Using interactive video for skills-based training – a case study and a proposed framework

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1. Background to the Project/ Issue related to the TAE sector

The Department of Educational Development (EDU) was approached by Singapore Polytechnic's Energy & Chemicals Training Centre (ECTC) to assist an Energy and Chemical company to find a solution to help upskill their process technicians. This company operates a highly automated terminal located at Tembusu on Jurong Island. The industrial terminal serves a large and growing number of manufacturers and suppliers located on Jurong Island. The company values the continuous professional development of their technicians and continues to leverage on new technology and technological processes to improve productivity and efficiency. To match the pace of change with the technology, technicians must continue to have current and relevant skills not only to perform efficiently at their work, but to ensure that all safety aspects are also strictly adhered to.

In order to upskill the technicians, there were certain conditions that were requested when designing the learning experience for the learners. These were as follows:

- Technicians already work long hours and they work shifts, can the learning experience be embedded into the already crowded work schedule?
- The technicians have a preference for hands on work. Can the learning experience focus on skills building rather than knowledge acquisition?
- Can the learning episodes be bite-sized to hold attention and motivate learners and more importantly allow for transfer of learning to the job?
- Besides skills building, can the learning episodes focus on also building critical thinking and helping technicians to react and apply their skills in the event of an emergency situation?

2. Intervention: Using Interactive Videos to meet the Learning Requirements

Drawing on Singapore Polytechnic's Simulated Practice Framework (2017), the team decided that to meet the learning requirements described above, it would be most prudent to reference the Simulated Practice Framework and to look at relevant technology that can complement the learning design without compromising on the learning experience, yet keeping costs down to help meet the technician's learning needs. Hence, using interactive videos complemented by a pedagogical approach was decided as the intervention.

2.1 Singapore Polytechnic's Simulated Practice Framework

According to Al-Elq (2010), "Simulation is a generic term that refers to an artificial representation of a real world process to achieve educational goals through experiential learning." Lateef (2010) notes that a simulation is a technique that helps to replace and amplify real experiences with guided ones, often "immersive" in nature, that mimic substantial aspects of the real world in a fully interactive manner. Simulation-based training can be a good way to develop learners' competencies (knowledge, skills, and attitudes), whilst protecting them from unnecessary risks. The realistic scenarios allow for deliberate and repetitive practice till one can master the skill.

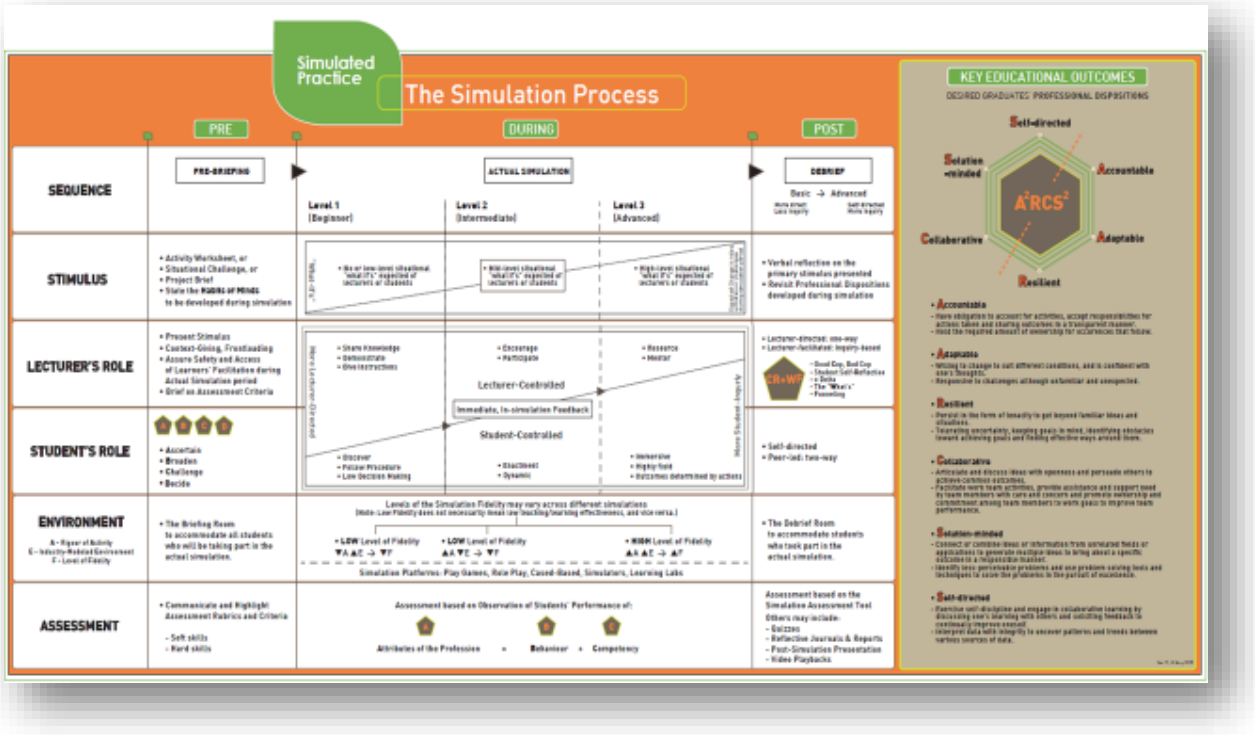
The benefits of simulation-based training include the following:

- Avoidance of risks to learners
- The ability to provide feedback
- Repetitive practice/ deliberate practice
- Exposure to uncommon events
- The ability to range the difficulty levels
- Reproducibility
- Opportunity for assessment of learners
- Transfer of training from classroom to real situation is enhanced

(Al-Elq, 2010; Bradley, 2006).

Singapore Polytechnic has developed a Simulated Practice Framework (as seen in Figure 1 below) to guide lecturers in integrating simulations into professional practice (2017).

Figure 1 – Singapore Polytechnic's Simulated Practice Framework (2017)



The Simulated Practice Framework is a versatile tool that informs designers and facilitators of how a simulated practice session or learning episode can be carried out and what roles that they need to play to extract deep learning opportunities regardless of the levels that learners are at. It is through the simulated practice sessions that learners begin to explore the world of professional behaviours.

In a typical simulated practice learning episode, the learners first attend a pre-briefing as the learning outcomes are first presented to the students and expectations are laid out for the students.

The facilitator will then provide the stimulus for the learners. A stimulus can take many forms. It may be a brief, or a scenario or even a case. It can also be a set of simple instructions or standard operational procedures that they may need to execute. This is where students start to take control

and ownership of their learning processes. After the stimulus is given, students are given some time to plan and create a learning strategy to tackle the stimulus. Facilitators also urge learners to ask questions to help them clarify their thinking and to fine-tune their learning plan / strategy.

The actual simulation then begins. Depending on the level of learning required, facilitators can either provide more direction and support by giving instructions or even modelling the learning for new learners. New learners have an opportunity to see how a subject matter expert deals with the stimulus and then have an opportunity to engage in their own deliberate practice. Facilitators may even need to provide over-the-shoulder coaching to help learners who are learning this information for the first time. If, however, the stimulus happens to be ill-structured or contain multiple possibilities, the facilitator will provide more autonomy to the students to let them control and manage their own learning. This may even mean allowing the students to make mistakes and to allow them to recover and repeat until the gain mastery WITHOUT interfering but providing feedback and other kinds of learner support such as helping students to reflect and think on their actions while the simulation is under way. As students engage in deep learning and executing their learning plan during the simulation, support from the facilitators help learners start to acquire the habits of how a professional may act in their given situation.

The last step of the simulation process is probably the most important. This is where the debrief is conducted. The debrief can be as long as the actual simulation itself and this is where facilitators and students truly benefit from the simulated practice process. Facilitators will begin to de-construct the actions that learners deployed during the simulation and through a series of different techniques, get learners to reflect and articulate on their learning strategies which they deployed during the simulation. Facilitators help to close the knowledge and skills gaps, provide feedback for better performance and more importantly support the autonomy of learners by allowing them to review their learning strategies and providing the relevant advice for them to learn more effectively the next time. Facilitators also at this point, will explicitly link the learning experience to the professional dispositions that the simulated practice session is supposed to have enhanced.

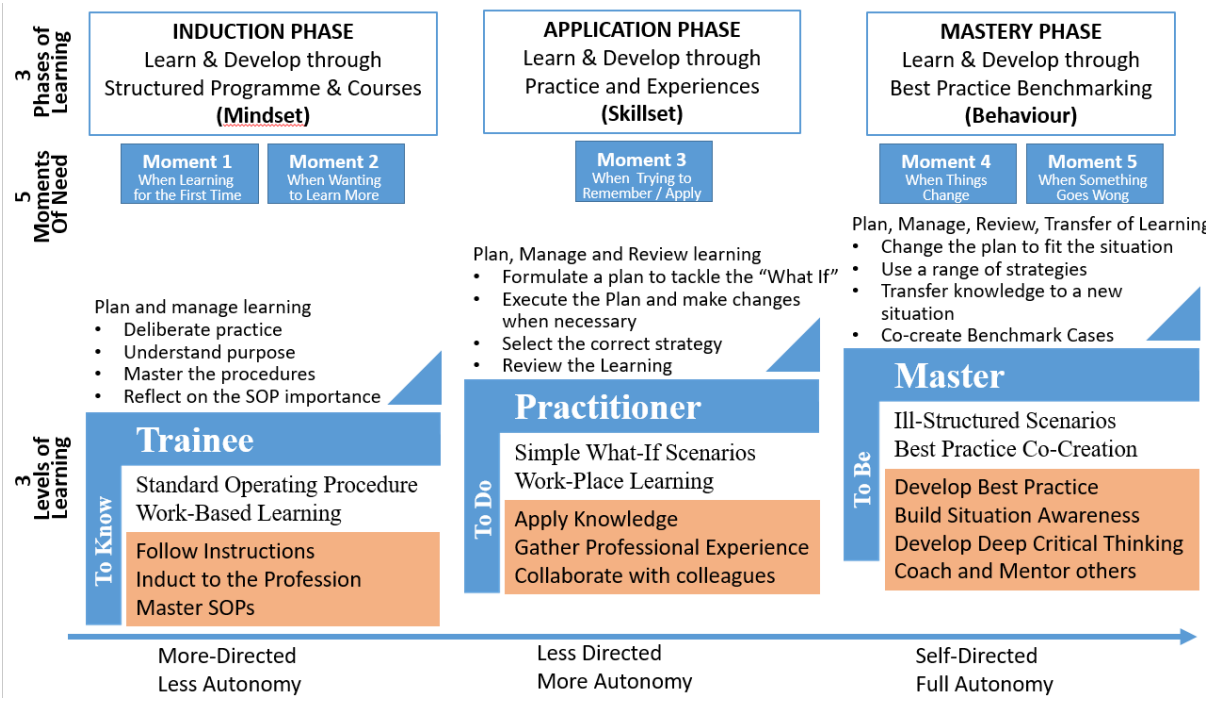
To meet the company's specific needs, the simulated practice framework was contextualised for them.

The Simulated Practice Framework was modified to integrate Gottfredson and Mosher's "Five Moments of Need" model (2011). These "Five Moments of Need" are:

1. When people are learning how to do something for the first time
2. When people are expanding the breadth and depth of what they have learned
3. When people need to remember and apply the learned concepts
4. When things change
5. When things do not go according to plan

Instead of focusing only on what the organization wants in terms of learning, the "Five Moments of Need" model helps to identify "learning gaps" by focusing on the specific needs of learners at work. Once these "moments of need" are identified, they can then be addressed by providing the requisite training and performance support. For example, there are moments when a learner is required to remember and apply the learned concepts. The organization may then decide on the use of simulation-based training to help the learner practice what they have learnt so they can perform their assigned tasks more efficiently and effectively. Continuous identification of "moments of need" serves to ensure that the learners continue to stay competent and that their skillsets are always relevant in a changing world. Please see Figure 2 for how it was integrated.

Figure 2 – Integrating Singapore Polytechnic's Simulated Practice Framework (2017) with Gottfredson and Mosher's 5 Moments of Need (2011)



The team used this Simulated Practice framework to guide the learning design of the interactive videos and to design meaningful skills-based training that helps learners learn key skills at the workplace.

In designing the interactive video, the team looked at the entire process of a technician's job role as well as focused on what the Generation Project (McKinsey, 2017) terms the "Key Breakdown Moments" – key skills that technicians do that makes the job what it is.

As a learner move from being a trainee to a master, the video simulations designed needed to be changed accordingly. As seen in the framework, simulations designed for "trainees" need to be more directed while simulations designed for "masters" are more self-directed and allow more autonomy. As learners start to gain experience and build mastery, they will progress along the learning continuum and more complex and advanced "What-If" scenarios can be offered to learners. Learners begin to take more ownership of their learning and continue to be more self-directed.

2.2 Why interactive videos?

The rapid growth of the Internet and Internet-based technologies have seen the use of training videos exponentially increased. Learners watch videos from different platforms (eg, Blackboard, YouTube) on multiple devices such as their desktop computers, laptops, tablets and mobile phones. The use of training videos in competency-based training is well established (Holton, Coco, Lowe & Dutsch, 2006). To maximize video's utility in learning, trainers need to consider three element when designing training videos: cognitive load; student engagement and active learning (Brame, 2016).

While non-interactive training videos may be interesting and engaging, however, they are passive. The learner does not have the opportunity to participate or interact with what they are learning. In recent years, due to the improvement in broadband speed, interactivity videos have exploded. They allow learners to actively participate by clicking, swiping, scrolling and dragging video content to gain

access to more detailed background information, link to other videos, make decisions and even change the narrative of the story as a result of the decisions made. By creating a participative experience for the learner, the learner becomes more invested in the learning created. The interactivity also helps to keep the learner's attention and keep them engaged with the learning materials longer.

The most common interactive video functionalities listed by video content producer Lemonlight (n.d) include:

- Hotspots: clickable areas within a video;
- Branching: a choose-your-own-adventure style experience where content is customised based on viewer preferences or decisions;
- Integrations: There are some software integrations that can help add interactive features such as quizzes, calls to action, real-time response and even live streaming into the training video;
- 360 video: These provide an immersive 360-degree view of a location or event where viewers are able to look up, down, left, right and all around them inside a training video.

A study performed by Schwan and Riempp (2004) showed that there are cognitive benefits of interactive videos. The interactive features allow learners to adapt their form and content to their individual cognitive skills and needs. As long as the interactive features allow for intuitive use without increasing cognitive load, interactive videos can lead to more efficient learning. Another study by Merkt, Weigand, Heier and Schwan (2011) found that features enabling micro-level activities in interactive videos such as starting and stopping the video or browsing helps with self-regulated information processing and are helpful for learning.

2.3 How interactive videos have been used to meet the company's learning requirements

Learning Requirement 1: Technicians already work long hours and they work shifts, can the learning experience be embedded into the already crowded work schedule?

How Interactive Videos Were Used

As mentioned earlier, the team focused on breaking down key aspects of the job into micro-learning lessons. An interactive video used to capture key elements of the job embedded work flows was then produced using the software Articulate Storyline and leveraging on actual footage shot at the company's terminal facility in Jurong Island. Articulate 360 is a mobile friendly application that can deliver high quality training sequences. This method of superimposing on existing video ensured that the training sequences remained authentic and highly realistic.

The interactive video was offered to the technicians through their mobile devices. Using the principle of leveraging on continuous workflow learning, when technicians were in between tasks, they could easily go through a sequence on a skillset through their mobile phone without having to leave their workplace.

Please refer to Figures 3-5 for examples.

Figure 3 – The introductory screen of the interactive video

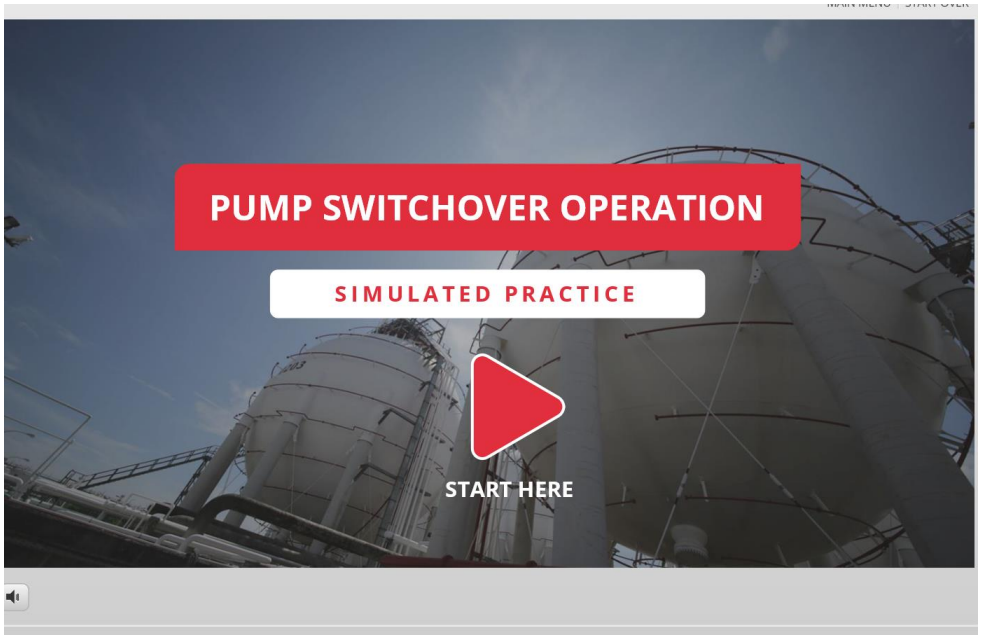


Figure 4 – A technician explaining the interactive video to learners.

Figure 5 – Main menu of the interactive video

Learning Requirement 2: The technicians have a preference for hands on work. Can the learning experience focus on skills building rather than knowledge acquisition?

How Interactive Videos Were Used

Teaching practical skills requires using very precise instructions to enable the learner to follow the process and to repeat the skill. Most often this involves using both visual clues and text or audio prompts. According to Peyton (cited in Nikendei et al, 2014), there is a four-step approach when teaching skills:

1. "The teacher demonstrates the skill at his normal pace without any comments (*Demonstration*)
2. The teacher repeats the procedure, this time describing all necessary sub-steps (*Deconstruction*)
3. The student has to explain each sub-step while the teacher follows the student's instructions (*Comprehension*)
4. The student performs the complete skill himself on his own (*Performance*)".

(Nikendei et al, 2014)

The development of the interactive video follows Peyton's four-step approach. Each skill that was developed, focused not only on how the skill is performed, but also allowed the learner to practice the skillset using interactive controls embedded into the video. For example, to prime a pump, learners are first given a demonstration on how the process is done before they are given a simulated scene to prime the pump themselves. Visual cues are given to learners who need it and immediate feedback is also offered to learners after they complete the interactive action.

Please refer to Figures 6-7 for examples.

Figure 6 – Learners are first given a demonstration on how the process is done

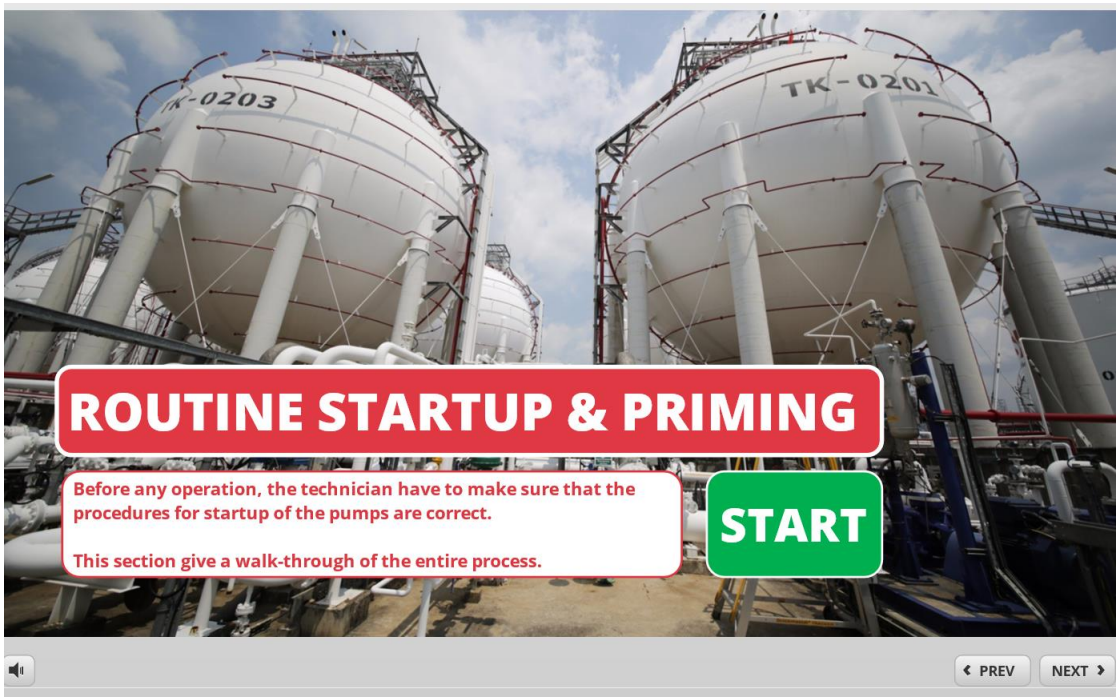
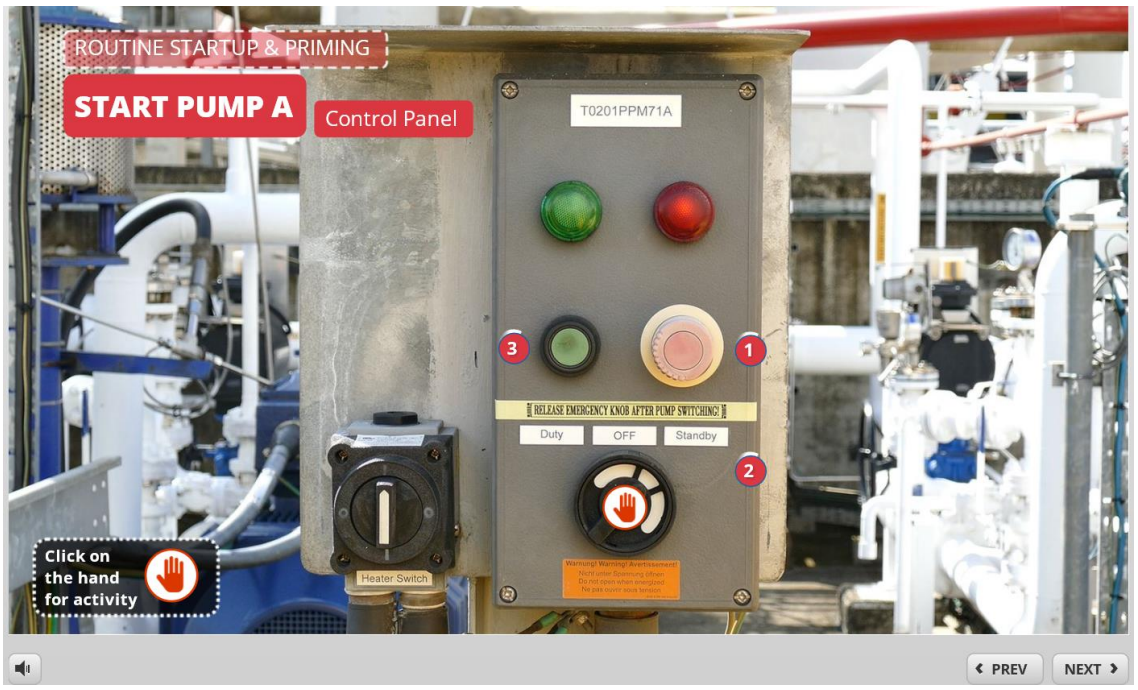


Figure 7 – Learners practice the skillset using interactive controls embedded into the video



Learning Requirement 3: Can the learning episodes be bite-sized to hold attention and motivate learners and more importantly allow for transfer of learning to the job?

How Interactive Videos Were Used

When designing the learning sequences and the video, the team made a conscious effort to package each skillset as an independent learning module that did not last for more than 10 minutes. This offered the opportunity for learners to learn anywhere, anytime and for as often as they want to continue to hone their skills.

Learners are able to pause the video at regular intervals and check their understanding of the concept along the way. To keep the learners engaged, the team included review questions, hot spots, drag and drop activities, and other interactive elements. To test their skills, a simulated case is presented to the learners via an interactive video, where they need to manipulate equipment to mitigate scenarios that require trouble-shooting and accuracy skills.

Please refer to Figure 8-9 for examples.

Figure 8 – An example of an interactive activity to help keep the learners engaged

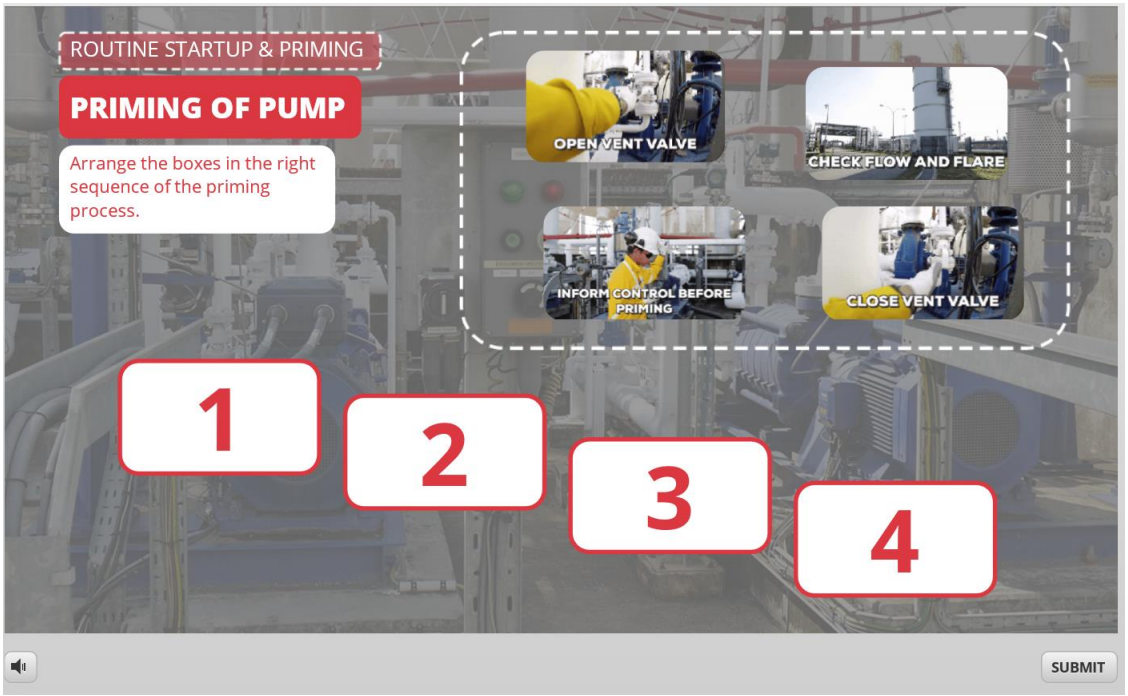
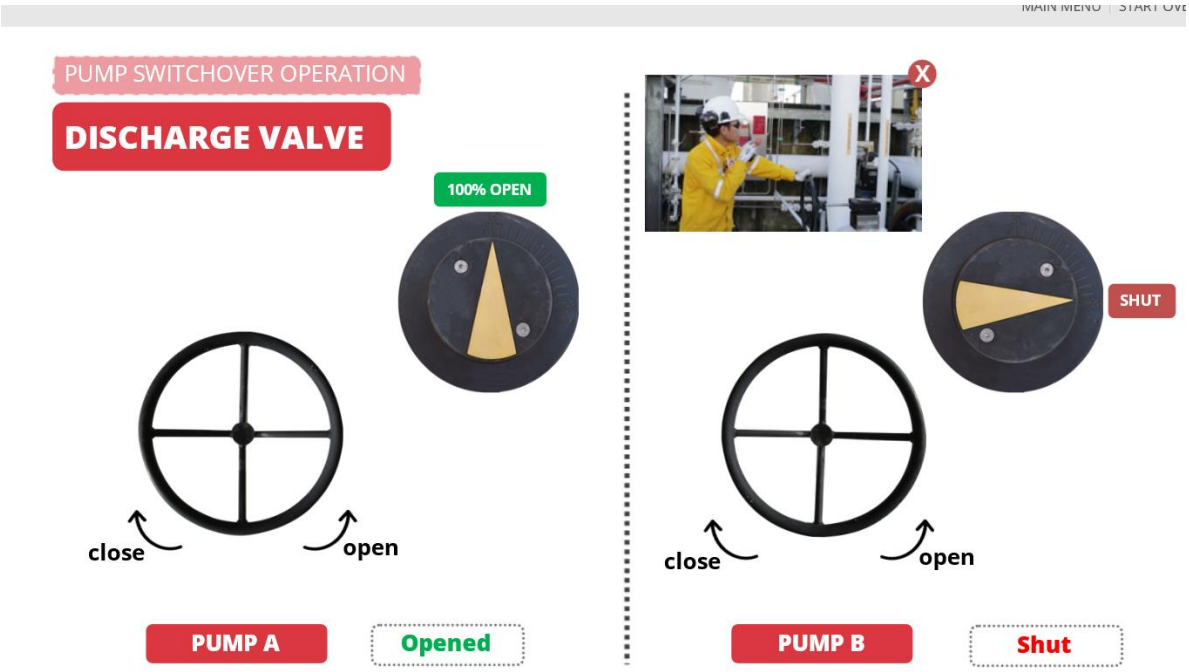


Figure 9 – Another example of an interactive activity to help keep the learners engaged



Learning Requirement 4: Besides skills building, can the learning episodes focus on also building critical thinking and helping technicians to react and apply their skills in the event of an emergency situation?

How Interactive Videos Were Used

To further extend the learning beyond skills, EDU also worked closely with subject matter experts to design interactive sequences that will test learner's abilities to deal with "What-if" type scenarios.

Here, learners would be offered a scenario with several choices and depending on the choices they make, progress further into the scenario or end up ending the scenario because they did not follow standard operating procedures or made critically unsound choices and decisions. These "What-If" scenarios allow learners to go beyond simple skills acquisition and require them to think critically and take ownership of their actions and learning.

Please refer to Figure 10 for an example.

Figure 10 – Interactive "What-If" scenarios are created to allow learners to go beyond simple skills acquisition and require them to think critically and take ownership of their actions and learning

3. Future Plans

As we have just begun to pilot some of this interactive video training, we will be putting in an evaluation study to focus on the learning experience of the technicians and to find out if the interactive videos have been useful in helping them be more productive in their work. EDU also has also begun to work closely with ECTC to leverage on other emerging technology such as augmented and virtual reality to focus on building skillsets. EDU would also like to focus a bit more on designing higher quality and more interactive "What-If" learning sequences for the Energy and Chemical industry using industry use cases. This will continue to help hone the skillsets of E&C professionals and to allow them to build more professional dispositions yet enjoying the learning in a safe learning environment.

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