White Paper

Interactive Plant Environment -

Process Plant Training Comes of Age

EMERSON

Process Plant Training Comes of Age

When training is conducted offsite and closely simulates actual process plant conditions, students learn quickly, more effectively and with higher retention.

A highly trained and effective workforce is always essential, and providing these workers is a challenge in the process industries because many experienced workers will be retiring over the next few years. This makes it imperative to bring new employees up to speed as soon as possible, and to improve the skills of those already on board.

Although there are many graduates of community college technical programs, and quite a few degreed engineers from four-year universities, many have not have spent time in process automation facilities during their school years. Existing employees already have some of the required skills, but must keep up to date on changing technologies, and also assume new responsibilities to fill the voids created by retiring workers.

Industry has to provide instruction to these aspiring and existing process automation professionals, and this is done via three main types of training: theoretical, component and immersive plant.

Three types of training

The first type of training is theoretical, some of which is imparted at the college level, and some of which is learned through on the job (OTJ)or third-party training programs.

The second type of training is component, where basic theory is applied to the operation of the key components of process automation systems listed below.

Process automation system key components

- HMI software
- Controller hardware
- Controller programming software
- I/O
- Instruments
- Analyzers
- Motors
- Valves
- Actuators
- Networks
- Asset management software
- Calibration management software

Component training helps familiarize plant personnel with common functions such as operation, calibration, and maintenance of the above items, along with other site-specific tasks.

The third and most advanced type of instruction combines elements of theory and component instruction within a process plant environment. Traditionally, this would be OJT training performed at a plant site. Another alternative is immersive plant training, administered offsite in a safe environment.

Theoretical training

The most common roles for process industry professionals are engineer, technician and operator. At least some theoretical training is required for each of these three positions. Theoretical training is the underlying component which imparts basic skills in math, reading, problem solving and critical thinking, and it's frequently learned at universities (Figure 1-1).

Figure 1-1. Process plant engineers typically receive their theoretical training at the university level.

But according to research and studies, specifically the 70:20:10 Model in Learning & Development created by Morgan McCall and his colleagues Robert W. Eichinger and Michael M. Lombardo at the Centre for Creative Leadership in the year 1996[1], it only constitutes about 10 percent of how people learn.

Their 70:20:10 Model was based on the results of a survey with input from successful and effective managers which showed the following results with respect to how learning occurs in corporate settings:

- 70 percent from tough jobs
- 20 percent from people (mostly the boss)
- 10 percent from courses and reading

1. *The 70:20:10 L&D Model for Developing a High-Performing Workforce.*

This stresses the need to extend learning beyond the classroom and course paradigm. It also provides a framework for improving and extending traditional training and learning into the workplace where:

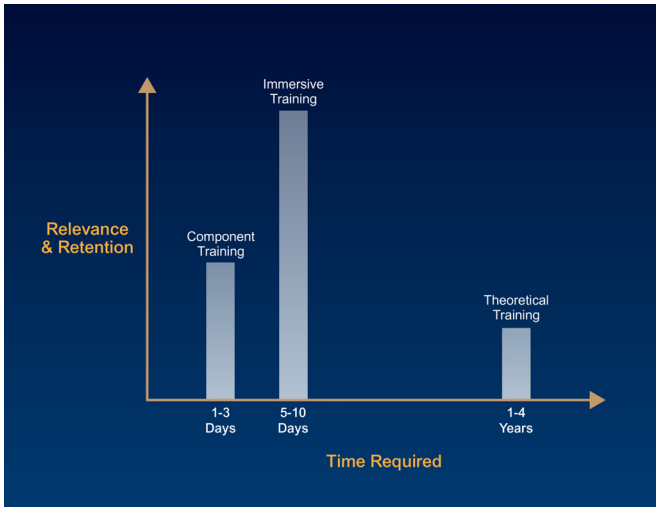
- '70' refers to "workplace learning" and "performance support"
- '20' refers to "social learning" (including informal coaching and mentoring)
- '10' refers to "structured learning"

This methodology, and Emerson™ observations, shows theoretical training is important, but just a start. Once theoretical training is completed, component training can then be effectively absorbed in the form of workplace and social learning.

Component training

This type of training focuses on particular hardware and software components of a process automation system (Figure 1-2). The features, configurations and details of specific components are explored. Depending on the complexity of the component, training time can vary from a few hours to weeks. A mixture of classroom and hands-on training is often used to impart component knowledge to students.

Figure 1-2. Component training for a measurement instrument can be completed in a day or two as the material to be learned is specifically targeted.



With a focused component training plan, the opportunity to experiment is usually very high, as most of the bench top training is done on individual components not installed and running in the plant. This allows trainees to learn by doing without fear of making mistakes. It, however, does not allow the trainee to work with the components together in a system or process.

The pinnacle of process automation training occurs at the plant level, either at the plant itself in the form of OJT, or offsite in the form of immersive plant training.

On the job training

Process plants often use OJT to train their personnel. New employees, with little or no formal process or instrumentation education, can learn effectively with OJT. Because this method has been so widely used and effective in passing down relevant technical skills, plants and unions have set up apprenticeship programs designed to formalize this approach.

But there are many challenges associated with OJT, including:

- Downsizing at some plants has reduced or eliminated apprenticeship programs
- Plants have combined job roles, allowing less time for OJT
- Technology advancements are increasing product complexity in some cases
- Not all subject matter experts are good trainers or mentors
- Not always easy to establish and measure clear learning objectives

These and other OJT challenges have led many process plants to look for other ways to train their employees, often offsite.

Immersive plant training

Immersive plant training is a type of instruction closely simulating actual plant conditions, with varying combinations of simulated and real-world hardware and software. Unlike OJT, it is done in a closed, safe offsite environment. This minimizes the possibility of a safety issue or recordable incident, while providing an environment allowing participants to achieve the 70 percent of workplace learning.

Immersive plant training enables students to learn about real-world plant applications and new technologies through direct hands-on experiences. Learners are provided real-life scenarios and instructors act more as mentors than lecturers, imparting knowledge gained via their work within process automation.

Immersive plant training also fosters a relationship with the entire process, simultaneously strengthening application learning. Immersive plant training allows students to think critically about the application to ensure specified device(s) are providing operators with accurate data. It thus extends beyond components and wiring to how devices interact with the entire process. Compared to theoretical or component training, direct relevance to plant operations is greatly increased.

Immersive plant training thus helps to address the issue of classroom learning which is often quickly forgotten once students are back in the plant due to the time gap between classroom theory and practice. Immersive plant training closes this gap by enhancing retention and providing students an environment to practices common plant scenarios they can directly apply at their plant. This style of training works well for new employees and veterans, as both groups will find immersive plant training the most effective way to absorb information in an environment with few distractions.

Offsite immersive plant training is only offered by a limited number of suppliers. One such supplier is Emerson Process Management, whose Interactive Plant Environment (IPE) facility in Charlotte, North Carolina is perhaps the most advanced in the industry.

Interactive plant environment specifics

Emerson has spent decades training process automation professionals, both for their own employees and those of process industry firms. Their IPE is a culmination of this experience and it combines the best aspects of the theoretical, component and OJT.

Emerson's IPE includes tanks, pumps, mixers, valves and other related equipment (Figure 1-3). Oil and water are circulated through the IPE, with these flows measured by over 160 points of measurement including flow, level, temperature, pressure, weight and analytical.

Figure 1-3. Immersive training at this offsite facility closely simulates actual process plant operations in a safe environment.

These points of measurement are typically made by smart instruments and analyzers. Smart instrument protocols include FOUNDATION™ Fieldbus, PROFIBUS® PA, HART® and *Wireless*HART®. The smart instruments and the equipment are controlled and monitored by an Emerson DeltaV™ control system.

An IPE facility provides a number of benefits to students, with the intent being to simulate actual process plant problems. By solving these problems, students learn how to deal with similar issues in their own facilities. Immersive plant training at the IPE allows students to:

- Learn in realistic conditions: An IPE accurately depicts challenging workplace conditions and applications. Throughout each course, personnel wear industry-standard safety equipment, learn proper equipment management, and perform adjustments in tight plant situations. Safety protocols are an inherent part of the training.
- Focus on actual industry scenarios: Action-oriented learning focuses on contextual problem solving, with proper processes and protocols taught for situations ranging from everyday maintenance to emergency shutdowns. Training courses can be customized to a particular facility, industry, and student needs.
- Practice in a safe, risk-free environment: Practice is the best way to improve skills, and it's far better for personnel to practice at an IPE rather than at a live facility. An IPE's simulated process is filled with safe, cool distilled water and non-toxic oil, and instructors oversee everything to ensure safety protocols are strictly followed.
- Train under certified technicians: Students learn and practice under the guidance of senior certified instructors, each of whom has years of extensive field experience (Figure 1-4). These instructors have been educated through rigorous technology coursework and certification processes, and are fully trained and certified on both products and adult learning techniques.

Figure 1-4. Hands-on instruction from experienced engineers and technicians can quickly impart the required knowledge for process plant personnel.

"I've been teaching process automation and instrumentation to students for a couple of decades," says an Emerson Field Service Engineer and Certified Instructor for Lifecycle Services. "During this time, I've often seen students learn the material well in a classroom setting, only to call me in a couple of months because they had forgotten what they had learned."

Through the design of the IPE and the creation of the Immersive Plant Training program, Emerson has developed a training program which closely mimics students' jobs, allowing the material learned to stick with them when they leave their training programs and return to work.

"The results have been above and beyond what we expected, as we've seen a dramatic improvement in our students' learning and retention upon completing an Immersive Plant Training course," relates an Emerson Certified Instructor. To illustrate why this is so, let's look at how Emerson walks a student through a work order from inception to completion, a very common and important process plant task.

Students are provided with work orders, which don't have detailed steps, but are instead based on typical process scenarios and problems. For example, a measurement point needs to be checked out because it's not performing as expected. The student needs to read a P&ID to locate where the measurement point is physically located, fill out the necessary safety paperwork, including Lock Out/Tag Out procedures, procure the correct tools, troubleshoot the issue, and resolve the problem. Having students perform these work order steps on their own just after completing the theory and bench labs reinforces what they learned, and more importantly shows them how to translate course work to their jobs.

Conclusion

Theoretical, component and on-the-job training have been used for decades to prepare process engineers, technicians and operators to perform their jobs. Each of these training methods has its advantages and drawbacks, and all three are typically required to some extent.

Immersive plant training is increasingly being used to supplement and improve upon OJT as it's often a better fit for the staffing levels, expertise and workloads found in today's process plants. The preferred method of immersive plant training is at an IPE, as this type of offsite facility allows students to learn in an environment which closely resembles their own plants, without the fear of causing plant disruptions.

This simulated environment has been proven to be very effective as it allows student to learn by doing in a hands-on manner, bringing them up to speed quickly with learning which can then be directly applied to improve their job performance, and ultimately the operation of their plant

For more information on the Interactive Plant Environment, see EmersonProcess.com/Rosemount/Lifecycle-Services.

Global Headquarters

Emerson Process Management
6021 Innovation Blvd.
Shakopee, MN 55379, USA
+1 800 999 9307 or +1 952 906 8888
+1 952 949 7001
RFQ.RMD-RCC@EmersonProcess.com

00870-0300-6114, Rev AA, November 2016

Linkedin.com/company/Emerson-Automation-Solutions

Twitter.com/Rosemount_News

Facebook.com/Rosemount

Youtube.com/user/RosemountMeasurement

Google.com/+RosemountMeasurement

EMERSON