Distance Education: Past, Present, and Future

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ABSTRACT

Alternative training technologies are being evaluated, with increasing interest in distance education and online training. Evaluations show the benefits of distance education in the face of limited staffing, shrinking budget dollars for travel to short schools and conferences, and the convenience, availability and quality of online training selections. In many industries today, distance education has become the staple for training management recruits and. other new employees. The water and wastewater treatment field is beginning to evaluate these same alternatives, as the cost of technology is now more affordable and the availability of this type of training is becoming more widespread. The following review of historical training will provide an introduction to this presentation. It will be followed by a study of current practices and suggestions for future improvements in operator training.

This presentation will include steps to evaluate and implement an online training program for water and wastewater treatment plant operators. Included are planning parameters, program design, software selections, server and system requirements, an evaluation of the efficacy of online versus classroom training, drawbacks and problem solutions, and the compatibility of Learning Management Systems (LMS).

I will provide a comparative study of four leading online providers within the water and wastewater field. Included is a comparison of online to classroom, pros and cons of online training, relative costs and benefits. In addition, the review includes comments and suggestions from operators, state administrators, utility managers and training coordinators to present an overview of the transfer of knowledge. The discussion of the challenges facing online training includes problems of standardization of LMS, issues in course development, and the development of systems for tracking and monitoring students' performance. As continuing education programs continue to evolve, questions for these challenges include how the training is accomplished, how well the training is retained, and what tools are utilized in training.

KEYWORDS

Distance Education, Continuing Education, Self-Study training, Web based training, Correspondence training, Online training, Classroom training, CEUs, Assessment

This study was published in 2011 and presented at the WEFTEC and ABC Conferences.

INTRODUCTION

Many times, we look at education and training without really understanding the benefits that come along with the requirements. Why did it start? When did it start? Why is it important? Is training a benefit or a burden to operators?

Where did Operator Training begin? Pioneers of training included Dr. John Austin of Clemson University, Dr. Ken Kerri of California State University-Sacramento, Dr. Bill Engel of the University of Florida's TREEO Center, Ken Hay of the USEPA, and the National Environmental Safety and Health Training Association, formerly known as the National Environmental Training Association (NETA).

The awareness of our environment, actions to begin cleaning it up, and the initial wastewater construction grant program began during the Nixon Administration, in the late 1960s. The United States Environmental Protection Agency, formerly a division of the Department of Interior, housed as the Division of Water Quality, was formed as an executive agency in 1970.

In the early 1970s, Congress and the Nixon Administration awarded millions of dollars of funding through the USEPA, to construct wastewater treatment plants, to begin the clean-up of our waterways and environment. As these facilities were under construction, the thought emerged as to who would operate these facilities, change the chlorine cylinders, and record the flows and carry out other necessary procedures. Ken Hay of the USEPA undertook the challenge to create a plan to train operators. His discussions of whether to utilize university instructors or experienced operators to become instructors became the basis of the training programs. The evaluations of theoretical vs. practical training became a main focus of development as Hay laid out the four key levels of Operator Training -- the Need-to-Know Criteria, namely: Must Know, Should Know, Nice to Know, and Related Information.

The 1977 Clean Water Act gave Hay the funding to develop the Need-to-Know criteria through the development of State training centers and training manuals. Ken Kerri created the Instructors' Manual, which later was revised and organized as a correspondence course. The approach that Hay and Kerri took was to "keep it simple" and pinpoint the Need-to-Know criteria that operators across the country would understand and utilize. In 1972, the USEPA developed the first technical manuals that are the foundation of today's start-up manuals, O & M manuals, and procedures for staffing and certification of treatment plants. These manuals are referred to as MO #1 through MO #8. They were perceived to be technically oriented and related to the engineering and design facets, rather than the fundamental and operational aspects of the treatment facilities. As an alternative, Ken Kerri created the California State University - Sacramento correspondence courses, which were originally funded by USEPA and written for operators to provide a practical approach to operating wastewater treatment plants. In the 1980s Ken Kerri developed drinking water manuals that mirrored his original work with Hay of the USEPA.

Ken Kerri received his doctorate degree from Oregon State in 1965 in Sanitary Engineering and has been referred to as the "Father of the Water and Wastewater Correspondence Courses." Dr. Kerri began his career in water and wastewater treatment in 1956, working for the U.S. Public Health Service as an assistant Sanitary Engineer. A true friend to the operating community, he developed and administered training programs for over forty years, and published numerous books, presentations, and programs.

Prior to the development of the Sacramento Courses, the University of Arizona and Clemson University had developed correspondence manuals in the late 1960s. In addition, Texas and New York State established the first Operator Training Short Schools and created training manuals in the 1950s and 1960s. As the USEPA funded State training centers, the Need-to-Know criteria were developed for:

- Standardized criteria
- Pollution Abatement Technology
- Hands-on training
- On-the-job training

The NETA served as a "pre-Internet" resource for trainers to network and exchange resources, ideas, and solutions to problems. From this networking, trainers developed the "Need-to-Know" criteria. In 1984 NETA began the Certified Environmental Trainer (CET) program in response to the perceived need on the part of members, who were at that time, U.S. EPA designated wastewater operator training centers at primarily community colleges, to encourage trainer competency in the field. Today, the CET qualification provides adult education programs an assurance of the certification and experience of the instructors. In 2003, NETA reorganized to become the National Environmental Safety & Health Training Association (NESHTA).

Pilot testing was conducted at three community colleges selected by USEPA. They were the Linn Benton Community College program headed by Dr. Peter Scott in Oregon, the Greenville Technical College in South Carolina and the Charles County Community College in Maryland. The community college training programs and methods were organized into course curricula and made part of the academic requirements to obtain an associate's degree. Bill Engel developed the Charles County Community College program in 1969. As a licensed operator and the safety coordinator of the Blue Plains 399 MGD Activated Sludge Facility, Washington, D.C., Engel become very active in developing a Wastewater Operator training program, which led to his directorship at the Maryland State Training Center, Charles County Community College, and development of the South Carolina Environmental Training Center. He has served as the director of the TREEO Center at the University of Florida starting in 1994.

In the 1970s, demand for operator training increased, as wastewater treatment plants expanded and new facilities were built. Additionally, operator certification programs instituted mandatory training for certification and renewal and OSHA mandated safety-related training. During this period, states began to certify water and wastewater treatment operators and the approximately 40 states that had a certification program created the Associations of Boards of Certification, also known as ABC. Through the leadership of Harris Seidel, George Burke, and many others, ABC unified certification programs. Today, Operator Certification Programs, working together under the ABC

guidance, have improved the certification standards and increased the awareness of operator training throughout the country. ABC has built an excellent model for operator proficiency and increased competence in treatment plant operations large and small through their certification program.

In a Florida Specifier article, which addressed the evolution of operator training, Engel wrote, “in the 1980’s, regulations were passed in solid and hazardous waste management, asbestos abatement and air quality. Operators and technicians saw their job descriptions expand as a result of these new regulations. This increase in responsibilities required training in more than one environmental field, creating a new era of cross-trained employees.”

“By the 1980s, federal and state funding for environmental training programs had decreased. This caused training centers to rethink their operations and begin functioning as revenue-generating businesses. It was during this period that the environmental training business first became competitive, according to Engel. Consulting firms began to recognize training as a business development opportunity, as more and more regulations were promulgated. Associations also began increasing training, as a service for their members and as a revenue generator. This forced the non-profit training centers to become self-sustaining and compete with the more sophisticated consultants and associations.

Engel expressed that the new way of thinking required employees to be cross-trained, in order to develop a workforce capable of operating within a process rather than a having a singular job function. He wrote, “Like most other industries, environmental training was radically affected by the introduction of personal computers and the Internet in the 1990s. The days of buying expensive books, photocopying, and cutting and pasting training visuals to deliver via projectors have gone the way of the dinosaurs.”

CURRENT TRENDS

Distance education and online training have become increasingly attractive options. Evaluations show the benefits of distance education, as staffing is being reduced amid shrinking budget dollars. Less time and resources are available for travel to short schools and conferences, and online training provides the convenience of extensive course selection and on-demand, flexible scheduling.

Types of Distance Learning Technologies

Print

- Textbooks
- Study Guides
- Workbooks
- Fax

Voice/ Audio

- Telephone
- Voicemail
- Audio conferences
- Audio tapes
- Radio

Types of Distance Learning Technologies - continued

Computer	Video
• E-mail	• Videotape
• Web-based courses	• Satellite delivery
• Videoconferences	• Microwave
• CD-ROM	• Broadcast video
• Collaboration software	• Desktop Video

Distance education technologies can be divided into four groups: print, audio (voice), computer (data), and video. There is some overlap among the different types, as blended learning concepts increase in popularity. An example of a blended learning concept is a text manual that includes a cassette tape or VHS tape.

Computer training continues to increase in popularity and provides the mechanics for high resolution in training illustrations. Computer technology has expanded our available tools to include 3D simulations, random selection of Q & As, learning management systems for assessment and tracking student progress and immediate updating of course material and content. The primary technologies used for computer-based distance education include e-mail, online collaborations, and web-based training.

E-mail:

Corresponding via the Internet has proven to become the standard communication link between instructors and their students on a personal and one-on-one basis. It is the most inexpensive approach to communicating and networking with an individual student and facilitating group discussions. The group discussion concept has grown to include chat rooms, operator forums, and the new blogs/wikis. One important aspect of e-mail is that it forces the student to write and to develop writing skills. In some educational arenas today, educators are increasingly concerned that engineering, computer, and science students lack these writing skills. According to Joe Grohens, a lecturer in the department of English at University of Illinois, “These students all have huge writing apprehension; they’re been told they can’t write. They’re good at math, but they don’t have many writing assignments. I want them to start feeling more confident in their writing.”

Grohens used the class wiki as a course-management system to publish assignments and for students to post their work. He believes the quality of students’ writing improves as a result of using the wiki, because drafting and revision is so easy, and because they know that someone besides the instructors – their classmates – will be reading and critiquing nearly every assignment. This technique of combining e-mail and collaborative assignments is fueling the development of the Electronic Blackboard or Whiteboard concept through the educational system. Various software and proprietary programs are becoming readily available to trainers to implement and expand their distance education programs.

Some of the advantages to e-mail communications include student access, anywhere at any time, and the establishment of list servers for assignments, discussions, and for providing links to additional reference material. Troublesome issues in this process are screen blockers and spam-ware, which prevent training providers from automatically responding or developing initial lines of communications between the instructor and student. Other obstacles to communication are hardware or software requirements of the student's PC, along with breakdowns and virus infections.

Online Collaboration:

Online chat, operator forums, and web conferencing all evolved from e-mail. Access to and use of the Internet and related technology for water and wastewater training programs have grown tremendously between 1995 and 2010 era. Whether the conference involves two, two hundred or two thousand sites, the interaction and communication links to educate and inform water and wastewater treatment industry professionals is continually improving. As stated in a University of South Florida/College of Education report, "Online chat allows students and teachers to communicate in real-time. For example, many instructors will establish virtual office hours, during which they will be available to chat with any student who may have questions. Because the chat takes place on the Internet, there are no phone charges to worry about!"

The development of illustration software programs such as Macromedia Breeze, Flash, Captive, Whiteboard, Blackboard, and PowerPoint, as examples, allows the instructor options to illustrate course material. These programs offer the communication links and immediate response requirements that are becoming standard in our industry. The ability to share data and chat between locations with the available feedback is a major advancement in collaboration. There are drawbacks to any concept, and collaboration has its own; namely, problems in schedule coordination for the interaction and issues with compatible software and programs.

Web-based:

Web-based education has become as easy as a Google® search. The World Wide Web provides a delivery mechanism for instructors to offer students text-based material, streaming videos, audio/video files, and links to resources for continuing education. The Web has opened doors for self-study and correspondence-based courses. Web-based training has become an alternative to traveling to workshops or conferences. The key advantages for a Web-based course are that it is self-paced, can be accessed anywhere and can be provided at a reasonable cost.

Web-based distance education training includes CD-ROM with accessible Internet sites, online training, and web conferencing with or without video interactions. This format provides for immediate updates of any breaking developments or rule changes, ease in additions or deletions to a program, in order to better illustrate a particular area of the course or provide links for reference purposes, and ease in eliminating any out-of-date material. A basic computer, a Web browser, and an Internet connection are normally all that is required for a student to access a web-based course. Printers are useful for making a hard copy for reference or for working on exercises prior to submitting the results. With web-based training, the courses can be in scheduled formats or be self-

paced, according to the design of the training provider. Some web-based courses include a VHS tape or CD-ROM to be reviewed prior to the next step or for orientation and some courses are coupled with a printed manual.

The disadvantages to web-based courses are hardware and software requirements. In some cases, the whole program must be downloaded prior to viewing; there may be problems with a firewall or blockers preventing site access, or the ISP connections and supplies can conflict. It is important for course providers to realize that some potential students may still be working with Windows ’97 and a 15” monitor with a dial-up connection, and to offer alternatives for those students.

Videoconference:
A videoconference is a two-way communication and interactive event where audio and video clips are transmitted to students at various locations. Satellite delivery is a form of videoconferencing, but usually limited only to audio response by the audience, because two-way videos are unavailable and restricted in most cases.

Web conferencing:

Sometimes referred to as web casting, the student utilizes a combination of a Web browser for visuals and telephone for audio conferencing and discussion. The instructor has the capability to illustrate charts or tables and provide discussion and interaction with the students at the same time. The program is available to all participants at the same time, with discussion via telephone conference call format. A web conference allows communication, collaboration, and real-time feedback. A drawback to this type of format is that the system requirement may not be met by those with dial-up network access and who have only a single telephone line.

In review, some of the key advantages to computer-based training are:

- Allows for self-paced self-study
- Ability to create illustrations through tables, charts, graphics, video clips, and audio
- Provides increased levels of interaction
- Reasonably priced
- World Wide Web access
- Improves tracking and monitoring of student performance
- Enhances feedback between students and instructors

Disadvantages to computer-based training include:

- ISP or server network problems
- Software or hardware requirements
- Computer virus and spam
- Requires written communication
- Some require time schedules for web conferencing

In evaluating distance education, the most important components are the purpose of the continuing education -- whether there is a standardized rationale for awarding CEU credits, and whether the purpose for continuing education is being fulfilled. In some cases, CEUs have been given for walking through the door. Should credits be given for “brown bag” lunch presentations to engineers? Restrictions and standards would protect

the integrity of continuing education programs from the rapid increase of infomercials or commercially-oriented training proposals and sales presentations being given credit, and ensure that credit is awarded for merit. Continuing education deserves to be distinct from on-the-job training, safety, or management jobsite training and operation and maintenance training for new equipment or processes. The purpose of continuing education is to broaden the knowledge of the individual, regarding rule and regulatory changes, provide information regarding improvement in process control techniques and operation and maintenance training, offer education for emerging technologies in disease control and process control performance, and areas within these boundaries.

In comparing, Distance to Classroom Education, let's evaluate the various formats in order to improve upon current technologies available for operator training.

Comparison of Distance Education vs. Classroom Training

FEATURE	DISTANCE EDUCATION	CLASSROOM - WORKSHOP
Enrollment	Open enrollment, available anytime	Fixed enrollment, schedule time with start date and end dates
Scheduling	Self-paced, provides for flexible hours and work schedules	Program-paced, set schedule for training schedule at given time and dates
Core Training Format	Printed material in correspondence mailed to student, internet based with course materials accessed through computer	Instructor lecture with reference handouts and printed materials – powerpoint
Support Services	Published system requirements, call center or e-mail for technical support, list of web based instructions	Instructor interaction with student response during classroom time
Learning Skills	Self-study with individual assistance	Group participation with interaction
Certificate Requirements	Issued upon of course completion	Issued blank at the end of the workshop, The operator may be responsible to fill-in name and submit form to obtain credits
Assessments	Normally a quiz or test is required with minimum 70% passing grade, feedback to instructor from student	No testing requirement, rarely submitted evaluation forms for any feedback - No Assessment required?
Enrollment Cost	Tuition based between $10 to $30/hour	Tuition varies by conference time Travel (estimate $ 100/day) Meals (estimate $ 35/day) Staff Replacement (estimate $ 150/day)

Certification Program Challenges

Certification Programs for operator training face challenges concerning the future of Continuing Education/Distance Education training that include:

- Obtaining appropriate information from course providers
- Verifying the credentials of the course providers
- Difficulty in determining how much credit to assign a particular course
- Increasing number of course providers requesting course approval
- Time required to adequately review each course
- Finding and training replacements for the great numbers of retirement-age professionals
- Identifying the level of retained knowledge from continuing education, especially in comparing distance education and traditional classroom formats
- Collecting the data for evaluating the training formats, including assessing the Classroom format
- Assessing instructor performance
- Determining that the needs of the operator are being met
- Broadening safety training (i.e. Confined space, blood borne pathogens, operating a forklift) to include specific safety criteria
- Expanding the formats and standards used today

FUTURE DIRECTION

Distance and classroom training formats have new and emerging technologies available to assist in improving training conditions. For example, small, remote controllers are readily available for classroom participation. The controllers provide the instructor with immediate feedback that can be used to survey students' needs or comprehension. Briefly, the attendee or student would enter the classroom, register, and be assigned a uniquely identified controller. By surveying the students, the instructor can determine the percentage of water to wastewater operators or assess the level of training or operations skills, with the inputs of the attendees appearing on a pie chart, table, or bar graph. Upon completion of the presentation, the instructor can flash a series of questions on the screen for attendees to answer. The students could make their answer selection on the controller and obtain their test score before leaving the classroom. This inexpensive tool could provide a means of collecting data and performance from the classroom presentation. Have we ever gauged the effectiveness of classroom education and asked what are the students remembering and how can we improve retained knowledge? Technology is providing the tools to assist in evaluating topics, instructors, need to know criteria, and assessing operator interests.

The future of distance education requires constant striving for improvement. As computers and training tools improve, so must we, to expand the standards of today and address the grey areas and misconceptions of continuing education.

Some of the areas in Distance Education that require improvement and evaluation for implementation are:

- There are no clear-cut standards. There is a need to expand upon the Guidelines for Distance Education. Uniform standards would assist states with reciprocity and credits applied for operator re-certification.

- There is a need to develop minimum login requirements for tracking and monitoring student progress. With an ID for login and monitoring progress, it is very easy to track the time and performance of the student's progress to evaluate the program and student participation. This is more of a challenge with especially slow or fast readers, individuals using special-needs accommodations, or for certain types of networks.

- There is a need to determine minimum system requirements, including whether:
    1. The system is browser-based or requires a total download prior to access,
    2. There is a firewall or other spam protection, and
    3. If access to technical support is provided.

- Minimum contact time requirements must be standardized. The standard of what constitutes one hour, for example: the current requirements are that one page of text or a PowerPoint frame is equal to two minutes. Unfortunately, some training providers are not following any standard and make claims stating that one sentence on the PowerPoint frame is equal to 2-3 minutes. There is a need for uniform standards for providers to assign CEU credit.

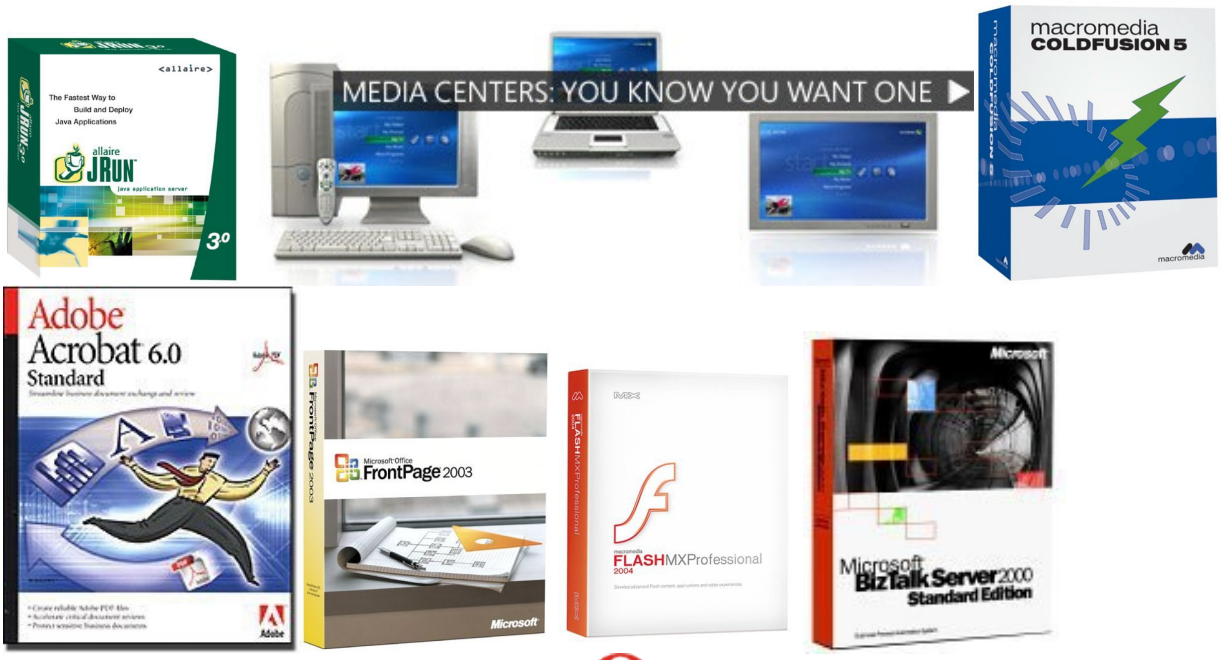
- There should be standards for course content. Some providers have scanned in technical manuals or textbooks and call them training courses, with no interactive features or gauge of student performance. What is the knowledge transfer taking place? Moreover, operators tired of these e-boring aspects, and training courses have to re-energize, in order to provide the student professional development. Distance Education requires the instructor to plan, develop, and create a meaningful training experience to enhance student knowledge.

- Assessment can be another area for training provider innovation. Why only pass/fail and not evaluation of performance on the jobsite? For example, by linking safety courses with safe workplace records, or linking energy savings with process control courses, or linking lower chemical/labor costs with troubleshooting courses? What assessments are we performing on the classroom? How can we evaluate the training format without assessments? Psychometric studies reveal that sometimes the 70% (pass/fail percentage) isn't an accurate measurement for proficiency, since the difficulty of an exam may require a margin of error that allows for a lesser passing percentage.

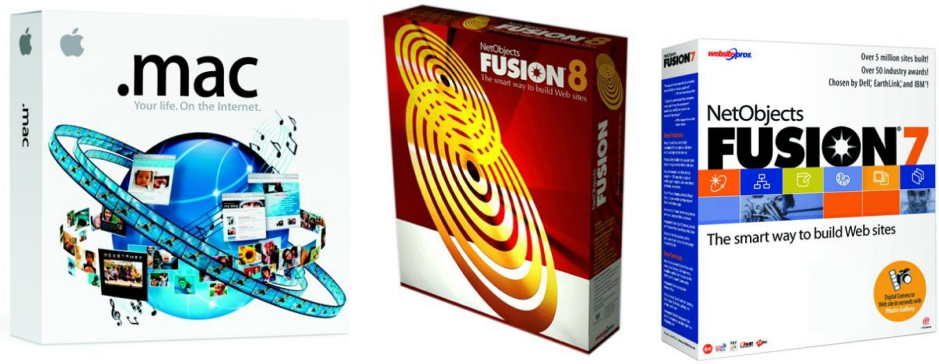
- Improvements to Learning Management System requirements. Most Distance Education providers have some type of database system, tracking students' performance in the pass/fail mode and listing the course registrations. These database systems are rapidly growing to include unique features of the individual student's program. Such systems are utilized by a compliance official of an Operator Certification Program and accessed for auditing operator training, for re-certification, and to combat fraudulent certificates of completions from being submitted. This technology provides Operator Certification Programs with additional tools to monitor, track and verify the required training of operators, and ensure compliance with the CEU program requirements.

Here are some helpful links to various sites of interest, to improve training programs:

Software and Hardware Producers:



Macromedia Studio 8



List of Online – Training Providers:

ABC	www.abccert.org (certification exams only)
AWWA	http://awwa.advanceonline.com/catalog.cfm
CEU Plan	www.ceuplan.com
David Paul, Inc.	http://www.dhptraining.com
Environmental Training	http://www.environmental-training.com
OCT	http://www.octinc.com
Red Vector	http://www.redvector.com
Technical Learning College	http://www.tlch2o.com
Training Frog	http://www.trainingfrog.com
360Water	http://www.360water.com

Comparison of Online Training Providers

description	AWWA	CEUPlan	RedVector	360water
Indicates State Approval Codes		•	•	
Nationwide Organization	•	•	•	•
Ease in Site Navigation	•	•		•
Technical Support/Assistance	•	•	•	•
System Requirements	•	•	•	•
Broken down between:				
DW	•	•	•	•
WW		•	•	•
Price range for: (based upon one hour course, measured in USD)				
Safety related courses	15-45	9.95	25-35	30
General related courses	20	9.95	25-35	30
Technical related courses	20	9.95	25-35	30
Process Control courses	20-30	9.95-14.95	25-35	30
Management Courses	15-25	9.95	25-35	30
Amount of Courses available	42	150	8	36
Printing Certificate of Completion	YES	YES	YES	YES
Reports to State Agency	NO	YES	NO	YES

The following are recommendations for standardization and to provide your state agency with reliable standards for approving online training providers:

- Training Provider of continuing education courses shall demonstrate compliance with either the ABC Guidelines for Distance Education, IACET, or an approved format for continuing education training.

- Course content and material must be relevant to the water and wastewater treatment field.

- Secured student login criteria, such as username and password, along with some type of monitoring and tracking function within the provider's system, to monitor students' participation with the training course. The training provider shall create a custom student page for each student with bookmarks for each course, location and status of the training course.

- Pass/fail percentage of testing, quizzes, or assessment techniques designated to meet state requirements, where they apply.

- Denote state agency approval, such as course title and/or course approval number on the training provider's website and course catalog for student, to minimize any confusion in the enrollment process.

- Provide certificate of completion with the student's license number, state approved course title and/or course approval number, along with date of completion, CEU credits for the course and program acknowledgement signature on the certificate.

- Provide the state agency with quarterly report of all course's completion by students. The report is to include students' license numbers, type of license, course title and/or course approval number, CEU credits and date of course completion.

- Provide students with a technical support system for questions about the course, their interaction with the course instructor, navigation problems associated with the provider's system and general issues.

- Indicate the system requirements of the training provider program to the student.

- Minimum five years' proven experience in the Distance Education field for all instructors. Minimum of fifteen years of field experience within the instructed field.

- Training Provider agrees to maintain all course completion records for a minimum of ten years.

CONCLUSION

The future of distance education is wide open. The organization called New Horizons for Learning is an international education network formed over twenty years ago as a catalyst for bringing about positive change in education. It is a resource and support system for educators seeking better ways of increasing student success. The mission of the network is to "seek out, synthesize and disseminate relevant research, supporting an expanded vision of education that increases awareness of human capabilities and offers educators and learners effective methods to develop these capabilities fully."

A recent study published in the American Journal of Distance Education from the University of Illinois Department of Human Resources Education found a significant difference in a learner's motivation, in terms of attention between the video-based instruction and traditional text-based instruction. The learners reported that the video-based instructions were more memorable than the traditional text-based instructions. This study implied that context-based videos in an online course have the potential to enhance a learner's retention and motivation.

The hardware and software tools for operator training are expanding rapidly, and training providers need to embrace and energize training programs to include them, while recognizing the student as the reason for improving training.

I sincerely hope my presentation and study has highlighted an interest in training programs. We need to further our discussions to improve continuing education. Our combined mission is to inform, to educate, and to network our experiences for improvement of the field.

ACKNOWLEDGEMENTS

Vicki Wheeler, editing assistance
Ken Kerri, CSU –Sacramento, Sacramento Courses
Ken Hay, USEPA (retired)
Bernita Starks, USEPA – Washington
Margaret Doss, President of ABC
Eileen O'Neill, Chief Technical Director of WEF
Curtis Truss, Jr., Executive Director of OTCO
Rick Richardson, Executive Director of NESHTA
Bill Engel, Executive Director of TREEO
Andy Holtan, State of Maryland
Rich Weigands, Executive Director OF WVETC
Bill Johnson, former Utility Director of St. Petersburg, FL
Russ Martin, USEPA – Chicago
Patty Settles, Metro Denver

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CEUPlan

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