The Case for Virtual Reality Training

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1 Introduction

Before planning to design a training program, it is important to first make sure it is worth the time and effort to create it and deliver it. That is why it's so important to, at minimum, perform an analysis of the work environment to determine the root cause for why a training program is needed. Once you feel comfortable that a training program is the appropriate answer to your employee development needs, then it's important to assess to whom you are delivering the training and make sure the training is targeted to that defined audience.

Define your audience by asking and answering questions like these:[1]

- Have there been any recent organization changes that might affect how people learn?
- Have target audience members been trained on the proposed topic previously?
- Who are the key stakeholders/players in the departments that the training will be rolled out to?
- What is the audience level of expertise? How familiar are learners with proposed subject matter? Does everyone in the proposed department need the training?
- What do learners need to know to be successful in their jobs? What skills need addressing? What tools do employees use (e.g., instruments, materials, equipment)?
- What are the demographics of those being trained (e.g., location, age, gender, number of learners)?
- Dependence on information sources (e.g., internet, intranet, magazines, texts, other programming).
- Technology experience (e.g., webinars, asynchronous learning, social learning).

[1] ATD Instructional Design Certificate Program. *Lesson 4: Performer Analysis Questions*, page 2-29 to 2-30. Version 5.0.

- What is the learner's attitude toward the subject? Do the learners understand why training is being provided? Do the learners understand "what's in it for me?"
- What design considerations are needed? Delivery platform? Instructional materials?

2 Achieving a Training Outcome

What outcome should be achieved with a particular training solution? Is there a business goal the training will support? Let's say that your manufacturing department has a high rate of injuries; you've been reported to OSHA ten times in the last quarter for employee injuries at work. The department needs to reduce the number of incidents. One way to do this is to improve employee knowledge on the proper way to use equipment, and have them practice using a simulation before they try it in a real setting. Virtual reality (VR) training is an excellent solution for this scenario to help decrease the number of injury incidents.

Epsilon XR Lockout/Tagout (LOTO) VR Training

That's why it's so important to consider what platform will achieve the best training for the business outcome. For example, start with a self-paced asynchronous course that delivers the foundation information on the equipment and how to use it. Maybe include videos to show the equipment in use. And finish with a virtual reality (VR) or augmented reality (AR) segment to allow participants to get experience without the risk of practicing on the manufacturing floor.

3 OSHA Use Cases

The following statistics detail the occupational injury and death incidents yearly in the U.S. and Canada:[2]

- Lockout/tagout incidents are 10% of industrial safety incidents each year (OSHA).
- LOTO incidents are in the top 10 for OSHA each year; they were number four in 2019 and number six in 2020.
- LOTO safety procedures are estimated to prevent 120 fatalities and 50,000 injuries annually (OSHA).
- Workers injured on the job from exposure to hazardous energy lose an average of 24 days of work to recuperation. Looking at the 328 electrical occupation fatalities that occurred between 2011 and 2019, LOTO procedure errors were the cause in 44 cases, or 13.4%. This was the third leading cause of electrical occupation fatalities.

The main goal organizations hope to achieve is to decrease the number of fatalities and injuries per year to zero.

Let's look at a couple of OSHA use cases on lockout/tagout (LOTO) that support use of a VR training platform.

Use Case 1: Automotive Component Lubrication Robotics[3]

At an automotive component manufacturing facility, manufacturing operations make extensive use of robots located within fenced cages. At one location, rotating tables transfer suspension parts from station to station, while greasing and other operations are performed on the parts by robots. If necessary, employees can gain access to the robots by entering the cages through electrically interlocked gates. When the gates are opened, the multiple energy sources that power the robots, rotating tables, and related machinery are turned off but are not de-energized or locked out. An employee who is inside a cage when a robot is activated could be struck by the robot arm or other machine parts and seriously injured.

An injury occurred when an employee, consistent with the employer's practices, entered the robot cage without de-energizing or locking out the equipment. The employee was attempting to unjam a robot arm. In freeing the arm, the employee tripped an electric eye, causing the robot arm to cycle. The employee's arm was struck by the robot and injected with grease.

The employer contends that lockout procedures were not necessary because once the gate is opened, movement of the robot arm is impossible. A maintenance worker inside the cage would have ample warning – by the closing of the interlocked gate –

[2] https://www.electricalsafetypub.com/features/lockout-tagout-compliance-saves-lives/

[3] https://www.osha.gov/etools/lockout-tagout/case-studies/automotive-lubrication-robotics

before the machinery started up, to avoid injury. According to the employer, once the interlocked gate is opened, it must first be closed and a number of buttons must be pushed before any machine movement can occur. The startup procedure would take some time and the person inside the robot area would be aware of the closing of the gate and the presence of another worker at the nearby control panel.

OSHA contends that the employer still has an obligation to provide the servicing and/or maintenance employee protection if they are exposed to the unexpected energization, start-up, or release of stored energy, which could cause injury. The standard provides no exemption simply because an employer would be required to take additional steps or implement additional controls to effectively protect employee engaged in servicing and/or maintenance work. The robot could have been rewired to eliminate the problem of computer memory loss, or could be reprogrammed using a slave computer to transfer the necessary data and instructions to the robot's computer.

Use Case 2: Sour Water Pipeline Repairs[4]

At a chemical plant, there are two lines carrying "sour water" (water contaminated with hydrocarbons, hydrogen sulfide, or other chemicals). The lines run between the facility's sour water stripping unit and its tank farm where the processed sour water is stored.

A group of maintenance employees is assigned to replace orifice plates in two lines running between the sour water stripping unit and the tank storage farm. One plate is in the line running into the tank storage farm; the other is in the return line. To perform this operation, eleven valves need to be isolated: nine at the sour water stripping unit, and two at the tank storage farm. The tank storage farm is located more than a half-mile from the sour water-stripping unit. Because there is no written procedure for this particular operation, the operator issuing the work permit for the orifice plate removals at the sour water stripping unit prepares a supplemental blanking and tagging list in order to identify all energy isolation points. After completing the list, the operator ensures that all nine isolation points within the operational limits of the sour water-stripping unit are isolated, blanked, locked, and tagged. Following this step, the two valves at the tank storage farm (the receive and return lines) must be isolated before the lockout/tagout is complete and the permit can be issued.

The sour water stripping unit operator telephoned the tank farm operator and requested that both the receive and return sour water valves be locked out at the tank servicing the sour water stripping unit. The tank farm operator called back and confirmed that lockout was accomplished. No one, however, verified lockout or hung a tag on the two valves at the tank storage farm. The employees took receipt of the permit and commenced work on the orifice plates. Although the tank farm operator indicated he had locked out both of the valves at the tank farm, he had

[4] https://www.osha.gov/etools/lockout-tagout/case-studies/sour-water-pipeline-repairs

apparently failed to lockout the return sour water valve. Because the line was not isolated at the tank farm, when the employees opened a flange at the site of the orifice plate in the return line, they were exposed to a stream of sour water. The employer completed an incident report.

How would you remedy these situations if it was your company? A few things come to mind.

- Ensure everyone using this equipment completes LOTO training, including a practicum.
- Document each time LOTO is required to enforce completion of the procedure.

What kind of procedure training would be most effective for these situations?

- The training for risk avoidance procedures should be presented in a way that is most memorable. Immersive training such as VR is described as 'sticky' because it tends to 'stick to' – is better retained by – those who learn this way.
- When safety is primary, the cost of implementing immersive training is offset by the cost of injury occurrences and reports to OSHA each year.

4 Why VR Training Versus Other Platforms?

Why are we suggesting VR as a training platform? Benefits of VR include:

- The retention increase benefit is unique when compared to other training platforms. Information presented in an immersive environment is retained at a higher rate, helping the learner remember what to do when presented with the same situation in a real workspace.
- The cost of VR design and development is decreasing. For example, Epsilon Systems developed a LOTO VR training course in 2018.
    - We used Unity to develop the VR program at an approximate cost of $1,800 per year for a subscription seat.
    - We used HTC Vive to drive the completed software at an approximate cost of $1,200 per headset.
    - Our software development labor cost was approximately $35,000. Designing, developing, modeling, editing, testing, and implementing the pilot for the training took approximately two months (350 hours).
    - The implementation cost was approximately $5,000.
    - The customer's injury incident rate was reduced, resulting in net cost savings.

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5 Summary

No matter what training platform you choose to design and develop, it's important to make sure it is suited to the work environment and the target audience. Will a training platform like virtual reality be the right answer for your organization or do you need a blended approach to best reach your employees? Take the time to analyze the work environment and the audience to ensure you have a proper fit.

In addition, identify the goal or expected outcome to measure your training against. For example, did the training reduce the number of injuries or fatalities previously experienced? This is how you will know if the training was worth the time and money spent.

6 About Epsilon Systems

Founded in 1998 and headquartered in San Diego, California, Epsilon Systems Solutions, Inc. (Epsilon Systems), a minority-owned business, has established an international presence with over 900 employees in 26 locations including three overseas locations. Epsilon Systems customers include the Department of Defense, Department of Treasury, Department of Energy, Department of Homeland Security, and non-profit and commercial customers.

Epsilon Systems Digital Media Team of professionals creates end-to-end blended and custom learning solutions for corporations, associations and government agencies. We combine state-of-the-art technical expertise with creative solutions to deliver results-driven training. We are a cohesive, experienced team of project

managers, instructional designers, technical writers, graphic designers, web developers, database developers, and QA professionals. Our production process allows for expedited development, no matter what the solution. And we are experts in complying with industry e-learning specifications, including SCORM and Section 508 of the Americans with Disabilities Act and other federal accessibility requirements.

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Barbara Greenstein, Senior Instructional Designer at Epsilon Systems Solutions, Inc. is a Performance Improvement Specialist providing proven and creative ways to improve human performance in the workplace.

Highly regarded for her instructional design and facilitation skills, with over 30 years in the learning and development field, she helps clients put the systems in place to more effectively manage in today's changing business environment while ensuring optimal performance and job satisfaction for all employees.

She received her M.A. in Human Resource Development from Marymount University, Arlington, VA. Barbara is a Certified Performance Technologist (CPT), from ISPI. Barbara can be contacted at bgreenstein@epsilonsystems.com

Bibliography

[1] ATD Instructional Design Certificate Program. *Lesson 4: Performer Analysis Questions*, page 2-29 to 2-30. Version 5.0.

[2] https://www.electricalsafetypub.com/features/lockout-tagout-compliance-saves-lives/

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