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Mechanical Engineering Virtual Reality Lab

Alan McDonnell
TU Dublin, alan.mcdonnell@tudublin.ie

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Integrating Digital Technologies

OLLSCOIL TEICNEOLAÍOCHTA BHAILE ÁTHA CLIATH
TECHNOLOGICAL UNIVERSITY DUBLIN

Case Study:

Title	Mechanical Engineering Virtual Reality Lab
Author(s)	Alan McDonnell
Module Title	Critical Utilities 1
Student Cohort (Programme year / FT or PT / UG, PG, or AP)	TU024 PT UG
On which campus were the F2F interactions	City Campus (Bolton St.)

Introduction & Context (100-150 words)

Students perform multiple engineering lab experiments within the Critical Utilities 1 module. The 'Pump Laboratory' experiment involves interaction with a fluid power training rig to record pressure and flow readings from a variety of system states. The recorded data from multiple pumping experiments is used to create pump and system characteristic curves and charts. This experiment is very appropriate to industrial practice and design. The typical cohort size is 10+ and the availability of only one training rig introduces a 'pinch-point' in the interaction capacity of the students; there is insufficient time for all students to perform all the separate lab experiments independently, within the timeframe of the single laboratory session. Lecturer demonstration to the class is used to facilitate a selection of the pumping experiments. It is too costly and prohibitive to purchase multiple physical rigs to facilitate all student interactions.

Changes Made to Practice (100-150 words)

The use of Virtual Reality (VR) technology was considered as an appropriate, affordable technology intervention to provide increased capacity for individual student interaction on a comparable digital form of the physical training rig. A digital equivalent of the physical rig was developed as a CAD model (using SolidWorks), enhanced with Virtual Reality interaction functionality (using Unity), and deployed on Virtual Reality headsets (Meta Quest 3). Each student was provided with one VR headset, and they completed elements of the experiment virtually.

Observations on Student Engagement (100-150 words)

In the initial instance of this pilot project, as part of the research context, the students completed some elements of the experiments virtually, and some elements in their existing format. This provided scope for student feedback in terms of comparison and efficacy of the new digital intervention. Student engagement in this new VR activity was very positive with the significant majority of students adapting to the VR technology with no technical issues whatsoever. Student feedback to the VR content was also widely positive. Students also found interesting, unexpected ways of interacting with the content to complete the experiment in a productive manner, which will be used a suggested operating procedures in future sittings of the virtual experiments.

Reflection - suggest a piece of advice from the experience (50 – 100 words)

The integration of a Virtual Reality intervention into this laboratory setting was very appropriate in a number of ways.
The engagement from the existing module lecturer to 'buy into' the new format of laboratory environment was very important.

The technical expertise required to develop the complete VR experience is significant; whilst I personally have the CAD and programming skills, this is not a development project that many lecturers would be capable of.

However, collaboration between staff with the technical expertise and lecturers willing to embrace the 'end product' have provided a very appropriate outcome.