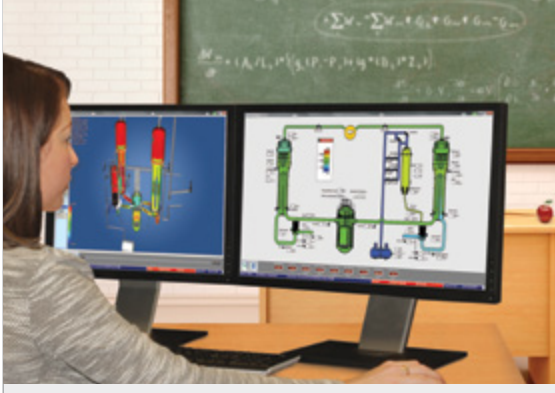
L3HARRIS™
FAST. FORWARD.

CONTEMPORARY LEARNING TECHNOLOGIES

Enhancing the Efficiency of Power Plant Learning



The objectives of power plant training programs are well documented and the training methods to accomplish the learning objectives have generally been the same for decades. Much of the training material is centered around black and white static 2D figures and illustrations accompanied by an instructor's verbal description of how a specific component or system functions. This form of instruction requires a substantial amount of imagination and visualization by the student to create the necessary mental 3D working image of the equipment or system. Wouldn't it be better if you could "show" the student how it works? That is exactly what we are delivering with our modern, visualization-enabled Learning Technologies.

Our Learning Technologies have the ability to show students, in 2D and 3D:

- How all of the interacting moving parts of a complicated component function
- Different system flow paths with dynamic parameters displayed that correctly respond to valve positions and pump status
- Piping and instrumentation or logic and control drawings that display current and changing control signals and outputs
- Nuclear steam supply systems that display the integrated internal thermodynamic properties throughout the reactor vessel, reactor core and interfacing systems

Adding these powerful tools in the teaching arsenal greatly enhance and augment the learning experience with a much higher degree of comprehension, retention and efficiency. Our Learning Technologies can be used as standalone training media or can easily be integrated with the existing classroom training materials or even the plant's operator training simulator.

Studies have shown that learning efficiency and retention are augmented by using a visually rich, interactive and immersive teaching environment, which can be summarized by these two principles:

- Seeing is understanding
- Interacting helps remember.

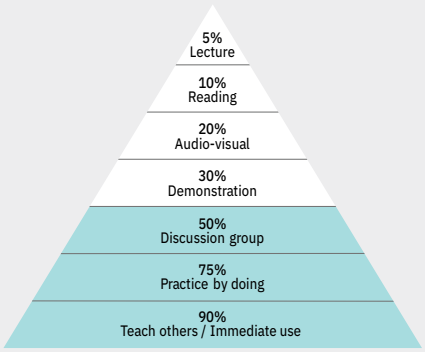
It is important to engage students and to create interest in the learning materials. In particular, the new generation of workers are accustomed to highly interactive and visual stimulus—they expect it. Given the choice of the instructor pointing to a static figure or a colorful working animated model that they can touch, they will pick the latter. More importantly, they will learn very quickly and want to learn more. L3Harris has devised Learning Technologies based on these principles. We have coupled computer visualizations with high-fidelity simulation to bring real-time, simulation-driven animated components and systems alive, allowing immersive and participatory, individual or classroom learning.

LEARNING MODULES: GETTING THE FUNDAMENTALS RIGHT

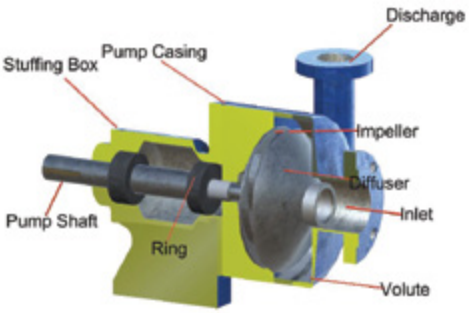
Experiential learning yields the highest student retention rates. However, a typical training program must have a certain structure, flow and content to ensure all objectives are satisfied. L3Harris' Learning Modules focus on the

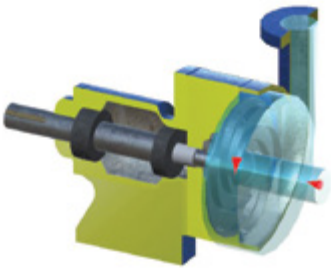
The typical training program in use around the world is composed of learning technologies and methodologies developed and refined in the 1980s and 1990s. A typical training program structure consists of three elements:

- Classroom training using text books, lectures and PowerPoint presentations
- Plant visits allowing students to see actual power plant equipment
- Operator training simulators duplicate plant control rooms with detailed mathematical modeling of all plant systems
- The training profession clearly acknowledges that simulator training is the most effective learning phase of the three methodologies. Simulator-based training allows "practice by doing." The educational community has ranked learning techniques as shown on the following figure.



Learning Pyramid
[National Training Laboratories, Bethel, Maine]





generic fundamentals training content by embedding 3D animation to augment or even replace the 2D static figures used in today's curriculums. With Learning Modules, colleges and operators can empower students to gain maximum learning value with hands-on experience. Learning Modules help students visualize various equipment such as valves, pumps and heat exchangers, etc. Remove the uncertainty of mentally picturing equipment construction and operation—touch it, assemble it, take it apart, watch it work—in the classroom and on portable student tablets.

SYSTEM KNOWLEDGE MODULES: MAKING PLANT DRAWINGS COME ALIVE

In a traditional systems training course, a system flow path drawing is presented and the instructor sequentially walks down the components and the flow paths in each system, with many slides. He/she verbally describes every component's purpose and function, and their effect on the flow paths being considered. The student has little concept how all of the components function together to control the process. Normal operating process values are not displayed, interactively controlled and rates of change not easy to understand. The state of equipment interlocks and logic and control are all uncoupled and static. It is very difficult for the student to gain a thorough understanding of the working system.

With System Knowledge Modules all of these limitations are removed and the student can see how the system works very effectively without assembling an awkward and possibly incorrect working picture in his mind. This approach results in extremely high student retention rates through experiential learning.

LEARNING SIMULATORS: ENHANCING PLANT LEARNING

The most important aspects of learning in a nuclear plant are all the interactions of reactivity coefficients, heat transfer mechanisms, relative internal pressures, water levels, void formations and temperatures of fluids and materials of the reactor plant systems. All of these properties are tightly coupled and the change of one parameter typically affects all others in a dynamic fashion. L3Harris' simulation models calculate with great precision and detail the nodal properties throughout reactor plant systems; and these dynamic calculations are used to drive 3D and 2D animated reactor plant systems in our Learning Simulators.

The student is provided an interactive cutaway view of the inner workings of these most important integrated systems, where the student can see all of the important properties in different regions of the the reactor vessel, reactor core and steam generators, etc.; even those regions that are not typically instrumented in actual plants. Normal, abnormal and accident response can be viewed in great detail. Learning Simulators can be delivered with pre-recorded scenarios or can even be connected to your operator training simulator for real-time feedback. Learning Simulators are available for different power plant types.

BENEFITS

Training and learning are fundamentally the communication of concepts and the transfer of knowledge. We effortlessly recall images and experiences that we have witnessed. All of these truths support our learning media.

The experiences gained through the Learning Modules, System Knowledge Modules and Learning Simulators are invaluable and are often logistically unavailable to the student. These learning technologies are all about improving the efficiency of learning for newcomers and for making recurring training better.

Other important attributes:

- Interesting, engaging and effective learning with more content than traditional training approaches
- Imparts knowledge in minutes instead of hours
- Improved subject matter retention
- Independent and self-reliant learning possible

LEARN MORE

For more information on L3Harris' Learning Technologies, visit L3Harris.com or send us a request at power.mapps@L3Harris.com

Contemporary Learning Technologies

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