https://doi.org/10.21061/jte.v13i1.a.2

Online Learning Needs in Technology Education

Jim Flowers

Introduction

The number of distance education courses, degree programs, and enrollment in the US nearly doubled from 1995 to 1998 (US Department of Education, 1999). As universities provide more courses online, possibly to a different population of students, it is important to assess the perceived needs of learners and potential learners. In the field of technology education, some (e.g. Davis, 2000, Ndahi, 1999) have studied university distance education programs, but a characterization of potential learners and their needs has not been performed. The goal of this article is to inform those considering offering online technology education, especially at the graduate level, of the perceived need for and appeal of online educational opportunities in technology education, as discovered through a needs assessment survey.

An educational needs assessment "has been increasingly recognized as a necessary part of curriculum design" (Pratt, 1980, p.79). Stewart and Cuffman (1998) noted that, "the integration of needs assessment as part of a total distance education system should benefit all stakeholders (e.g., faculty, administrators, students)."

> [A] limited use of needs assessment is valid, and it is likely to result in better program design, development, and delivery than otherwise might occur. However, needs assessment can do more than that. [Those providing continuing education] can use it to optimize their service to clients and to enhance the organizations and institutions they represent. (Queeney, 1995, p. 261)

Needs assessments in other areas, such as engineering education (Rutz, 2000), have provided direction for the design of distance learning. As university level technology education programs begin to offer more online classes and degree programs, some current face-to-face technology education professors may be in the position of developing online offerings. Because online education can overcome some traditional barriers related to time and place, there may be special interest in the development of online graduate programs that could serve professionals who might find it a better option than leaving their work and home

Jim Flowers (jcflowers1@bsu.edu) is Associate Professor and Director of Online Education for the Department of Industry and Technology at Ball State University, Muncie, Indiana.

https://doi.org/10.21061/jte.v13i1.a.2

to establish residency at a university. Planning instruction for a new group of students using a new delivery method should be informed by the perceived needs and preferences of the target population.

Methods

Because of the ability to provide information from a large number and wide variety of respondents, the survey technique was chosen over other typical needs assessment data gathering methods, such as interviews, focus groups, and on-site observations (McClelland, 1995). A survey instrument was developed consistent with the five typical stages of needs assessment survey development noted by McClelland (1995): content definition, composing the survey, pilot testing, revision, and gaining approval to distribute the survey. Some of the instrument's content was developed based on the technological literacy standards released by the International Technology Education Association (ITEA, 2000) only weeks before the survey. A preliminary questionnaire was then developed, following recommendations by Gupta (1999) on the writing of training needs assessment instruments (i.e., Determine the types of data to be collected. Determine data sources. Involve experts. etc.)

During the development of the instruments, content and survey specialists were consulted. Content consultants included technology teachers, undergraduate and graduate technology education students, and professors in technology education. Two technology education professors from universities other than the hosting university were consulted specifically because they had recently conducted national surveys in technology education. Two instructional technologists were also consulted, one of whom had recently used the survey software for dissertation research. Finally, two survey specialists from the hosting university's assessment office were consulted regarding the format of the instruments and coding of the results. Pilot testing occurred throughout the development period. Subjects included one undergraduate technology education student, one graduate technology education student, and five technology teachers. During the final round of pilot testing, all subjects seemed to interpret the meaning of the questionnaire's items and the formatting of their response as intended.

After pilot testing, a revised instrument was prepared for delivery by mail and online. In May, 2000, following human subjects protocol approval, 3,203 questionnaires were mailed with a cover letter and a postage-paid return envelop to all professional and student members of the International Technology Education Association (ITEA). A parallel online version of the questionnaire was available as an alternative, and cited in the mailing. The questionnaire included items on demographics, computer use, learning needs, and the educational appeal of online instruction.

Results and Discussion

Respondent Characteristics

As of July 20, 2000, 923 usable questionnaires were received (including 111 submitted online) for a response rate of 29%. This was nearly double the

https://doi.org/10.21061/jte.v13i1.a.2

response rate from a needs assessment survey of engineering educators (Rutz, 2000). Most of the respondents (88%) indicated they were professional members of ITEA, with only 8% indicating they were student members (the remainder did not respond to this item.)

The most typical occupations of respondents were high school technology teacher (38%) and middle school or junior high school technology teacher (29%); ten percent noted they were university technology teacher educators, and 5% and 2% were undergraduate and graduate technology education students, respectively. Most respondents (57%) indicated that the master's was their highest degree completed; 25% indicated the bachelor's, and 12% indicated the doctorate. Only 145 respondents (16%) had ever taken a course online. Thus, the results of this survey must be seen as describing the perception of online education, rather than experience with online education.

When asked about their use of the Internet, 829 respondents (90%) noted that they personally used the Internet to learn about some aspect of technology. This indicated a high level of readiness to engage in non-formal distance learning.

Computer Resources. Developers of online offerings should be aware of the computer resources available to their distance education students. Selected hardware and software technologies reported by the respondents as being used regularly are shown in Table 1. Many more respondents reported using a PC regularly both at work and at home, than a Macintosh (though some reported using both computer platforms). Many respondents reported using Microsoft Office and using the Internet. The use of digital still and video technology was not as common, and was greater at work than at home, probably due to the cost of the equipment and its presence in many technology education laboratories. Most respondents (63%) indicated that they used a 56K modem at home and most (57%) used T1 Internet connection at work.

These responses may seem to indicate that the majority of respondents have access to typical computer resources, including at least a 56K modem. However, online educators are cautioned against developing online instruction that is only appropriate for a fraction of potential students, even if that fraction does constitute a majority. Instead, accommodations for students with lesser technological resources should be devised.

Table 1.
Percent of respondents reporting regular use of selected technology (n=923).

	Location	
Technology	Home	Work
Email	82%	85%
Internet	82%	86%
PC	76%	81%
MS Office	74%	81%
Digital Camera	30%	53%
Macintosh	27%	38%
Online Chat	14%	6%
Digital Video	12%	25%

https://doi.org/10.21061/jte.v13i1.a.2

Perceived Learning Needs

Future Coursework Required. Is there a job-related need for future coursework? Sixty-five percent of the respondents indicated such a need. The greatest need (36%, $n = 336$) was for continuing education credits. Such credits are not necessarily graduate or undergraduate college credits but typically include approved workshops and other training opportunities. Ten percent of the respondents indicated a requirement of one course or less per year, and seven percent indicated the need to finish another degree.

Provision was made on the instrument for respondents to write their requirements for continuing education. A wide variety of required coursework was indicated, due largely to the variability in state requirements. Examples included, "100 workshop credits every 3 years minimum;" "2-4 courses / 5 yr for MA recertification;" and "1 class every 5 years." This variety can be seen as an opportunity for online education that spans geographic boundaries.

Content Areas of Interest. Several questions were included on the survey to determine the respondents' interests in different content areas. The first of these asked the respondent how much interest he or she has in taking a course or workshop (not necessarily online) on each of the five topics shown in Table 2. A five-point Likert-type scale was used with the following scale category descriptions: None – Little – Moderate – Much – Great. The mean level of interest was between "moderate" and "much" for all five areas, with the greatest reported interest in courses or workshops dealing with "activities to teach about technology." For each topic, moderate to great interest was indicated by 71% to 90% of the respondents.

However, this level of interest varied by the educational level of the respondent. For example, "Teaching methods and student management" ranked the lowest of the five, but for respondents whose highest degree was an associate's, ($n = 17$), it ranked third; for respondents indicating high school as their highest level ($n = 29$), it ranked first. Is there a need to provide education on teaching methods and student management? Yes, but with the current survey sample this need is more acute with pre-baccalaureate teachers, as might be expected.

Table 2.
Respondents' interest in taking a course or workshop in selected areas.

	Level of Interest						
Area	None (1)	Little (2)	Moderate (3)	Much (4)	Great (5)	*n*	Mean
Activities to teach about technology	5.3%	5.1%	22.6%	34.0%	33.1%	909	3.85
New and emerging technologies	5.3%	5.2%	31.7%	34.3%	23.4%	900	3.65
Technology education curriculum	6.9%	9.9%	27.5%	33.4%	22.4%	902	3.55
Using the Internet to teach about technology	7.5%	9.8%	31.0%	28.7%	23.0%	904	3.50
Teaching methods and student management	10.2%	19.2%	35.5%	20.0%	15.0%	889	3.10

https://doi.org/10.21061/jte.v13i1.a.2

The questionnaire also assessed respondents' interests in educational enrichment in regard to the newly released ITEA content standards (ITEA, 2000). The newly identified content areas within technology education such as medical technologies and technology assessment were expected to spark much interest since there have been few educational opportunities in these areas. Interest in these areas were expected to be higher than manufacturing and construction which have long been a part of the curriculum. To assess this interest, some of the twenty areas identified by the ITEA standards document were combined, resulting in a sixteen-part survey question. A seventeenth content area related to usability was added to this list.

As indicated in Table 3, the areas related to ITEA content standards that received the most interest were "information and communication" (3.52) and "technological design" (3.50). Those ranking the lowest were "agricultural and biotechnologies" and "medical technologies," with means of 2.84 and 2.74, respectively. This indicates an interest among the respondents between "little" and "moderate." The overall mean for all seventeen items related to ITEA content standards, indicate a moderate interest in all content areas, warranting attention by those providing courses and workshops. Technology education professionals who are potential students would be well served if ITEA coordinated and facilitated access to education in these areas. This would also serve the needs of this association in ensuring that the content standards are understood and applied.

Some of the more traditional areas received greater interest than some of the newer areas, as seen by comparing means for "manufacturing technologies" and "construction technologies" with those of "agricultural and biotechnologies" and "medical technologies." However, there are multiple reasons why a respondent might indicate a relatively low need. If an area is thought to be important, but the individual is well versed in the area, there might be little perceived need. Likewise, if an area is thought to be unimportant or irrelevant, whether or not the individual has studied the area, there might be little perceived need. Furthermore, although survey research assumes that respondents reply honestly, it is possible that regardless of a respondent's expertise or need, this list of seventeen items was seen as an opportunity to "cast a vote" regarding the importance of certain content areas in technology education.

A rather large number of respondents seemed to recognize no personal learning need that could be met by taking a course or workshop. This is surprising considering that the respondents were professionally involved in education. This view, which was most prevalent in respondents with doctorates, those that have fulfilled job requirements for education, and those near retirement, is contrary to the notion of life-long learning and continued professional development.

Need for Online Technology Education. Two Likert-type questions asked respondents for their general opinion on the need for online technology education. The first question in this area asked: "How much of a need do you think there is for online education in technology education (above the high

https://doi.org/10.21061/jte.v13i1.a.2

Table 3.
Mean interest levels for courses or workshops based on content areas included in the ITEA standards. (n = 869 to 891.)

Content Area of Interest	Mean
Information and communication	3.52
Technological design	3.50
Manufacturing technologies	3.40
Construction technologies	3.34
Transportation technologies	3.30
Learning to use technology	3.28
Energy and power technologies	3.25
Technological connections and integration	3.24
Technology and the environment	3.20
Technology assessment	3.15
Technology and history	3.02
The core concepts of technology	3.00
Technology and culture	3.00
Learning about usability	2.95
The characteristics and scope of technology	2.90
Agricultural and biotechnologies	2.84
Medical technologies	2.74

Note: 1 = none, 2 = little, 3 = moderate, 4 = much, 5 = great

school level)?" The points on the scale were coded with numbers 1 representing "no need" to 5 representing "great need." From the responses to this item, a mean of 3.81 resulted. Sixty-three percent chose the top two levels, and 30% chose "great need," whereas only 1% chose "no need."

This level of perceived need is noteworthy and indicates an opportunity for universities considering offering online education. Possibly contributing to this perceived need is the current shortage of technology teachers and the perception that distance education can overcome previous obstacles.

A similar question asked respondents, "How much of a need is there for online technology education for students in grades K-12?" The mean of 891 responses was 3.49, based on the same 5-point scale. This could indicate further opportunities for online curriculum developers interested in reaching K-12 students.

Likelihood of Taking a College Course. When asked, "How likely are you to take college courses over the next 3 years?", 37% (339 of 916) of the respondents indicated they were "certain" to take a college course, and 19% indicated this was "likely." Although these figures (from this self-selected survey sample) may not be generalizable to a larger population, there is a distinct indication of the need for college courses, whether online or not.

As illustrated in Table 4, there is greater likelihood that a respondent will take a continuing education course or workshop rather than a college course at any of the three levels listed. Respondents were least likely to take an undergraduate class. This is not surprising, considering only 5% of survey respondents indicated that high school or an associate's degree was their highest level of education.

https://doi.org/10.21061/jte.v13i1.a.2

Table 4.
Likelihood of taking a course over the next three years, by course level.

		Likelihood				
Course Level	*n*	Very Unlikely	Unlikely	50/50	Likely	Certain
Undergraduate	673	59%	14%	10%	9%	10%
Master's	786	29%	9%	16%	21%	26%
Doctoral	718	45%	18%	16%	13%	8%
Continuing Educ/ Workshop	836	6%	4%	18%	34%	37%

Educational Appeal

The next group of questionnaire items attempted to determine the appeal of different structures for online courses, perceived obstacles and benefits, advertising opportunities, and the appeal of teaching online.

Relative Appeal of Online and On-Campus Classes. Respondents were asked, "How appealing is each of the following to you?" They were then presented with two items, each with its own 5-point Likert-type scale. The items were "Taking a standard on-campus class" and "Taking an online class." The Likert-type scale headings, coded 1 to 5, ranged from "very unappealing" to "very appealing." On that scale, the average appeal of taking an online class (3.54, n = 909) slightly exceeded the average appeal of taking an on-campus class (3.15, n = 901). Both means were situated between "50/50" and "appealing." Respondents who had previously taken an online course reported greater appeal of online classes (3.32, n = 136) than did those who had not. Although the reader is cautioned against generalizing these survey results to a larger population, it is worth noting that at a minimum, 505 ITEA members (or at least one in seven) found the idea of taking an online course appealing or very appealing.

Preference for Different Course Logistics. Educational opportunities can be structured in a variety of ways. It might be that the traditional, three-credit, fifteen-week college course on a fixed calendar is not always the best structure for online educational offerings. It was suspected that shorter, 1-credit courses might be more attractive due to decreased demands on a student's time. Using a format similar to the previous questionnaire item, respondents were asked to rate the appeal of a 1-credit and a 3-credit class.

Within this survey sample, 3-credit courses seemed to be slightly more appealing (mean = 3.62, n = 900) than 1-credit courses (mean = 3.23, n = 886), although the means for both were situated between "50/50" and "Appealing." The flexibility of 1-credit offerings was anticipated to increase appeal, but this was not found to be the case. The greater appeal of 3-credit courses might be due somewhat to tradition but also to the need of teachers to take courses that fulfill their districts or degree's requirements.

Course length is another factor to consider in structuring online courses. Respondents were asked to "indicate the ideal number of weeks you would suggest for a 3 credit online course (between 1 and 15 weeks)." Presenting the mean recommended course length (mean = 8.84 weeks, n = 852) does not

https://doi.org/10.21061/jte.v13i1.a.2

adequately describe responses. The top choice was 10 weeks (145 respondents), followed by 15, 6, 8 and 12 weeks. Yet, 194 respondents indicated an ideal time less than six weeks. Universities should consider offering online courses that differ from the length of their traditional courses.

Another logistical factor in course design concerns the course calendar. A questionnaire item asked the following: "Some distance education classes require students to complete the assignments according to a fixed calendar, while others are self-paced. Which would you prefer?" They were then presented three choices: "Fixed calendar," "Self-paced," and "Undecided/ Depends on Content." The number of respondents selecting "Undecided/ Depends on Content" was the greatest (338, 37% of $n = 906$), just greater than the number choosing "Self-paced" (325, 36%). The third option, "Fixed calendar," was selected by 243 respondents (27%). This does not mean that the preference does not matter, or that these discrepant views cancel each other. Rather, educational providers should be cognizant of the diverse preference of learners.

The final question in this area was an attempt to determine preferences for group or individualized learning structures. When asked to select one of four possibilities, the majority of respondents (564, $n = 913$) reported having a preference for "a mixture of independent and group learning." More respondents preferred learning on their own (184) than preferred "learning by interacting with other students" (116). An implication for instructional designers and teachers of online courses is to include a variety of individualized and group learning activities in online classes.

Obstacles to Taking an Online Course. An attempt was made to determine perceived obstacles to taking online courses. Respondents were asked, "For you, what is the biggest obstacle to taking an online course?" The item with the most responses (228) was "no opinion / don't know." This might seem like a response with little semantic impact. However, it parallels many of the comments made in the attached "comments" portion of the instrument. There, several respondents indicated that they had never considered online education before, so they were not aware of obstacles. Ironically, this may be the most telling data concerning obstacles: "lack of awareness" or no consideration of online education as a viable alternative could be the biggest barrier between many technology education professionals and online educational opportunities. To overcome this obstacle, educational providers would be wise to take on the responsibility of informing the public and their potential clients of the services they offer, paying special attention to describe what it is like to take an online course.

The second and third ranked obstacles were "time requirements" (227) and "I can't find a course I'm interested in or need" (192). For these, and other obstacles, solutions may be possible. Varying course length and timing may successfully overcome some individuals' "time requirements" obstacles, while better publicizing online course offerings may help overcome the inability of potential students to locate a course they want.

Other obstacles noted in a comments section tended to be related to: ignorance ("Never given it much thought!"); apathy ("Need no longer exists. I

https://doi.org/10.21061/jte.v13i1.a.2

have enough credits"); personal characteristics ("Need structure of classroom"); computer issues ("I am slow at keyboard"); and questions of quality ("Poor quality of instruction"). However, it should be noted that these are perceived obstacles, and students who enroll in online education may soon overcome a previously perceived obstacle. For example, Wells (2000) found that by the midpoint of an online course, "the anxiety surrounding the course requirements and gaining the necessary enabling skills were mitigated."

Degree Program Interest. A survey item asked, "If you were to begin an online college degree program, in which level would you be most interested?" Respondents chose the "master's" level (287 respondents, 38% of $n = 761$) as most appealing, followed by the "doctoral" level (30%) and "continuing education credit" (27%). As would be expected from the educational level of respondents, relatively little interest was shown in an undergraduate degree.

A second question ($n = 686$) in this area asked, "If you were to begin an online college degree program, in which area would you be most interested?" A clear favorite here was "Technology Education" (69%), over the alternatives of "Educational Administration" (25%) and "Curriculum and Instruction" (20%).

Most Attractive Aspects on Online Courses. In an open-response question, respondents were asked, "What is the most attractive aspect of taking an online course?" The quantity of responses to this item was high ($n = 765$), but the variety of responses was not. By far, the most common responses concerned convenience, which seemed to be partitioned between not having to travel, and the flexibility to work at one's own schedule. This corroborates the work of Thompson (1998) who noted that, "Traditionally, distance education has attracted students whose geographic distance from a higher education institution discouraged or prevented enrollment in on-campus classes" (p. 12.). However, some respondents indicated that the self-pacing of online education is appealing. (This points out a preconception among some that online education is necessarily self-paced, in spite of examples to the contrary.)

Least Attractive Aspects of Online Courses. In a parallel item, respondents were asked, "What is the least attractive aspect of taking an online course?" The number of responses to this item was once again great ($n = 726$), but the variety was greater than the previous item. The most common response expressed the belief that there would be little human interaction, either with the instructor or with fellow students. This confirms the findings of Schmidt and Gallegos (2001), who surveyed four technology classes at Purdue University to determine issues and concerns of distance learners. Other common responses from the present study concerned low interaction ("No interaction with instructor/classmates"); low quality ("Quality is near -0-."); time, work, and cost requirements ("Cost / time"); personal characteristics ("Motivation"); computer concerns ("Not being totally comfortable with using the Internet"); ignorance and fear ("Unsure of what it is all about"); and availability ("Finding one to take.")

Strategies should be devised to minimize each of these "least attractive" aspects. For example, designers of online instruction might consult newly published standards and principles for online education in their effort to ensure

https://doi.org/10.21061/jte.v13i1.a.2

quality (Innovations in Distance Education, 1998; The Institute for Higher Education Policy, 2000). Most significantly, however, is the need to overcome the belief that online courses do not include interpersonal contact.

Ignorance and misconceptions about what an online course entails may pose a problem in analyzing the results of this item. Anderson (1997-1998) noted that typical students who take their first online course are often unaccustomed to the instructional techniques and mistakenly assume a passive role. It is not feasible to use an online course to overcome such misconceptions if they pose a significant obstacle to enrolling in an online course. Instead, universities and others should educate potential students about what it is like to take an online course. Because there is much variety in both student needs and possible educational offerings, universities should provide sufficient information to potential students that would allow them to wisely choose courses or programs that meet their content needs and learning styles.

Locating Online Offerings. Respondents were asked the following question: "If you decided to take an online course or begin an online degree, where would you look to see what is available? Where should universities advertise?" Many stated they had no idea where to look. Others listed ITEA's website and publications. A surprisingly large number of respondents noted that they would look toward local (geographically) sources to find information about online courses. They most commonly included nearby universities, the Web pages of those universities, state organizations affiliated with ITEA, and state departments of education**.**

The implications for the technology education profession are clear. First, there should be a free, centralized clearinghouse that facilitates easy listings of, and easy searches for, online education in technology education. ITEA is the logical choice within the US for this clearinghouse, though other associations may be more appropriate elsewhere. A second implication is that universities should use a variety of strategies to disseminate information about online offerings. These include Web-based sources, mailings, organizations, bulletins, and partners. The Web addresses (i.e., URLs) of courses should be submitted to search engines so that keyword searches will find the necessary information about the online offering.

Willingness to Teach Online. Respondents were asked, "Would you like to try teaching online (even if that means getting training in online teaching)?" A large number (437, 47%) answered, "Yes." This was higher than had been expected, considering the observation of Williams, Paprock, and Covington (1999). They stated, "When teaching and training professionals are asked to participate in open and/or distance learning projects, many have an underlying resistance to change" (p. 75). Those without prior experience as online students were more likely to answer "Yes" than those who had been online students.

The implications for universities and the technology education profession are not certain, here. Should universities recruit online technology teachers? Should they specifically offer training in "how to teach technology education online"? Should technology teachers provide online K-12 education?

https://doi.org/10.21061/jte.v13i1.a.2

Conclusion and Recommendations

Perceived Online Learning Needs

A variety of views emerged concerning online learning needs. While some people indicated a need for individual courses, others preferred continuing education credits, or entire degree programs. Although the greatest job-related educational need was for continuing education credit, a higher level of interest was expressed for online programs in technology education and at the master's level than in other alternatives.

Interest was evident in courses and workshops covering a variety of topics, including activities to teach about technology, new and emerging technologies, technology education curriculum, and using the Internet to teach about technology. Teaching methods and student management were also of interest, but more among those who had not yet completed a bachelor's degree. Furthermore, interest was expressed in topics related to the ITEA content standards. Of these areas, the most interest was expressed for "information and communication" and for "technological design." "Medical technologies" and "agricultural and biotechnologies" were of least interest.

Several barriers to meeting online learning needs emerged. Among these were a lack of perception of need, a lack of awareness of online opportunities, a perception that online education is too impersonal, and a perception that online education is of inferior quality. Yet, universities can help overcome some of these barriers if they advertise online offerings that have been designed to ensure both high quality and personal interaction.

A number of preconceptions emerged that may not accurately describe online education. For example, a perceived lack of inter-student contact in online courses seems to be contrary to the use of collaborative online strategies and technologies (See Mason, 1999; Verdejo and Cerri, 1993.) Other preconceptions that should be scrutinized include a perceived lack of contact with the instructor, a self-paced calendar for an online class, and lower quality of online education compared to traditional education.

Recommendations for Educational Providers

The following recommendations are made to potential providers of online technology education:

1. Take advantage of the perceived need for online education in technology education by offering more online courses and workshops. Areas such as "information and communication" and "technological design" may meet a greater need than other areas and may yield greater enrollments. Courses that are part of complete online degree programs, especially at the master's level, may be useful to those seeking credit only and to those seeking degrees.
2. Ensure high quality in the online learning experience. This concerns the depth of content, accommodations for significant interpersonal interaction, and the facilitation of a wide variety of learner needs and capabilities.
3. Advertise and promote online opportunities using a variety of techniques

https://doi.org/10.21061/jte.v13i1.a.2

to reach near and distant technology education professionals. Where possible, note where online courses and workshops meet individual re-certification requirements for teachers from a variety of geographic locations. Help dispel misconceptions about what it is like to take an online course.

Finally, future needs assessments should be performed to gain information on the changing needs of a changing population. Stabb (1995) noted that "there is near universal recognition of needs assessment as an ongoing, dynamic process that responds to shifts in the local context" (p. 53).

https://doi.org/10.21061/jte.v13i1.a.2

References

Anderson, M. D. (1997-1998). Critical elements of an Internet based asynchronous distance education course. *Journal of Educational Technology Systems, 26*(4), 383-388.

Davis, R. (April 2000). *The status of distance education of selected technology education graduate programs*. Paper presented at the annual conference of the International Technology Education Association, Salt Lake City, UT.

Gupta, K. (1999). *A practical guide to needs assessment*. San Francisco: Jossey-Bass Pfeiffer.

Innovations in Distance Education. (1998). *An emerging set of guiding principles and practices for the design and development of distance education.* University Park, PA: The Pennsylvania State University. Available: http://www.worldcampus.psu.edu/ide/docs/guiding_principles.pdf

The Institute for Higher Education Policy. (2000). *Quality on the line: Benchmarks for success in Internet-based distance education.* Washington, DC: Author. Available: http://www.ihep.com/quality.pdf

International Technology Education Association. (2000). *Standards for technological literacy: Content for the study of technology*. Reston, VA: Author.

Mason, R. (1999). *Globalizing education: Trends and applications*. NY: Routledge.

McClelland, S. B. (1995). *Organizational needs assessment: Design, facilitation, and analysis*. Westport, CT: Quorum Books.

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

Pratt, D. (1980). Curriculum design and development. New York: Harcourt Brace Jovanovich.

Queeney, D. S. (1995). *Assessing needs in continuing education.* SF: Josey-Bass.

Rutz, E. (2000). Use of distance learning for continuing education of engineers: Results of an educational needs assessment. *Journal of Engineering Education, 89*(3), 261-264.

Schmidt, E. K., & Gallegos, A. (2001). Distance learning: Issues and concerns of distance learners. *Journal of Industrial Technology, 17*(3). Available: http://nait.org/jit/Articles/schmidt041801.pdf

Stabb, S. D. (1995). Needs assessment methodology. In S. D. Stabb, S. M. Harris, & J. E. Talley (Ed.), *Multicultural needs assessment for college and university student populations*. Springfield, IL: Charles C. Thomas.

Stewart, R. G., & Cuffman, D. M. (1998). Needs assessment: A systematic approach for successful distance education. In Proceedings of the 1998 Mid-South Instructional Technology Conference. Available: http://www.mtsu.edu/~itconf/proceed98/rstewart.html

https://doi.org/10.21061/jte.v13i1.a.2

Thompson, M. M. (1998). Distance learners in higher education. In C. C. Gibson (Ed.), Distance learners in higher education: Institutional responses for quality outcomes. Madison, WI: Atwood Publishing.

US Department of Education, NCFES. (1999). Distance education of postsecondary education institutions: 1997-1998 (NCES 2000-012). Available: http://nces.ed.gov/pubs2000/2000013.pdf

Verdejo, M. F., & Cerri, S. A. (Eds.). (1993). *Collaborative dialogue technologies in distance learning*. Berlin: Springer-Verlag.

Wells, J. G. (2000). Effects of an On-Line Computer-Mediated Communication Course, Prior Computer Experience and Internet Knowledge, and Learning Styles on Students' Internet Attitudes. *Journal of Industrial Teacher Education 37*(3). Available: http://scholar.lib.vt.edu/ejournals/JITE/v37n3/wells.html

Williams, M. L., Paprock, K., & Covington, B. (1999). *Distance learning: The essential guide*. Thousand Oaks: Sage Publications.