Case Study

ExxonMobil Applies Experiential Learning Cycles in Training Simulation

“...A simulator is not a magic training machine into which learners are plugged. Developing scenario-driven learning experiences for simulation training on process control system requires considerable time, effort and thought.”

- Richard C. Ortloff, Ed.D., ExxonMobil Chemical Company, Beaumont, Texas

**Background**

Since its beginnings during the excitement of the Spindletop oil boom, the history of ExxonMobil in Beaumont, Texas, has paralleled that of the region and the worldwide petroleum industry. The oil discovery at Spindletop in 1901 gave the world a vast new supply of petroleum. This single event prompted the area’s forward-thinking pioneers to create a manufacturing infrastructure that heralded in the age of liquid fuel.

Built along the banks of the Neches River in 1903, the original Beaumont refining facilities have grown into an integrated petrochemical complex that today supports the energy needs of the nation and the world.

ExxonMobil Beaumont employs approximately 2,000 people and more than 1,000 contractors. The refinery, chemical plant and lube plant are located on approximately 2,400 acres near downtown Beaumont. The polyethylene plant, established in 1977, occupies approximately 300 acres west of Beaumont.

Beaumont Refinery processes 365,000 barrels of crude oil per day and produces 2.8 billion gallons of gasoline annually.

Beaumont Chemical Plant produces building-block chemicals such as ethylene and propylene, synthetic fluids and lubricant basestocks, and more than 25 different types of zeolite catalyst.

Beaumont Polyethylene Plant produces granular and pelletized polyethylene, which is used in the manufacture of plastic products.

Beaumont Lube Plant manufactures greases, blends lubricants, and packages finished products. Mobil Grease 28 (used on NASA space shuttles) and Mobil 1 (the world’s leading synthetic motor oil) are both manufactured and packaged at Beaumont.

**Benefits**

Training simulation enables instructors to accelerate knowledge transfer to process operators in order to:

- Deliver earlier operating profits through faster startups
- Protect production profits through incident avoidance
- Prevent equipment damage and environment upsets
- Avoid cost of poor product quality, material loss and reprocessing.

By applying techniques related to the way people learn, more effective operator training is possible and preferred.

**Challenge**

“In the last 30 years, digital control systems have fundamentally changed the way work is accomplished in the process industry. These remarkable machines have become supremely complex, inextrvably automated and increasingly challenging to learn. We often attempt to teach people to operate these systems by...
employing powerful and innovative process simulators. To use these simulators effectively, training practitioners should employ equally innovative ways of training. Too often, however, training is designed to teach by memorization of procedures, utilizing activities with predetermined outcomes and canned learning objectives," explained Dr. Richard C. Ortloff of ExxonMobil Chemical Company.

He continued, "Apparently, there is insufficient understanding of how individuals learn to accomplish work in the digitally informed workplace, and especially in regard to how console operators learn how to control complex process systems. We construct elaborate and expensive twenty-first century methodologies in the associated training design. Why? Commonplace understanding of how learning occurs has simply not kept pace with increased technical complexities. Therefore, as workplace educators, we must renew our understandings and adopt more contemporary methodologies if we are to be effective within this maelstrom of technical change.

Digital control systems used in the process industry can control multiple interconnected processes simultaneously, automatically, efficiently and during typical operations with very little demand on the machines' operator, other than simple monitoring. The digital controls console is typically minimally staffed, often with only one system console operator monitoring several processes at once.

These console operators often view the controls system as a "black box," shrouded in mystery, and typically only possessing a rudimentary understanding of how the system they are controlling operates. These digital control systems now electronically control almost every aspect of the complex processes of the chemical plants, power plants, and refineries in which they are installed."

**Solution**

Simulators can teach—and can teach in a dynamic, interactive and even entertaining manner. The most effective simulator activities are somewhat uncontrolled, and give learners opportunity for experimentation. Effective design of simulator activities engages learner curiosity and promotes active involvement. However, all too often the trainers or training designers simply plug in linear-logic lists of activities with predetermined outcomes and hard-and-fast “learning objectives.”

Dr. Ortloff explains that the concept of utilizing experiential learning cycles to teach and learn has been examined, redefined and refined by adult learning scholars and theorists many times since Kolb first wrote about the subject in 1984.

The following diagram shows the current representation of Experiential Learning Cycles. One key addition is that of "reflection in action" formulated by Donald Schon of the Massachusetts Institute of Technology in 1987.

![Experiential Learning Cycles Diagram](Image)

This figure illustrates Kolb's core construct and incorporates some associated concepts germane to this discussion.

**Recommendations**

Dr. Ortloff makes these recommendations:

- Expand the typically regimented simulator training to facilitate learning through experiential learning cycles.
- Include active experimentation and reflective activities.
- Encourage learners to investigate and experiment with scenarios and problems that may not have predefined solutions.
- Allow free-play time. Let learners push the simulated unit or equipment, and their own understanding beyond normal limits.
- Include "self-directed learning" time for individual investigation.
- Encourage learners to chronicle their experiences or collaborate with the instructor.
- Give learners considerable latitude to explore in a self-directed manner (Candy, 1991).
- Ensure that instructors are readily available periodically to answer questions or point out problems.

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