smaller, more saleable "knowledge chunks," use "outside developers, not just faculty" to develop materials for fast-changing demand, offer cheaper rates for students who promise not to use the library, hire faculty with multimedia skills, and use packaged courses rather than have their faculty design new courses.

Given a choice, students them-selves are rightly prone to want a mixed model that provides the best of both traditional and online education. But, as I've discussed, this mixed model costs more than traditional education—and society doesn't seem willing to bear the cost.

Institutional inertia may slow the online revolution on most campuses. The eventual danger, however, remains: the emergence of a two-tier educational system, a more expensive upper tier with sound traditional education supplemented with full online access that I described earlier, and a cheaper, inferior tier dispensing programmed training that meets objectives far narrower than the traditional goals of liberal education. ■

Endnotes

[1] cf. Alic, 1997

[2] Gunaratne and Lee, 1996

[3] Cohen, 1994

[4] Rice-Lively, 1994

[5] See California State University, 1995; Cukier, 1998 California State University (1995), Cukier (1998), Jones and Simonsen (1999), McArthur and Lewis (1997), Open Learning Technology Corporation (1997); Jones and Simonsen, 1999; McArthur and Lewis, 1997; Open Learning Technology Corporation, 1997

[6] 1997: 6

[7] ex., Farenga, 1996

[8] ex., King, 1995

[9] ex., Russett, 1994, found unanimity on this point

[10] Kirkwood and Ismail, 1994; Eggers and McGonigle, 1996

[11] Garson, 1995: 154-162; Townley, 1977

[12] 1997: 6

[13] ex., Hamilton and Miller, 1997

[14] Hall, 1996: 40

[15] 1998: 33

[16] 1996: 28

[17] 1996: 35

[18] 1996: 29

[19] Davis and Botkin, 1994) and The Digital Economy (Tapscott, 1996)

[20] 1996: 32

[21] Ringle, 1996

[22] Note ref. to article

[23] DeLoughry, 1997 24: 1996.1997

Notes

*This essay updates and substantially revises an earlier article which appeared in the *Social Science Computer Review*, Vol. 14, No. 4 (Winter, 1996): 394-409.

References

ACM (1996). "Learner Centered Design"; Also: "A special section, Group Communication", *Communications of the ACM*, Vol. 39, No. 4 (April 1996): 24-97.

Alic, John A. (1997). "Knowledge, skill, and education in the new global economy," *Futures*, vol. 29, No. 1 (Feb.): 5-16.

Barnard, John (1997). "The World Wide Web and higher education: The promise of virtual universities and online libraries." *Educational Technology*, Vol. 37, No. 3 (May-June): 30-35. Special issue: Web-Based Learning.

Barone, Carole A. (1996). "Full speed ahead—with Caution," *Educom Review*, Vol. 31, No. 3 (May/June): 26-29. (Part of a special Educom symposium on "Why Technology?")

Blumenstyk, Goldie (1996). "Faculty group calls for caution and curbs on distance education." *The Chronicle of Higher Education*, Vol. 42, No. 20 (Jan. 26): A20(1).

California State University (1995). Benefit-cost models for evaluating technology-mediated environments.

Cohen, Lance (1994). "Augmenting instruction in business communication courses with the Internet." *Bulletin of the Association for Business Communication*, Vol. 57, No. 3 (Dec.): 31-35.

Cukier, Judith (1998). Cost-benefit analysis presentation at Learning Solutions '98. Http://research.cstudies.ubc.ca/nce/reports.html.

Davis, Byron L. and Edward L. Kick (1996). "Human capital issues in the use of information technology in education." *Social Science Computer Review*, Vol. 14, No. 2 (Summer): 169-180.

DeLoughry, Thomas J. (1995). "Will higher education thrive or wither in cyberspace?: High level administrators meet to debate on future of university higher education." *The Chronicle of Higher Education*, Vol. 41, No. 20 (Jan 27): pA22(1).

Denning, Peter J. (1996). "The university's next challenges." *Communications of the ACM*, Vol. 39, No. 5 (May): 27-31.

Denning, Peter J. (1997). "Skewer the stereotype." *Educom Review*, Vol. 33. No. 3: 30-34.

Donahue, Stacey (1996). "Programs and resources in distance education." *Journal of the American Society for Information Science*; Vol. 47, No. 11 (November): 870-874.

Eddy, John, John Burnett, Donald Spaulding, and Stan Murphy (1997). "Technology assisted education." *Education*. Vol.117, No. 3 (Spring): 478-81.

Eggers, Renee M. and Dee McGonigle (1996). Internet-distributed college courses: Instructional design issues. In Proceedings of Selected Research and Development Presentations at the 1996 National Convention of the Association for Educational Communications and Technology (18th, Indianapolis, IN, 1996).

Farenga, Stephen J. (1996). Prototype of a procedural knowledge teaching model. Paper presented at the Annual Conference of the New York State Association for Computers and Technologies (31st, Catskill, NY, June 1996).

Forster, Michael and Timothy Rehner (1998). "Part-time MSW distance education: A program evaluation." *Computers in Human Services*, Vol. 15, No. 2/3: 9-22.

Freddolino, Paul P. (1998). "Building on experience: Lessons from a distance education MSW program." *Computers in Human Services*, Vol. 15, No. 2/3: 39-50.

Gunaratne, Shelton A. and Byung S. Lee S. (1996). "Integration of Internet resources into curriculum and instruction." *Journalism and Mass Communication Educator*; Vol. 51, No. 2 (Summer): 25-35.

Hall, Brandon (1996). "Lessons in corporate training: Multimedia's big payoff." *New Media*, Vol. 6, No. 4 (March 11, 1996): 40-45.

Hamilton, Kendall and Susan Miller (1997). "Internet U—no ivy, no walls, no keg parties." *Newsweek*, Vol. 129, No. 10 (March 10): 12.

Jones, Judy I. And Michael Simonsen (n.d., accessed 1999). Distance education: A cost analysis. Http://www.iptv.org/FINELINK/resources/full_text/13-full3.htm.

King, Maxwell C. (1995). Distance learning and technology plan. Brevard Community College, Cocoa, FL. 4 Oct 1995

Kirkwood, Adrian and N. Ismail (1994). "Personal computing: transferring the costs of learning at home." In G. Dhanarajan et al., eds., *Economics of Distance Education: Recent Experience*. Hong Kong: Open Learning Institute Press, Open Learning Institute of

Hong Kong.

McArthur, David and Matthew Lewis (1997). Untangling the web: Applications of the Internet and other information technologies to higher education.

Miller-Cribbs, Julie and Letha A. Chadiha (1998). "Integrating the Internet in a human diversity course." *Computers in Human Services*, Vol. 15, No. 2/3: 97-110.

Muffoletto, Robert (1997). "Reflections on designing and producing an Internet-based course." *TechTrends*, Vol. 42, No. 2 (March): 50-53.

Noble, David F. (1997). "Digital diploma mills: The automation of higher education." Accessed 2/27/98. Written October, 1997. Reprinted in summary form in *Educom Review*, Vol. 33, No. 3 (May/June, 1998):22-25.

Open Learning Technology Corporation, Ltd. Models of cost-benefit analysis (1997). (Bibliography).

Patchner, Michael A., Helen Petracchi, and Sharon Wise (1998). "Outcomes of ITV and face-to-face instruction in a social work research methods course." *Computers in Human Services*, Vol. 15, No. 2/3: 23-38.

Rafferty, Jackie (1998). "Changing to learn: Learning to change." *Computers in Human Services*, Vol. 15, No. 2/3: 159-170.

Rice-Lively, Mary Lynn (1994). "Wired warp and woof: An ethnographic study of a networking class." *Internet Research*, Vol. 4, No. 4 (Winter): 20-35.

Ringle, Martin (1996). "The well-rounded institution." *Educom Review*, Vol. 31, No. 3 (May/June): 30-32. (Part of a special Educom symposium on "Why Technology?".)

Russett, James Alan (1994). Telecommunications and pre-service teachers: The effects of using electronic mail and a directed exploration of the Internet on attitudes. Doctoral dissertation, University of Nebraska-Lincoln.

Shields, Mark A. (1996). "Lost in cyberspace? Virtual learning and higher education." *Social Science Computer Review*, Vol. 14, No. 4 (Winter): 410-422.

Stocks, J. Timothy and Paul Freddolino (1998). "Evaluation of a World-Wide Web-Based graduate social work research methods course." *Computers in Human Services*, Vol. 15, No. 2/3: 51-70.

Townley, Rod Matthew (1997). Students' and instructors' perceptions of Internet education in the community college. Doctoral dissertation, Colorado State University.

Tapscott, Don (1996). The digital economy: Promise and peril in the age of networked intelligence. (NY: McGraw-Hill).

Twigg, Carol A. (1996). "Is technology a silver bullet?" *Educom Review*, Vol. 31, No. 2 (March): 28-29.

West, Thomas W. (1996). "Learning technology". *Educom Review*, Vol. 31, No. 3 (May/June): 34-35. (Part of a special Educom symposium on "Why Technology?".)

Wood, William H., III and Alice M. Agogino (1996). "Engineering courseware content and delivery: The NEEDS infrastructure for distant independent education." *Journal of the American Society for Information Science*, Vol. 47, No. 11 (November): 863-69.