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Hassan B. Ndahi

John M. Ritz
Old Dominion University, jritz@odu.edu

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Developments in electronic technologies are having major impacts on higher education. With the expansion of these technologies, programs listed in the *Industrial Teacher Education Directory* (Bell, 1999-2000) are beginning to experiment with alternative means of delivering courses and programs. Universities as a whole are beginning to use alternative forms of instructional delivery. Some are researching the instructional possibilities of catering to new student populations (Smith, Smith, & Boone, 2000). Others are investing in new delivery systems such as Web-based courses, one-way and two-way television, videotapes, and CD-ROM delivered courses (Okula, 1999; Pisel, 2000; Wang & Lawrence, 1996; Zirkle, 2000).

Two-way television is being used to teach classes at regional sites without having faculty travel miles to deliver the instruction. Other programs use correspondence and prerecorded video materials to deliver instruction at a distance. With the developments of the World Wide Web and its capabilities to store academic materials, some faculties are beginning to offer Web-based courses and programs. This is a natural for faculty who are experienced in teaching with various technologies.

Recently, a number of conference presentations and journal articles have been developed on the topics of distance learning and education. These scholarly works reported success stories (Russell, 2001). Because of the increased dialogue on distance learning, we undertook a study to determine the state-of-the-art of distance learning in those programs listed in the *Industrial Teacher Education Directory* (Bell, 1999-2000).

An Analysis of the Use of Distance Learning Technologies

Delivering instruction through distance learning is gaining increased use in all aspects and all levels of education. It provides additional means to reach students in different geographic locations; these may be students with individual needs, students with family and work responsibilities, and students who need to update their knowledge and skills for their current and future careers.

As a result, more and more institutions are offering distance learning courses and degree program options. This is a trend for program growth and positioning within the university setting. Although the quality of these alternative methods of delivery concern both instructors and institutions, there is not an agreement on which courses or methods of delivery are best for their programs or universities. While these issues are being debated, there is a continuing increase in the delivery of courses through distance learning methods. A survey by the U.S. Department of Education revealed that the number of distance education programs increased by 72% from 1995 to 1998, with most of the expansion coming from online offerings (Carnevale, 2000). Because of these trends, we wanted to gain information and learn from colleagues what methods of distance learning are being used to deliver distance learning courses and degree program options.

Distance Learning Institutions

Distance learning is referred to as the acquisition of knowledge and skills through mediated information and instruction, encompassing all technologies and other forms of learning at a distance (U.S. Distance Learning Association [USDLA], 2000). It uses currently available technologies to achieve two main objectives for teaching and learning: (a) providing equitable access to quality education and (b) meeting the unique learning needs and styles of individuals (Barron, 1994).

Through the use of advanced and traditional means of instructional delivery, both the instructor and student rely on electronic devices and print materials to deliver and receive instruction. The National Center for Education Statistics (1999) reported that one third of the nation's two-year and four-year postsecondary education institutions offered distance education courses and another one fifth of the institutions planned to start offering courses within the next three years.

Typical technologies used for distance learning include satellite, fiber-optic, television broadcast, compressed video, computer conferencing, audio-conferencing, radio, and

videotapes. Currently, the more common technologies used for distance learning delivery are interactive satellite systems, cable television systems, microwave systems, instructional television fixed service systems, compressed television systems, and the audiographics public switched telephone networks (Baker & Dickson, 1996). These technologies enable the transmission of live one-way and two-way auditory and visual signals. Two-way audio and live video transmissions provide the teacher-student interactions that most other distance teaching technologies lack (Roach, 1998). The telecommunications industry is changing with continued improvements promised for the 21st century. Higher education faculty are taking advantage of these improvements and adapting their program delivery systems to using these technologies.

Determining Our State-of-the-Art in Distance Learning

Since faculty are active in discussing the consequences and methods of delivering courses and degree program options at a distance, we chose to survey colleges/universities to determine the extent of their use of distance learning in their instructions. Our research goals were to (a) identify which industrial teacher education institutions offer distance learning courses or degree program options; (b) identify which programs are being delivered through distance means (i.e., teacher education, industrial technology, engineering technology, etc.); (c) identify forms of distance learning technologies being used to deliver instruction; and (d) determine whether institutions allow students to take courses from other institutions through distance learning technologies and apply them toward their program degree requirements.

Population

The *Industrial Teacher Education Directory* (Bell, 1999-2000) was used to identify department chairs, program leaders, or deans responsible for academic programs in technology education, industrial education, occupational education, trade and industrial education, vocational education, vocational-technical education, industrial technology, engineering technology, and other special programs included within this directory. All institutions listed in the directory, national and international, were surveyed. This included

201 institutions, 185 national and 16 international.

Instrument

A survey instrument was developed to determine the state-of-the-art of distance learning instruction in these technical programs. It was based on the goals of this project and consisted of six questions. The study used closed and open-ended questions to gather information to achieve this purpose. Two demographic questions were directed to the individual respondents which included the institution and respondents' names.

Four other questions sought information on whether the university programs were involved with distance learning, courses or degree programs offered through distance learning technologies, technologies used for course/program delivery, and the transferability of distance courses for meeting degree requirements. These questions were based on studies that indicated the number of institutions involved in distance learning delivery (Ndahi, 1999), transfer of credits (Robertson, 1994), technology used (Okula, 1999; National Center for Education Statistics, 1999; Wang & Lawrence, 1996), and degree programs offered (Collins, Hemmeter, & Schuster, 2000).

What Was Learned

We organized and coded the responses from the open-ended questions into categories based on the pattern of responses. Frequencies and percentages were also used to analyze the data. A total of 201 institutions were surveyed including 16 from Australia, Canada, Japan, and Taiwan. A total of 91 surveys were returned, representing a 45.2% response rate. This included one follow-up to nonrespondents.

Institutions offering distance learning courses or degree. Of the 91 institutions returning surveys, 55 institutions (60.4%) offered courses or degree program options via distance learning, while 36 institutions (39.5%) did not offer distance learning courses or degree programs.

Types of degrees or programs options offered by institutions engaged in distance learning. Several degree programs and courses were offered by the responding institutions. The degrees offered were Safety Management (BS and MS), Human Resource Development,

Table 1. Degree Programs and Levels of Degrees Offered Via Distance Learning

Degree Programs	Degree Levels	No. of Institutions
1. Occup./Voc./Tech. Edu./ Trade & Ind.	AS, BS, MS	10
2. HRD/Training & Development	BS, MS, PhD	5
3. Industrial Technology	BS, MS	4
4. Safety Management	BS, MS	2
5. Workforce Education & Development	BS, MS	2
6. Engineering Technology	Not Specified	1
7. Fire Service Management & Training	BS	1
8. Human Ecology	BS	1
9. Technology Management	PhD (Consortium)	1
10. Technology Education	MS	1

Training, and Management (BS, MS, and PhD), Occupational, Vocational, and Technical or Trade and Industrial Education (AS, BS, and MS), Workforce Education and Development (BS and MS), Human Ecology (BS), Industrial Technology (BS and MS), Fire Service Management and Training (BS), Technology Education (MS), and Technology Management (PhD). Occupational, Vocational, and Technical, and Trade and Industrial Education (AS, BS, and MS) were the major degree programs offered by 10 institutions. Table 1 lists the degree programs, levels of degrees offered through distance education at institutions cited in the *Industrial Teacher Education Directory* (Bell, 1999-2000), and the number of institutions offering the degrees.

The courses taught via distance learning included Occupational Safety and Health, Basic Electricity/Electronics, AC Circuits, Electronics Technology, Industrial Management, Auto CAD, Technology Management, Multi-Media, Vocational Education Administration, Technology and Society, Computer Training, Curriculum Development, Learning Theory, Engineering Management, Technology Leadership, Industrial Safety, Advance Technology Education, and Applied Technology Training.

Types of technology used for delivery of instruction. Different types of technologies were being used to deliver distance instruction. The institutions surveyed used one or more technologies for delivery of instruction. The survey provided the following selections that were based on past findings (Okula, 1999; Pisel, 2000; Wang & Lawrence, 1996): print only, audiotape, videotape, Web-based instruction, computer-based instruction, CD-ROM, and television. Television had the following subcomponent selections: one-way video, two-way video, compressed video, or other to be filled in by the respondent. An analysis of the technologies used showed 44 institutions used Web-based delivery systems, 30 institutions used televised two-way audio

Table 2. Technology Used for Delivery

Technology Used	No. of Institutions
1. Web-based	44
2. Print/competency-based instruction packets	10
3. Videotape	9
4. CD-ROM	8
5. Audiotape	1
6. Televised instruction	45
a. Compressed video	11
b. Two-way audio and video	30
c. One-way audio and video	4

and video, and 11 institutions used compressed video. The least used technology was audiotape, used by only one institution. Table 2 shows the methods of distance learning delivery used by the institutions within these technical education programs.

Transfer of distance learning course credits. One area of concern for distance learning students was whether the credits earned via distance learning could be transferred to their home institutions to meet graduation requirements. Although cohesiveness is a major part of a degree program, all institutions had their own transfer policies. If students were within the guidelines of the home institution transfer policy and the faculty of the program allowed the transfer, then they were allowed to complete transfer courses from other institutions using distance learning techniques.

Forty-six institutions (83.6%) said that credits could be transferred into their institution, and only two institutions (3.6%) said courses could not be transferred into their programs. Seven institutions (12.7%) gave reasons such as it depends on the home institution procedures for accepting credits earned via distance learning and it was done through collaboration with institutions to which the student intended to transfer his or her credits.

Implications for the Profession

1. Institutions Involved

Of the 201 institutions listed in the *Industrial Teacher Education Directory* (Bell, 1999-2000), 91 responded to our survey, but of these, 55 institutions (28.4%) offered distance learning courses/program options to their students. Statistics for all of higher education showed 33% offering programs or degree options via distance learning. When compared to all higher education, it showed that industrial teacher education institutions were beginning to participate in distance learning, but our programs were not necessarily among the leaders of disciplines employing the technologies of modern learning.

One reason for this lower percentage might be that most programs had technical/laboratory equipment-oriented classes as the core of their degree programs. The literature was void of writings on the delivery of technical/laboratory-based classes through distance learning techniques. However, the data gathered through this study indicated that classes such as computer-assisted drafting and electronics were currently being offered through distance learning methods.

2. Programs Being Offered

It was found that various types of programs were available from industrial teacher education institutions through distance learning systems. These included Technology Education, HRD/Training and Development, Occupational/Vocational/Trade and Industrial Education, Safety Management, Workforce Education and Development, Human Ecology, Industrial Technology, Fire Service Management and Training, and Technology Management. The program offered the most was Occupational and Technical teacher preparation, by 10 institutions, representing 18.18% of the 55 institutions that responded to the survey. We believe that this program had used alternative means of delivery for a long time, since many of the trade teachers were hired from industry and had different state requirements for teacher licensure. The print/competency-based materials produced by the American Association for Vocational Instructional Materials had provided the foundation for licensure courses for this population of teachers.

3. Distance Learning Technologies

All forms of distance learning delivery were available within the professions of industrial teacher education studied. The instrument allowed respondents to check more than one method of distance learning delivery. As the following figures show, this, in fact, is occurring. Of the 57 institutions that offered programs through distance learning, the greatest numbers of courses/programs were delivered using televised instruction (two-way audio and video, one-way audio and video, and compressed video) by 45 institutions (81%). Forty-four institutions (80%) used Web-based delivery systems, while 18 institutions (32.7%) used CD-ROM and print/competency-based materials as delivery systems. Nine institutions (16.4%) used videotapes, and the least used delivery system was audiotapes, limited to a single institution.

4. Transfer Procedures

To determine if programs were seeking to take advantage of distance learning courses

offered by other institutions, a question was posed regarding the transferability of distance learning courses into and out of their programs. Forty-six institutions (83.6%) allowed their students to enroll in and transfer distance learning credits. This is especially important to the institutions in our profession. It takes time to develop distance classes. By opening and advertising the accessibility of classes, institutions can collaborate so students can have access to complete degree requirements. For institutions involved in televised instruction, studio time may not be available for the transmission of all classes required for a complete program, and collaboration could enable higher education institutions to develop completely televised programs.

A Final Word

Although distance learning using electronic technology is not new to higher education, continued updates are needed to gauge the impact that it has on the professions cited in the *Industrial Teacher Education Directory* (Bell, 1999-2000). Of the 201 institutions surveyed, 28.4% were involved in such delivery. Further research is needed on the assets of its applicability to our professions. Research is needed to show that students are able to learn subject matter as efficiently as they do in traditional classroom/laboratory settings.

Research to explore methods of distance delivery of technical courses also needed to be undertaken. Some institutions are currently searching for methods that can be used to offer laboratory-oriented classes at a distance. Accessibility to equipment and liability issues also need to be explored.

The health care and engineering technology professions have proven that laboratory-based classes can be offered through distance means. In health care, internships are used to allow students into facilities and learn techniques from practicing health care professionals. Engineering technology has employed a procedure of offering occasional weekend classes at regional sites to enable students to complete their hands-on laboratory learning. What are the possibilities for industrial teacher education programs? This is an important issue for those programs that provide teacher licensure. Shortages of technology education and trade and industrial education teachers are nationwide. If distance learning can be used to license these teachers,

it can become a winning situation for teacher preparation and teacher shortages in our public schools.

Research needs to investigate the comfort level factors associated with distance learning for both students and teachers. Teaching and learning from a distance requires adjustments for both students and teachers. What are the differences and what types of training are needed for both faculty and students (Ndahi, 1999)?

The very nature of a virtual degree using advanced electronic instructional delivery also needs to be explored. Many instructors use videotapes to support classroom instruction.

These videos are up-to-date and bring contemporary industry, business, and society into our classrooms and laboratories. The addition of this technology has been accepted by most faculty. Can electronic instruction be adapted to allow the industrial teacher education professions to create virtual degree programs where students learn more or all of their instruction from home, or provide accessibility to courses that meet their degree needs and schedules?

This research allows our professions to understand where we are in the use of distance learning for technology-based programs in higher education. We need to become imaginative as we look into the future. Technology applied in the marketplace and classrooms will continue to change. Distance learning can provide increased access to learning. Will we use the assets of distance learning to enable more people to gain teaching licenses and/or university degrees? Will we apply the teleconferencing procedures to update graduates to new technical processes or management techniques? Will we develop consortiums that share credits to enable students to obtain credentials without necessarily relying on only one university? Will distance learning lead to virtual education that will strengthen individuals' and society's access to education? Continued research needs to be undertaken to integrate distance learning technologies to the benefit of the student learning process.

Hassan B. Ndahi is an assistant professor and John M. Ritz is a professor and chair in the Department of Occupational and Technical Studies, Darden College of Education, Old Dominion University, Norfolk, VA. John M. Ritz is a member of the Alpha Upsilon Chapter of Epsilon Pi Tau.

References

Baker, B. O., & Dickson, M. W. (1996). Factors in determining rural school readiness to use distance learning. *Rural Educator,* **17,** 14–18.

Barron, D. D. (1994). Distance education: The virtual classroom update. *School Library Media Annual,* **12,** 76–81.

Bell, T. P. (Ed.). (1999-2000). *Industrial teacher education directory.* Millersville, PA: CTTE and NAITTE, Department of Industry and Technology, Millersville University of Pennsylvania.

Carnevale, D. (2000). Survey finds 72% rise in number of distance education programs. *The Chronicle of Higher Education,* **46**(18), A57.

Collins, B. C., Hemmeter, M. L., & Schuster, J. W. (2000). Using team teaching to deliver course work via distance learning technology. *Teacher Education and Special Education,* **19,** 49–58.

National Center for Education Statistics. (1999). *Distance education at postsecondary education institutions: 1997– 1998.* Washington, DC: U.S. Department of Education, Office of Research and Improvement.

Ndahi, H. B. (1999). Utilization of distance learning technology among industrial and technical teacher education faculty. *Journal of Industrial Teacher Education,* **36**(4), 21–37.

Okula, S. (1999). Going the distance: A new avenue for learning. *Business Education Forum,* **53**(3), 7–10.

Pisel, K. P., Jr. (2000). *The design of a planning process for the implementation of distance education in higher education and corporate training.* Unpublished doctoral dissertation, Old Dominion University, Norfolk, VA.

Roach, R. (1998). Cyber diversity. *Black Issues in Higher Education,* **21**(10), 28–29.

Robertson, D. (1994). Proposal for an associate degree: The search for missing link of British higher education. *Higher Education Quarterly,* **48,** 294–322.

Russell, T. L. (2001). *The "no significant difference phenomenon."* Retrieved March 13, 2001, from http:// nova.teleeducation.nb.ca/nosignificantdifference/

Smith, S. B., Smith, S., & Boone, R. (2000). Increasing access to teacher preparation: The effectiveness of instructional methods in an online learning environment. *Journal of Special Education Technology,* **15**(2), 37–46.

U.S. Distance Learning Association. (2000). *Research information and statistics distance learning defined.* Retrieved March 13, 2001, from http://www.usdla.org/04_research_info.htm

Wang, S., & Lawrence, B. (1996). A practical setting of distance learning classroom. *International Journal of Instructional Media,* **23**(1), 11–22.

Zirkle, C. J. (2000). Preparing technical instructors through multiple delivery systems: A working model. *T.H.E. Journal,* **28**(4), 62–68.