DISTANCE HIGHER EDUCATION: Outlook for the Safety Professional as Student

By TIMOTHY J. RYAN

In the U.S., education no longer stops with a high-school diploma, even for those who elect not to pursue a career based on completion of a higher education (e.g., four-year college degree, or advanced degree). This is particularly true for those engaged in safety and environmental health, where prescribed industrial training has become expected for most (if not all) workers employed at particular job sites.

According to Frederick, et al, the most successful and actively recruited environmental, health and safety (EHS) professional has a B.S. in Occupational Safety and Health or Industrial Hygiene; three to five years' professional experience in industry; and the certified safety professional designation (31). Given these demands, higher-education institutions are being asked to provide effective distance-learning opportunities.

The paradox faced by safety professionals seeking career advancement and new challenges is that employers ideally want to hire candidates with demonstrated experience in the job at hand. Thus, those in the technically challenging fields of safety, hygiene or environmental management may find themselves attractive only to employers that desire essentially the same set of job skills which the prospective candidate might prefer to move beyond.

Solutions to this conundrum are somewhat limited; they include obtaining an advanced degree; attaining a recognized, exam-based certification; or some combination of the two. This article focuses on obtaining career advancement through a quality higher education. Continuing education for degreed individuals is discussed, as are options for those seeking personal growth or an advanced degree. In addition, the Internet's impact on existing distance education programs will be discussed, as are anticipated changes in such programs given the advent of the Internet2 and Next Generation Internet (NGI).

DISTANCE LEARNING NEEDS

Before continuing, it is important to distinguish between *learning* and *training* in this context. In its most-prevalent form, computer- or web-based *training* involves the imparting of a specific task-skill or ability to the student, without any deeper understanding of subject matter complexities. For example, many training products facilitate safety task completion related to EPA regulations, EHS management, recordkeeping, HazMat transportation requirements, and asbestos, lead or other HazMat safety training topics.

Distance *learning* communicates most of the same competencies of training, but often without specifically prescribed or targeted outcomes; it also typically leads to in-depth understanding of the subject matter. For example, respiratory protection training might focus solely on where and when an employee must wear such protection. Learning focused on this topic would seek to convey more-advanced information about respiratory hazards and respirator limitations, in addition to the where and when components. The learner in this situation might then be (rightly) expected to know how to accurately select a suitable respirator with a high degree of confidence. The remainder of this article pertains solely to learning.

In an article detailing pros and cons of distance education as it presently exists, Fender describes several key definitions used in the distance learning field and explains why a prospective occupational safety student may choose to pursue a degree via this avenue (26). In addition to those topics, other aspects of distance education and learning require discussion.

Most newly hired safety practitioners need options that allow them to remain dedicated to their employers. If Adams is correct in his assertion that "Generation X" will usher in an era in which most safety practitioners will be four-year-degreed professionals (28), then it will be the non-degreed or associate-degreed individual most in need of realistic avenues for pursuit of college-level coursework.

TABLE 1
Typical Computer Specifications: 1994 vs. Today

COMPONENT	1994		1999	
Processor	Intel 486DX-33	$202	AMD K6-2400	$130
RAM	4 MB	$327	128 MB	$120
Hard Disk	200 MB	$436	13 GB	$140
CD-ROM	1x	$381	40x+	$70
Modem	14.4 kilobytes/sec.	$272	56 kilobytes/sec.	$60
Video	1 MB	$191	16 MB graphics	$99
Audio	SB-Pro	$218	32-bit PCI	$40
Other Items	Printer, monitor, floppy, etc.	$905	Printer, monitor, floppy, etc.	$525
Total System		$2,932		$1,184

Adapted from *Consumer Reports,* May 2000.

In addition to GenXers, other students who prefer traditional correspondence courses might include the burgeoning second-career employment sector (consisting primarily of those age 40 or older) as well as foreign students who, for reasons of currency devaluations, cannot afford higher education in a residential environment.

Surprising as it may seem, not all independently motivated learners have either the electronic connectivity or compelling desire to use Internet-based forms of distance learning. Despite a 60-percent decline in the cost of a home computer over the last seven years, young people may still lack the average $1,184 price of a modern, Internet-ready PC (Table 1). These individuals should remember that legitimate, mail-based correspondence opportunities exist for many degree choices applicable to the pursuit of a career in a safety-related field (Wilson).

For example, many universities operate successful traditional correspondence course networks. One of the oldest, yet increasingly overlooked of these options is correspondence study by mail. The attractiveness and value of such courses is not the logistics of receiving or submitting lessons. Instead, students enroll because course content is supported by the expertise of qualified faculty from stable, long-established, accredited institutions.

Whether delivered via mail, video or public telecasts, or over the Internet, the benefits of distance learning are overwhelmingly attractive to certain students. Students older than average (SOTAs) are a special group of learners for whom the autonomy, self-pacing and convenience of non-campus-based programs are especially beneficial.

Thanks to a clearer sense of purpose—or perhaps out of necessity—as a group, SOTAs are more highly motivated than the traditional four-year residential college student (Jafe). Older students typically have more time, resources and obligations than their 18- to 22-year-old counterparts. As a result, they tend to use their resources more efficiently and are more interested in finding educational providers that can best meet their needs.

Early career technicians and specialists are yet another group that finds distance learning attractive. They often have erratic schedules, including frequent and unplanned travel. As a result, it is difficult for such students to maintain continuity in their professional development, even if they must attend class only once per week at a local facility. The same is true for intensive weekend programs, although mid-career-level students will likely be able to more-consistently attend class.

DISTANCE LEARNING CHALLENGES

For all working professionals, the educational venue is critical. Therefore, the challenge for traditional residential schools is to meet student demands for accessibility and convenience. In most cases, a primary concern is time away from home and family; this factor can test the learner's resolve—it requires dedication to the pursuit of education, self-motivation and an independent learner attitude (Bryant and Hartle 35). Clearly, for such students, even the best residential campuses have significant limitations.

Increasing costs, large class sizes and lack of peer interaction can all contribute to the failure of the traditional college experience to meet the needs of working professionals. For example, Friedlander and Kerns note the pitfalls of large lectures (or poorly executed distance learning, for that matter) where "students do not feel part of a learning community. Lost in a sea of faces, they sit with other strangers who they understandably perceive as competitors for the all-important grade . . . without supportive, encouraging, motivating relationships among learners and instructors, students often do not prepare for, or even come to, lecture" (53). Lawson also cites lack of human interaction as a significant disadvantage of computer-based training (CBT) (31).

To remedy these issues, several online course software packages incorporate features designed to foster a connectedness, or social presence, for Internet-based distance learners. Although these packages are as varied as the students in a classroom, most allow for rapid grade access, chats of assignments, instructor-designed web presentations or links, and e-mail or listserv Q&A. More-advanced providers include live (synchronous) classroom interaction, asynchronous video streaming, animations or web-linked interactive assignments. Table 2 compares several of the larger such services.

Although distance learning software can solve some familiar live-lecture course problems, it presents some unique challenges due to its "distant" nature. For example, Blair notes that most safety professionals possess requisite technical knowledge to effectively function, yet lack non-technical skills needed to effectively interact with co-workers (28). This raises an important question about whether interpersonal skills can be competently imparted through an inanimate medium.

The short answer to this question is that Internet distance learning *can* effectively teach these subjective skills. In *Designing the Instruction,* Kemp, et al provide four concrete steps by which critical interpersonal skills can be conveyed in asynchronous distance learning: 1) Present the model skill to the student. 2) Teach the learner to develop a verbal and imagined (self-visualization) model of the behavior. 3) Allow the student mental rehearsal. 4) Practice overtly (111).

Applying this model to development of distance learning, aspiring safety professionals should be able to achieve impressive results in key non-technical job skill areas. According to Blair, the top non-technical safety manager competencies, as judged by mean rating scores from a Likert-scale survey, are 1) communicating effectively; 2) listening actively; 3) accepting responsibility; 4) motivating others; and 5) maintaining flexibility (32). Using the interpersonal skills model, it is conceivable that one can teach such skills over the Internet using audiovisual media.

TABLE 2
Current Internet Distance Learning Courseware in Use at U.S. Universities

NAME	HOST COMPUTER	FEATURES	COMMENTS
Blackboard CourseInfo	Local University	Accessible by any browser; security	Most widely used worldwide
Education-to-Go	National Internet Provider	Prepackaged online course	For-profit distance education attempt
IBM Global Campus	National Internet Provider	Lotus Learning Space	Turnkey package for course administration
Vcampus	National Internet Provider	Advertises 1,100 courses online	For-profit distance education attempt
WebCT	National Internet Provider	Uniform appearance to students	Readily accessible

What about attitudes (i.e., a belief and associated behavior or response)? According to Kemp, et al, attitudes may similarly be taught (113). They need only be included in the four-step method and a consequences element (necessary to reinforce either a positive or negative outcome) added.

Beyond questions about a lack of human interaction, or the abilities to shape people skills or attitudes from a distance, real work remains to be achieved with respect to the teaching of "hands on" safety or health topics. Specifically, is it possible to use current Internet tools and technology to teach a laboratory-based safety curriculum? Efforts at Ohio University to interactively teach industrial hygiene sampling has found, as did Parlengeli, et al (37), that a difficult-to-use hypermedia system can negatively affect—not enhance—overall learning performance.

However, these user interface problems can be resolved, which may resolve this issue of teaching traditionally hands-on safety content. If the experience of the medical and allied health sciences is a useful indicator (and a case could be made that it is, in that such education can literally have life or death outcomes), then experiential learning in safety sciences should be feasible (DiPiro 170). Early work in the hands-on field of HazMat management has already been attempted, yielding mixed results (Holme and Fisher 1).

TECHNOLOGY-DRIVEN FACULTY CHANGES

These are the current attributes, benefits and challenges of distance learning. How can it be improved or made more utilitarian for the targeted audience (working safety professionals)? To adequately answer this question, two variables must be considered: 1) changes in technology, which historically act as a catalyst for change in other areas; and 2) repercussions of these changes on those who use existing technology to deliver distance learning at the higher education level.

According to Drucker, higher education as we know it is "doomed."

> *Thirty years from now the big university campuses will be relics. Universities won't survive. It's as large a change as when we first got the printed book. Do you realize that the cost of higher education has risen as fast as the cost of healthcare? . . . Such totally uncontrollable expenditures, without any visible improvement in either the content or the quality of education, means that the system is rapidly becoming untenable. Higher education is in deep crisis. . . . The college won't survive as a residential institution* (Croy 317+; Fender 29).

It should be noted that Drucker's expertise is in management, not higher education. Certainly no person, regardless of his/her area of professional competency, can honestly claim to accurately know the future. Few will forget the concerns raised, yet never realized, with respect to Y2K problems (Fivizzani 4; Hansen 37). Still, potentially revolutionary comments such as Drucker's merit serious consideration. While it seems unthinkable that the nation's many revered university campuses could be nonexistent in 30 years, changes in their faculty will drive change in their course content, infrastructure and delivery methods.

If the history of technological innovation is of any value in predicting the future, then one can reasonably believe that the transition from conventional higher education in safety and health will follow an evolutionary course, not Drucker's revolutionary timeline. As such, present delivery methods and practices are the best indicators of how distance learning will be provided. In terms of distance learning, those methods include the existing lecture format and web-based education.

In 1993, the American Academy for the Advancement of Science called on educators to move away from a predominantly didactic model (i.e., lectures imparting basic facts) toward a learner-centered model in which learning activities involve immersive student inquiry and problem solving, often in a collaborative framework with each other and the instructor (Duffy 2). At that time, delivery of such a learning experience over the Internet was simply not realistic based on the technology available.

Much has changed since then, and universities have been at the forefront of such efforts. As present Internet capabilities are utilized, new models, such as that created by Bannan-Ritland, et al (78) for effectively structuring distance learning presentations are evolving (Table 2). While the lecture-based environment still predominates at universities today, one can expect this "sage on the stage" approach to give way to the "guide on the side" paradigm of Internet-based distance learning (Bryant and Hartle 36).

INTERNET2 TECHNOLOGY IMPACT

Not only will lecture formats evolve thanks to new technology, existing Internet services will similarly evolve with the advent of Internet2, which itself will serve as a model for the planned Next Generation Internet, or NGI (Grush 4). These changes will emerge through funded grants presently being implemented nationwide at Internet2 universities—those connected to the Abilene or vBNS computer networking infrastructure. In early 2000, 173 member organizations were tied together by one of these two computer infrastructures. The vBNS—very high performance backbone network service—was created by MCI Worldcom and the National Science Foundation, and primarily constitutes the present Internet2.

Technology advances in computing and communications have historically fueled innovative applications in many

TABLE 3
Content Delivery Models for Web-Based Instruction

CONTENT LEVEL	TYPE OF METHOD	DESCRIPTION OR EXAMPLES
1	Information Delivery	Posting of course syllabus, notes, assignments. Didactic course information.
2	Information Delivery Using Pre-Defined Resources	Instructor organizes web links, or puts slides or content on controlled website.
3	Information Delivery Using Online Interaction	Asynchronous online class/instructor communication (chats), e-mail or listservs.
4	Predesigned Instructional Delivery	Web-based tutorials, video streaming, other multimedia modules from instructor. Select laboratory simulations possible.
5	Information Synthesis or Creation of Resources	Student created web links, homepages or web resources.
6	Immersive Collaborative Environments	Computer conferencing, text or visual chat. Student presentations, synchronous laboratory sessions possible.

Adapted from: Bannan-Ritland, Harvey and Milheim 78.

fields, and the safety profession is no exception. The advent of relatively inexpensive PCs with high-speed processors and high storage capacity helped usher in the explosive growth in the use of CBT. Directly as a result of such advances, PC-based industrial CBT that utilizes full-motion video, animation, graphics, audio and text has become a proven, popular approach to meeting training needs (Lawson 30; Janicak 36). Collaboration between industry, government and education on new Internet2 services will likely lead to similarly rapid advances in many applications, including distance learning for safety professionals.

These advances will likely fulfill present expectations of voice, data and video services converged on the new backbones. Although the elements are the same and seem familiar, the transition from the current understanding of them to the new applications will be remarkable. In the author's opinion, these changes will be akin to the dramatic difference between early kinescope television and today's surround-sound home theaters. While both technologies involve moving pictures with sound, the experience with the former pales in comparison to that with the latter.

This evolution will bring about live, high-quality, synchronous video applications with integrated data or extensive digital libraries through newer technology such as high-definition TV (Van Houweling 10). Applications built around these capabilities might include lifelike virtual tours of jobsites, as well as interactions with unique museums or state-of-the-art government research facilities (such as NIOSH). In addition, these features will be available through a connection to the home or office—a significant benefit to working safety professionals.

In fact, both distance learning and distance training are likely to be affected by advances in the connectivity of Internet2. On the industrial side, more utilitarian software will likely be created for Internet2. Consider this scenario. A production supervisor at an ISO-14001-certified global corporation in Malaysia needs specific chemical toxicology data. She does not know that what she wants to research is considered "applied toxicology," only what the specific hazards are of some new chemicals and whether special protection is needed.

Using a shopfloor terminal, this supervisor calls up the chemical by trade name from a web-based browser connected to a vendor that supplies safety data worldwide, 24/7. Although few people will be impressed by the ability to access an MSDS online (Daniels 326), in this scenario, what will appear on screen is the actual application at the employee's worksite (linked to her medical file); a specific list of required safety equipment and precautions; relevant disposal practices in her native language; and a flash video that reviews how to leaktest a respirator that has been pre-approved to wear.

One needs no special training to work with Internet2—simply the ability to turn on a TV. With digital video hardware suites now commercially available for less than $20,000, such integrated corporate-sponsored training is not only possible, it is becoming a reality in private-sector in-house production units.

Not only will universities serve as co-inventors of Internet2, they will also be among the first major users and developers of the planned NGI. A critical link between better academic institutions and their students is the ability of research faculty to bring such work to the classroom. With a more-completely integrated Internet2 infrastructure, advances along such lines will be possible. Concurrently, the line between distance learning and traditional lecture formats will blur, acting as the evolutionary step that will transform higher education from its current form into what it will ultimately become.

Imagine an NGI infrastructure with speeds hundreds to thousands of times faster than current Internet connections, enabling astounding end-to-end performance (Van Houweling 10). The quantity and quality of data that can be delivered via this connection could make the average workstation of today seem as powerful as a direct-wired terminal to the fastest supercomputer now available.

Given suitable applications development, this capability will be applied to provide unheard-of distance education opportunities—opportunities that not only make current Internet software seem like early TV, but that also open new access to once-impractical teaching locations.

Immediate prospects include astronomy taught online, simultaneously webcast to hundreds of individual students at locations throughout the country from the (then aging) Hubbell telescope; classroom study of 3D anatomical images constructed from actual patient MRI scans located in a distant operating theater. In the safety field, applications in formerly computational intensive outputs can be imagined, such as interactive computer-modeled crash testing, or visualization of excessive noise exposures in reverberant fields.

CONCLUSION

This article has identified and highlighted some needs and realities of future developments in distance education. Thanks to technological innovations, opportunities for early- and mid-career safety professionals are evolving in the

Universities are continuously developing new programs, particularly in the distance learning arena. Prospective students are encouraged to conduct further research to find a program that best meets their needs.

areas of course content, presentation formats and instructional quality. Institutions are moving toward Internet-based lecture delivery and assessing how existing courseware can not only deliver—but also enhance—student learning. Ultimately, through the fledgling Internet2 or NGI, continuing safety education will become more timely, engaging, stimulating and effective. ■

TABLE 4
Distance Learning Programs

INSTITUTION	PROGRAM	WEBSITE
Auburn University	General and Health Sciences Undergraduate & Graduate	www.ohio.edu/healthsciences/
Tulane University	Public Health	www.tulane.edu/
Ohio University	General and Health Sciences Undergraduate & Graduate	
University of Wisconsin	Environment	www.uwex.edu/disted/catalog/
Cal State – Domingus Hills	Quality Assurance	www.csudh.edu/dominquezonline/
Indiana University	General Undergraduate and Graduate	www.indiana.edu/
McGill University	Occupational Health	www.mcgill.ca
Australian Correspondence Schools	Health & Environment	www.acs.edu.au
University of Alabama	College of Engineering	www.eng.ua.edu/
University of Southern Maine	School of Applied Science	www.usm.maine.ed
Central Missouri State University	Safety Science and Technology	www.cmsu.edu
Texas Tech University	Dept. of Industrial Technology	www.ttu.edu
University of Wisconsin-Stout	Technology, Engineering and Management	www.uwstout.edu
University of Findlay	National Center of Excellence for Environmental Management	www.nceem.org
Georgia Institute of Technology	Center for Distance Learning	www.conted.gatech.edu/distance/enve.html

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