WHITE PAPER

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Cloud-Based Training

Learning in the Cloud

When working in a new role or with a new process, all operators grapple with the same problems. What do I need to know in order to be successful at this job? What gaps exist in my present knowledge and experience, and how can I redress those deficiencies? How do I even know if I have the right skills for this job, and how can I pull this off without making any mistakes? Where can I go to up-my-game, and improve my skills and proficiency?

Providing a credible and readily accessible training resource for operators is critical to their growth and success, but traditional static e-Learning is insufficient. A cloud-based solution that is accessible anytime and can dynamically respond to operator needs, delivers a solution. By using virtualized systems in a cloud-based environment, operators can train using complete instances of their control system.

The e-Learning Paradigm

There has been a significant increase in the use of e-Learning over the past decade across all industries. Whereas previously the technological limitations of e-Learning reduced its effectiveness in some areas of instruction; the introduction of new technologies such as 3D modeling, interactivity, and simulations, has eliminated many of these limitations such that the only remaining constraint is simply the time and expertise needed to develop the content.

It is widely understood and accepted that e-Learning delivers significant savings in both training time and money when compared to traditional classroom training, especially where large numbers of personnel are involved. Some other well-known benefits of e-Learning include the ability to deliver training on-demand as schedules permit; training is self-paced; content is consistent and not subject to variations in instructor proficiency; and the administration, testing and tracking of results is automated.

These benefits yield significant cost savings and the Return on Investment (ROI) has made e-Learning very attractive to corporations. For example IBM found in an internal study conducted in 2004, that their e-Learning program and related web-learning technologies "enabled the company to trim the cost of training by $400 million a year," [1] compared to their previous classroom based training program. "While the return on investment is clear within a short period of time with about 50 percent reduction in training time, rise in productivity, 40 percent reduction in travelling costs and improved employee commitment." [2]

[1] Heidi Kramer, "Measuring the Effect of E-Learning on Job Performance". Dissertation Graduate School of Computer and Information Sciences, Nova Southeastern University, 2007. P. 14.

[2] Elisabeth Goodridge. "Slowing Economy Sparks Boom In E-Learning -- Online training lets companies provide more employee instruction for less money." InformationWeek. LexisNexis Academic.

The savings combined with the other benefits have naturally led to an increase in the use of e-Learning. In the process industries in particular, e-Learning is being used in virtually every area of instruction including; safety, health and environment; regulatory and compliance; maintenance and troubleshooting; and process and operations.

Despite widespread use of e-Learning and the success of such training with respect to time saved and ROI; some deficiencies have been noted in training curriculums that rely too heavily on e-Learning. Critically are the issues of keeping content current; the inflexibility and isolated nature of training using e-Learning; the lack of a genuine group learning experience or instruction tailored to the individual needs of the trainee; and most importantly the difficulty of proving competency using automated electronic testing.

Knowledge Retention

Many training programs have subsequently arrived at a blended learning format, with e-Learning providing initial introductory instruction for trainees, and classroom or mentor led instruction being used for the remainder. In one such case where a new piece of electronic equipment was being rolled out across multiple locations, e-Learning was used for initial introductory training and it was found that "those who completed the online training were both confident and competent in using the new equipment in significantly less time than those who did not complete the online training first." [3]

Placing training online and making it available to personnel as reference, greatly reduces the amount of instructor resources needed to maintain proficiency. E-Learning "is particularly effective for refresher training or for learning that extends current knowledge." [3] It provides a valuable learning resource that trainees can access anytime as needed. e-Learning used in this manner greatly improves knowledge retention, "studies show knowledge retention to be higher when learning is based on a need." [4]

A blended learning program that delivers readily accessible training in an e-Learning format provides consistency and constancy for users. Permitting them a discreet means to redress any gaps in their knowledge before they attend an instructor led classroom course or mentored led training program.

Proficiency Gap

e-Learning modules, when combined with a suitable Learning Management System (LMS), form a seamless automated training system. LMSs automatically track and sort assessment results, and depending on the types of questions and events an e-Learning module is designed to test for, they can provide a great deal of insight into a user's strengths, weaknesses, and overall proficiency.

[3] Bronte Moran. "Valuing eLearning". Training and Development in Australia. Aug 2011. p.35,36

[4] R. Aronen and G. Dierssen. "Improving Equipment Reliability through e-Learning". Hydrocarbon Processing. Sep 2001. p.8

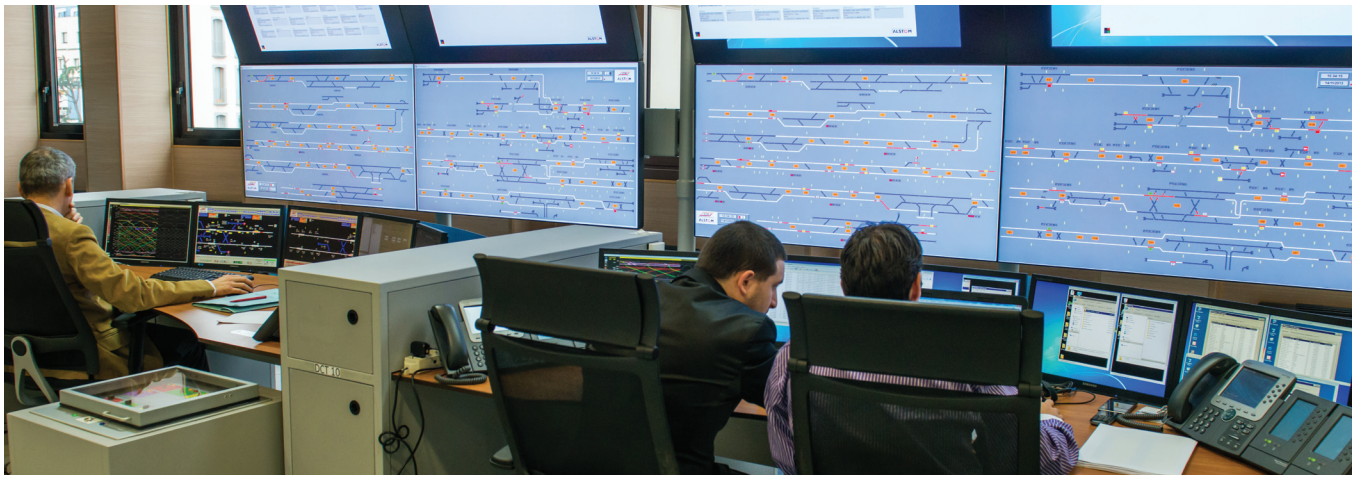
When such results are collected from a large group, either from one site or across a whole organization, they enable one to weigh the effectiveness of a training program as a whole. Overtime such data can be mined and analyzed for trends, and provide training administrators with a real tool to redress any observed weaknesses in the knowledge and proficiency of a workforce. Testing results can then be used to determine if the training is adequate; needs to be reworked; or additional training added to address certain problem areas.

Sharpening the Saw

Certainly the need for process simulators and the benefits of such systems, have long been recognized within industries such as petroleum and petrochemical. High fidelity simulators however are costly to develop, run and maintain. Trainees have a limited amount of simulator time available, and such systems rarely provide any testing or metrics integrated into the simulator itself. But as the capabilities of desktop PCs and e-Learning have grown over the last decade, so has their capacity to deliver simulations. Interactive and dynamic low-fidelity process simulators combined with traditional e-Learning content, provide an inexpensive means to train and assess console operators. They are used to familiarize operators with a particular DCS and teach them the fundamentals of process control. They also give them the means to apply what they have learned and hone the skills necessary to operate a process efficiently.

These highly interactive and dynamic e-Learning programs are designed to teach skills, and build practical competency in the principles of process control and operations. They can be used to reinforce best practices; execute procedures; practice troubleshooting; and learn to handle critical upset conditions.

By using scenario based simulations of specific situations, operators can also learn how to assess and respond to such conditions without having to



[5] Baboo Santhosh. “Improving Effectiveness of e-Learning in Maintenance Using Interactive 3D”. International Journal of Computer Science and Information Security. Vol.5 No.1. 2009. p.21

[6] Katie Weiler. “Jump Start Operators with Virtual Training”. Construction Equipment. Aug 2009. p.28

experience them first hand. “The online [simulation] was scenario-based, giving the learner practice at interpreting the procedures and making decisions.” [5]

Such simulators can be modeled to recreate a specific unit, or a generic process can be used. These readily accessible PC-based desktop training programs are generally served online and tied to an LMS to track and assess a user’s performance. Their “benefits quickly outweigh the costs. By not using actual machines for initial operator training, companies will save on individual instructor costs, fuel consumption, machine wear-and-tear, maintenance, engine-use hours, and emissions reduction.” [6]

Triple Loop Learning

Knowing what to improve and how to improve are critical to personal learning. However even more important is understanding ‘why’ we learn. Knowing how and what to learn can only take a person so far, what motivates and sustains them beyond the simple ‘how’ and ‘what’ is knowing ‘why’. The why is what fuels a person’s desire and enthusiasm to achieve their learning goals.

Traditional e-Learning, while an efficient and inexpensive means of training personnel, does not have sufficient depth to engage learners beyond the rote memorization of facts. The rules and regulations, procedures and best practices can be communicated to the learners, but are absorbed only in a cursory way. Such information is more solidly remembered and retained if the learner has a vested interest in the subject, and it is pertinent to them at that time.

Integrating dynamic simulations into desktop e-Learning provides an environment where learners can interact with processes, permitting them a level of engagement previously unavailable at this stage of their training. Traditional e-Learning teaches them the basics, and this is immediately followed up with scenario based exercises in a simulation environment. In this way they can immediately put what they have learned into practice.

Past incidents and upset conditions can be presented in scenarios, so learners experience past situations and discover solutions for themselves. Such exercises provide learners with a deeper understanding of the relationships between their actions and the state of the process. Diagnosing and resolving problems and understanding how they are related in the context of a running process. Such experiences are critical to developing the practical skills and competencies necessary to becoming a skilled console operator.

These integrated e-Learning and process simulation programs provide a depth of training that was traditionally only available in costly high-fidelity simulators, or on the job in a mentored type training environment.

Praxis Paradigm

Yokogawa in partnership with Praxis Technical Group has developed the cloud-based Virtual Operator Trainer™, a technology that delivers just such a training environment. This technology gives corporations a means to train their personnel and improve their proficiency in a manner that is cost conscious,

practical and accessible on-demand to learners. The Virtual Operator Trainer™ is delivered through a desktop computer with Internet access. Alternatively a private cloud can be setup and accessed through a client's internal intranet.

Console operator training using cloud-based virtual machines is a next generation e-Learning technology. Learners train using complete instances of their Distributed Control System (DCS) Human Interface Station (HIS), hosted in a virtual environment. Training content runs the complete spectrum from fundamental lessons on the controls and navigation of the DCS, to the basics of process control. Custom client training can include site specific process screens, and standard operating procedures, as well as process specific simulations. Furthermore simulators can provide group training, allowing multiple operators to train together in the same environment.

e-Learning content is presented in the HIS, with results being tracked and reported to a Learning Management System. The Virtual Operator Trainer™ monitors the learner's actions in the HIS and can respond with help if they have difficulty, cue some remedial training to address a gap in their knowledge, or correct an observed shortfall in their operation of the console or process. The Virtual Operator Trainer™ can help raise operators to the next level with respect to their skills and understanding of process operations.

The advent and application of e-Learning and its evolution over time, has led to a complete shift in the training paradigm. Training curriculums for complex industrial processes should include e-Learning such as the Virtual Operator Trainer™ to deliver cost-effective introductory training, and provide an evergreen learning resource that is accessible to users on-demand. In this way e-learning is used to effectively bookends the core classroom and mentored training, and makes for a complete blended learning program.

Training programs that include e-Learning are proven to improve knowledge retention. The Virtual Operator Trainer™ builds on this by engaging users through high-quality dynamic content that is learner directed. The system monitors and responds to control moves, assesses their skills, helping trainers and trainees identify strengths and weaknesses. Integrated simulations take this a step further providing an environment that behaves like the real thing.

A training curriculum that includes e-Learning content and tools like the Virtual Operator Trainer™ is the next stage in the evolution of e-Learning. The cloud-based virtualized environment delivers comprehensive and engaging training that is evergreen and trouble-free.

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