

434f A Study of Student Experience and Feedback on Web Based and Simulation Based Practicals Developed for a Process Engineering Module within Biosystems Engineering

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Practicals are a key component in the training of engineering students. They complement the theoretical content of lectures and bring to life the many technologies that engineers will encounter during their careers. Laboratory practicals are very resource intensive in equipment facilities, laboratory space, materials and time input by academics and technicians. As they are normally carried out in small groups, they can also present considerable timetabling difficulties. As a result, the number of practicals undertaken by students can be constrained by resources or timetabling limitations. One approach to overcome these constraints is to develop simulation software that is based on the equations underlying the principles of operation of the subject of interest. The software then allows the student to investigate various scenarios by varying different variables. Simulation can be a very powerful learning tool for engineers. However from the teaching perspective, simulation lacks the 'hands on' element that is a very important component of conventional practicals. Web based practicals offer a novel alternative as an intermediate step between conventional laboratory practicals and simulated practicals. The main advantage of a web based practical over simulation is that the student can see and carry out a practical in real time. Web based practicals also remove many of the resourcing constraints associated with conventional laboratory practicals. Web based practicals can be accessed at any time, so a student can carry out the practical after covering the subject material in lectures and can repeat the practical if the student wants to review the material. The objective of this work was to develop a number of simulation and web based practicals for use in a processing engineering course for undergraduate Biosystems engineering students. The objective of the web based practical was to demonstrate the flow rate / pressure characteristics of centrifugal pumps. There were two separate components to constructing the web based practical, a centrifugal pump rig and a web camera to broadcast the experiment continuously over the net. The pump rig consisted of a small centrifugal pump recycling water into a reservoir. The back pressure was varied stepwise using valving. Flow rate and pressure was displayed by instrumentation that can be easily read by the web camera. The rig was programmed to cycle continuously through a series of pressure / flow rate settings. Students, remotely viewing the rig over the net, manually record the pressure / flow rate results displayed by the web camera while also viewing the obvious change in flow from the pump returning to the reservoir. Students can subsequently plot the flow rate / pressure characteristics of the centrifugal pump. The simulation based practical simulated the temperature distribution in a simple heat exchanger and how this varied with flow rate. The practicals were designed to act as 'pre-practicals' for similar lab based practicals. It was hoped that the web and simulation based practicals would enhance the pedagogical outcome of practicals by allowing students to undertake practicals at their own pace and repeat the practical if necessary. It was anticipated that students would be better prepared by the time they carried out the lab based practicals. Student surveys indicated that the students considered the pre-practicals interesting and well worth doing. However, the survey indicated that the students considered that these type of pre-practicals should complement current laboratory based practicals rather than replace them.