Occupational Safety and Health Training on the Internet

DEVELOPING QUALITY INSTRUCTION

by Gregory Loos, EdD, and John W. Diether

The Occupational Safety and Health Act of 1970 mandates improved research, regulation, and training aimed at reducing the incidence of occupational injury and illness. To achieve the goals set forth in the Act, provisions were made for two Federal agencies: the National Institute for Occupational Safety and Health (NIOSH) and the Occupational Safety and Health Administration (OSHA). Safety and health regulations in the workplace are developed and promulgated by OSHA. The NIOSH serves the occupational safety and health research needs of the federal government and the public.

Currently, more than 100 OSHA standards contain requirements for worker training—others limit certain jobs to individuals deemed competent by virtue of special training. However, the documented outcomes of various forms of occupational safety and health (OSH) training remain varied and inconclusive. In the late 1980s, the U.S. Office of Management and Budget (i.e., the agency overseeing federal spending and other burdens imposed on the public) requested OSHA provide evidence that OSH training was reducing job related injury and illness. Unless OSHA could demonstrate the benefit of training,

the agency could no longer include training requirements in its standards.

In 1991, OSHA sought the assistance of NIOSH to demonstrate the positive effects of OSH training. In response, NIOSH conducted an extensive review of the literature (Cohen, 1998). The NIOSH literature review cited data related to the characteristics of successful training. Information gained from trainee feedback, knowledge tests, and posttraining monitoring suggests the following:

● Including hands on exercises involving case studies and problem solving consistently produces the best training results.

● Allowing trainees to address hazard control issues from their own work setting makes learning more relevant and increases the likelihood of learners applying acquired knowledge to the workplace.

● Setting performance goals and issuing feedback to learners foster significant learning during and after training.

Furthermore, established learning theory states that adult learners do not regard instruction as a means of reinforcing learning. Rather, they use instruction to construct their own knowledge (i.e., adults learn best what they "discover" for themselves) (Duffy, 1996; Knowles, 1984). Therefore, training via the Internet (i.e., e-training) for adults must be based on the following principles:

● Learning is an active process in which the learner constructs knowledge rather than acquires it.

● Instruction is a process of supporting this construction rather than communicating knowledge.

E-training can successfully accommodate such features using available technologies. In addition, the development of a global economy strongly supports the need for e-training. This article includes a discussion of the need for e-training, the current status of e-training in the United States, and the need for research related to e-training with a focus on a proposal by NIOSH.

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TABLE
Instructional Design of Occupational Safety and Health E-Training

	University based	Commercial Vendor	Other Providers
Number of websites visited	12	11	5
Low end cognitive instruction	9	11	3
High end cognitive instruction	5	0	5
Predominantly instructor led	12	11	5
Predominantly student led	0	0	0
Text based instruction only	12	11	5
Narration available	4	7	2
Graphic illustrations	6	9	2
Video illustrations	1	5	1
2D/3D virtual simulation	0	0	0

Note: Some sites offer both low and high end cognitive instruction.

E-TRAINING FOR WORKERS

The NIOSH review of OSH literature notes that training programs organized from authentic circumstances encountered in the workplace are often the most effective (Chhokar, 1984; Cohen, 1984; Fox, 1987; Komaki, 1978; Ray, 1990; Reber, 1984; Saarela, 1990; Saari, 1989). This authenticity of instruction was one of eight major factors identified as influencing training. Transfer of learning from the instructional environment to the workplace is the ultimate purpose of OSH training. To facilitate this transfer, e-training can integrate numerous media and instructional approaches into a single presentation. Furthermore, e-training can provide learning environments in which students receive continuous feedback to refine their understanding and build knowledge.

The use of three dimensional simulations holds particular promise for transferring learning to action (Loos, 2000). Technology currently permits the creation of "virtual worlds" resembling actual work settings. These instructional environments enable learners to visualize abstract concepts, test newly acquired knowledge in multiple contexts, and appraise their own learning. Most important, virtual simulations can permit learners to manipulate circumstances and incorporate data from a specific worksite (e.g., floor plans).

The NIOSH review also indicates personal characteristics, beliefs, and experiences (Lin, 1983; Wallerstein, 1994) influence training outcomes. As economic globalization continues, the work force will become more diverse, and training will need to accommodate cultural differences among learners. Instruction needs to be learner centered—designed so learners use their world view, background, and existing knowledge to construct new

knowledge (National Research Council, 1999). Because e-training is self directed, it is uniquely adaptable to learners with different learning styles, interests, and cultural beliefs. In addition, e-training affords flexible pacing, which is ideal for instruction aimed at both new and experienced workers.

PROFESSIONAL AND CONTINUING E-TRAINING

During the next 2 decades, world population growth and the industrialization of less developed countries will elevate worldwide demand for occupational safety and health professionals (Institute of Medicine, 2000). As the predicted global economy becomes reality, qualified OSH personnel will be needed on a global scale. To meet new and evolving needs worldwide, professionals must have access to information and training regardless of location. Long distance professional education depends on advanced cognitive programs transmitting quality instruction without exhausting extant training programs. E-training is the most promising approach to meeting this demand.

In addition to its sheer reach, e-training allows extensive networking and group learning among professionals. Interactive features such as bulletin boards, threaded discussions, and chat rooms will facilitate a worldwide exchange of knowledge and expertise. Such information will be especially useful in a global economy because it is derived from multiple cultures and circumstances.

Instant information retrieval and update is a key advantage of electronic formats. When many OSH programs were established twenty years ago, information doubled every 15 to 20 years. Currently, information doubles approximately every 5 years. If the trajectory of

information generation continues at its current pace, information will double every 73 days by 2020 (Rolph, 2000). Training delivered at one point in time will become dated as new research, experiences, and cross cultural developments modify knowledge. To remain current in their field, all OSH professionals will need information and training on demand. Because e-training is easily accessed and modified, it is a potentially powerful vehicle for lifelong learning.

OVERVIEW OF CURRENT OSH E-TRAINING IN THE UNITED STATES

The authors identified 28 websites originating from the United States offering OSH training for workers, professionals, or both (see Table). These sites were identified through literature and Internet searches; electronic distribution lists; and consultation with professional associations, employers, labor unions, and academia. (In total, 55 websites related to OSH training were investigated. However, only those offering e-training were included.) Twelve sites are produced by universities, 11 by commercial vendors of training materials, 2 by the government, 2 by professional and trade associations, and 1 by a corporation. All sites were operational as of May 2000. Two thirds of the programs reviewed provide audio narration, and 80% feature graphics (e.g., charts, photographs, illustrations). Half of the sites contain video files.

Two universities offer full degree programs in public health. One of these institutions offers an associate's program; the other offers two master's programs. The remaining universities provide between one and four courses apiece toward a degree or continuing education credits.

The two master's of public health programs consist of fully synchronous courses. Such courses are cast "live" to learners. All other forms of training are either fully asynchronous (i.e., containing stored information only) or hybrids of synchronous and asynchronous learning. The asynchronous and hybrid programs stress knowledge delivery and retention. They use a behavioral approach to instruction almost exclusively. Most programs require students to recall factual information by answering multiple choice questions. Such instruction encourages lower end cognition only (Bloom, 1956). None of the programs require students to apply higher level creative thinking (Gagné, 1985).

Presenting propositional (i.e., factual) knowledge alone, without testing whether learners can apply this knowledge, is a major shortcoming of the asynchronous programs reviewed (National Research Council, 1999). All of these programs are text based, and fewer than 20% require students to analyze situations and make critical judgments. Even within this minority, such approaches are used infrequently. Although the asynchronous programs present relevant information, little guidance is given on how to apply the information.

An important benchmark for training effectiveness is durability: Does the training have long term impacts such as professional development or improved work perfor-

IN SUMMARY

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1. Training via the Internet (e-training) for adults must be based on the following principles: (1) learning is an active process wherein the learner constructs knowledge rather than acquires it and (2) instruction is a process of supporting this construction rather than communicating knowledge. E-training can successfully accommodate such features using available technologies.

2. Because e-training is self directed, it is uniquely adaptable to learners with different learning styles, interests, and cultural beliefs. E-training also affords flexible pacing, which is ideal for instruction aimed at both new and experienced workers.

3. As the predicted global economy becomes reality, qualified OSH personnel will be needed on a global scale. To meet new and evolving needs worldwide, professionals must have access to information and training regardless of location. E-training is the most promising approach to meeting this demand.

4. Currently, occupational safety and health e-training does not fulfill its potential. Most training programs do not encourage higher level cognition, critical thinking, or transfer of knowledge. Therefore, training effectiveness research is needed to improve the state of e-training.

mance? (National Research Council, 1999). According to the producers of the sites, no program reviewed had conducted evaluations of training impacts. Few training programs, Web based or otherwise, currently provide this type of evaluation.

NEEDED E-TRAINING RESEARCH

As discussed, the advantages of electronic formats are significant. Educators must now move beyond mere recognition of these strengths and ensure e-training lives up to its potential. When evaluating e-training, the overriding concern is quality: Is e-training equal in value to classroom training? If not, is the trade off between quality of learning and global reach acceptable?

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To address these questions, NIOSH is developing test bed multimedia e-training. The curriculum will feature:

- Textbook style factual instruction.
- Internet links affording individual exploration and cognitive development.
- Video, 3D modeling, and virtual reality simulations.

Research suggests adult education is most effective when factual information is complemented by opportunities for individual discovery and knowledge construction (Lyons, 1999).

The curriculum will be programmed to track and compare usage patterns across:

- Learner populations.
- Learners within a single population.
- Learning trials of a single learner.

This information will allow researchers to identify preferred instructional media and determine how these media correlate with learning outcomes.

The study curriculum will focus on correct use of the NIOSH lifting equation, and will be evaluated in a controlled study comparing classroom and e-instruction (via the Internet and CD-ROM). Immediate outcomes of learning (e.g., changes in knowledge, attitude, behavioral intent) will be measured. In some cases, retention of these outcomes will be assessed 1 year after training. Because measures of transfer are important to assessing the quality of OSH e-training (Byrnes, 1996), longitudinal studies tracking learner performance, transfer of knowledge to novel situations, and other impacts of training are also planned. Currently, NIOSH researchers are securing partnerships to facilitate such studies and cross sector analysis. Individuals interested in collaborating with NIOSH should contact the authors.

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