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GoPro Plant Authentic Learning (GoPro PAL)

Live Streaming to Facilitate Collaborative Troubleshooting Skills for Plant Operations

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INTRODUCTION

Learning Environments in Technical and Vocational Education

In this era, technical and vocational education can be delivered through different learning environments such as classrooms, workshops, laboratories or virtual digital environments. A simulated workplace environment could help with learning outcomes of coping with real working conditions and procedures. Hybrid learning environments, in which different learning environments, digital technologies and innovative pedagogies are combined could offer additional channels for gaining knowledge and enhancing skills (Cedefop, 2015).

ITE Plant for Authentic Learning

At ITE College East, the Plant Authentic Learning (PAL) facility functions as a chemical process training workshop equipped with scaled down process pilot plants commonly used in industry. For their chemical process technology students, the PAL (comprising the plant and the control room), provides hands-on training in operating and controlling continuous processes in the petrochemical and pharmaceutical manufacturing facilities.

Challenges in Process Plant Operation

The practical knowledge in Process Plant Operation includes starting up and shutting down various types of equipment such as pumps, heat exchanger and distillation columns. Normal practical procedures involve students at the plant (field technicians) explaining plant conditions to students in the control room (panel technicians) using a radio set or known as walkie talkie. Likewise, students at the control room will respond and give instructions to the group at the plant to carry out actions leading to safe and proper running of the plant. As field technicians will not know how the plant is operating, they

Overview

Implementing Institution(s):	Institute of Technical Education, Singapore
Country and / or localities where practice has been implemented	ITE College East, School of Applied and Health Sciences (AHS) for Nitec in Chemical Process Technology
Timeline:	Full implementation: 2016 to date (on-going)
Target group:	About 40-60 students (1-2 classes) annually
Total cost incurred/resources required:	1 GoPro camera $514 1 Apple iPad $720 6 radio set $370 x 6 = $2,220 3 computers/control panels in the Plant for Authentic Learning (PAL) were donated by an industrial company

(a) (b) (c)

Figure 1: (a) Panel Technicians; (b) Field Technicians; and (c) Field Area Gangways

have to depend on the panel technicians to guide them, via radio set communication.

On average, about 20 students in a class will be present at the PAL in addition to teachers. As the gangways are tight and narrow (accommodating 2 adults standing back to back), there is a challenge to facilitate lessons in big groups; for every student to be engaged and aware of what is happening in both the plant and the control room, analyzing the live situation and collaborating in discussion to troubleshoot real-life problems in plant operation.

IMPLEMENTATION OF THE PRACTICE

Livestreaming using GoPro Camera

With the use of radio set communication alone, a barrier exists between the 2 groups of field and panel technicians as they cannot view each other's actions. Any mistakes by the field technician is not observable by panel technicians.

The GoPro PAL practice has introduced the use of a GoPro[1] camera to be carried by one of the field technician, enabling the panel technicians in the control room to have a live view of the equipment in operation and the manner the field technician is troubleshooting the operations of the plant.

In training situations, a visual capture and recording of the process operations at the plant could be beneficially replayed by lecturers during debriefing and discussion sessions for better explanation of contextual processes. Students can also independently reflect on the processes as many times as required.

Furthermore, students could now witness scenes at the plant such as purging of steam, handling high pressure and high-temperature environment through livestreamed examples. If preferable, dangerous scenes could be pre-recorded instead of physical runs.

Aims of GoPro Plant Authentic Learning

GoPro PAL is designed to allow students to simulate real-life scenarios in a safe process plant environment while promoting critical thinking, problem solving and peer learning. The

[1] *A GoPro is is an innovative camera designed to record live sessions. The participant is able to pinpoint a particular angle of the scene and then stream a consistent clear view of action.*

objectives of the practice are to:

1. Enhance the learning capability of students through the use of technology
2. Strengthen the troubleshooting skills through 'live' cases of plant upsets
3. Enhance analytical skills through group discussion on recorded sessions of plant upsets
4. Enhance teamwork and collaboration

Pedagogical Design for GoPro Plant Authentic Learning

The students are divided into 2 groups whereby one group will be the field technician stationed at the plant, while the other group will be the panel technicians stationed in the control room. There are about 8 to 10 students in a group and only one field technician will be carrying the camera at any one time.

Students are briefed on the learning objectives of this process and the instructions on what they are supposed to do for different roles. Panel technicians are taught how to pair the GoPro camera with the GoPro software in the iPad and field technicians are taught how to use the GoPro camera for recording and also live streaming purposes. The student carrying the camera is instructed to position the camera in the correct angle height when it is being hanged over his body. This student also has to closely collaborate with the Panel technician so he/she will have to carry a radio set for direct communication.

The plant has three main sections so three field technicians will take turns to carry the GoPro camera to show the live streaming and troubleshoot with the panel technician at the respective control panels. The panel technicians have access to the control panel and this is where they can control the plant and assess

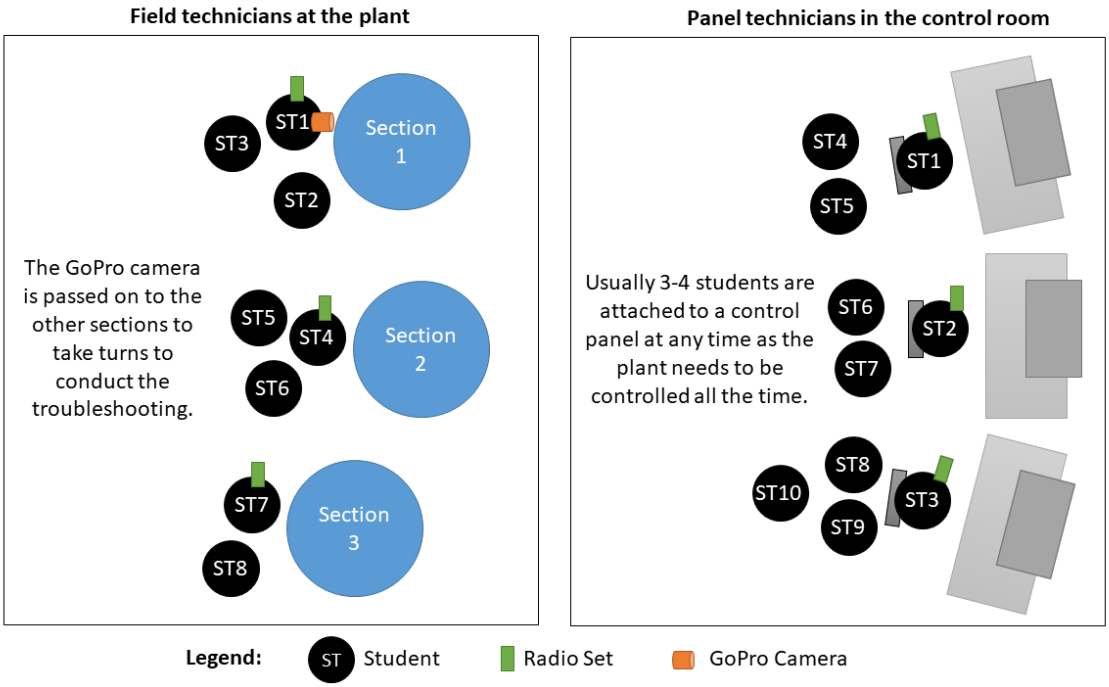

Figure 2 : Plant and Control Room Design

whether the plant is running in a proper manner by monitoring the DCS in control room and the live streaming from the GoPro camera on the iPad and communicating with the field technician.

There are three control panels in the control room to control each of the three main sections of the plant and usually there are about 2-3 students manning each control panel per session. There are six radio sets used concurrently for communication between the panel technician and the field technician, with one at each panel technician sitting at the control panel, and one at each section of the plant (Figure 2).

Through the live streaming, the panel technicians can discuss the issues that are occurring in the plant. An example would be the tray flooding which can occur in the distillation column and can only be seen from the sight glass of the equipment, which shows the internal part of the distillation column. The panel technicians are able to view the different stages of flooding that is taking place and they will be able to know the best way of countermeasure, for example, by reducing the pump flow rate at the control panel. Without live streaming, it is difficult for a student to describe the condition of flooding and thus impedes the troubleshooting process.

IMPACT OF IMPLEMENTATION

Cohorts of students who experienced GoPro PAL revealed through conducted survey and interviews, that the strategy was more effective than traditional classroom teaching, in terms of enhancing their understanding of concepts and retention of knowledge. A significant majority of students agreed that through the use of livestreaming, their understanding of plant operations is deepened, enabling them to apply what they have learnt to troubleshoot simulated hazardous work situations.

The availability of recorded videos of the plant operations enabled students to master the skills through repeated viewing, which also increased their competence and confidence to operate the plant again. The use of a livestreaming camera made visualization easier for the students during the troubleshooting and learning process. The start-up process was faster as students in the control room could visualize the livestreamed scene at the plant and control the plant effectively.

Further evidence of success was observed during the shift work period, where students were able to recognize the signs and symptoms of malfunction and carry out appropriate corrective actions independently. As part of the training to record activities in the plant, students who experienced GoPro PAL were also better able to communicate accurate handover information and details to the next shift, due to better understanding of the processes. They were able to perform the start-up, shutdown and troubleshooting on their own during their 2-week shift work period; operating the three units independently with success after 14 weeks of training.

LESSONS LEARNT AND FUTURE OUTLOOK

GoPro PAL has been improved over a few cycles of implementation, providing the following lessons learnt:

1. Initially, student complained of a lot of vibration in the live streaming video, causing them to feel abit giddy upon viewing. After troubleshooting this issue, it was discovered that the cause of it was due to the camera not being strapped securely onto the student and thus created unnecessary movement of the camera which resulted in a 'shaky' image of the video.
2. During the early stages of the video production, the camera was turned on for the entire process at the plant. This resulted in a long and draggy video; and not all students had the motivation and patience to view the video until the end. The counter measure was to inform the students that the recording camera is to be turned on during specific troubleshooting process. This resulted in a shorter video with focused learning contents.
3. Initially, students had difficulty analysing the long video to identify individual troubleshooting processes to be learned. The videos were then marked into shorter sections such that the students were able to discuss based on stages of the troubleshooting process. After that, each troubleshooting stage were discussed in alignment to the whole process.

REPLICABILITY

GoPro PAL utilizes the HERO 4 silver GoPro model with the Ipad as streaming device. Based on feedback, the learning curve of this combination devices are not steep. Basically, action cameras with direct streaming functions that are stable and robust can be used and any compatible smartphone or tablet could be used for streaming the video.

The computers used are applicable in the course, as a Distributed Control System used in process plants for monitoring of process parameters. Depending on context, it may not be required for other courses. In the case of GoPro PAL, the maintenance of the computers is carried out in-house while patch updates on the programme is done by the company.

GoPro PAL could be adapted by any learning institution that requires the use of live streaming for an enhanced learning pedagogy. Through the use of live streaming, lecturers can view first-hand the behavioural aspect of the students during a troubleshooting process. GoPro PAL could be replicated to support authentic learning in the confined spaces of actual environments such as the aircraft cabins for Aerospace courses or engine rooms for Maritime courses.

CONCLUSION

GoPro PAL showcases an example of an authentic real-world learning environment that is optimally used in tandem with innovative technology-pedagogy to support and improve teaching and learning in TVET. The technology of

livestreaming action cameras was used to enhance authentic learning while solving the issue of large group learning in a confined environment.

Overall, the application of technical knowledge through practical application, practice-based and hands-on experiential learning, complemented with real scenario practical training at PAL bring students closer to being equipped with skills, behaviours and expectation that fit the industry.

With continuous advancement in technology, it is hoped that more lightweight action cameras with improved audio capture could become a staple among educators' observational and developmental tools.

REFERENCES

Cedefop (2015). Vocational pedagogies and benefits for learners: practices and challenges in Europe. Luxembourg: Publications Office of the European Union. Cedefop research paper; No 47

FURTHER INFORMATION

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