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LABORATORY E-TUTOR FOR ENGINEERING

Dr. Aldo Rona
Department of Engineering, University of Leicester
2510
ar45@leicester.ac.uk

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The laboratory e-tutor is a bespoke collection of self-running presentations in Adobe Communicator on Blackboard, written for the second year thermodynamic and fluid dynamic laboratories. The e-tutor has significantly changed the way laboratories are taught in Engineering by providing a bespoke step by step video guidance to each experiment in the form of an interactive presentation. Building upon the existing LabView computer based data collection and processing, the e-tutor uses the existing PCs attached to each experiment. It enhances the paper instruction sheet that is handed out at the beginning of each laboratory session by providing a multi-media content that enables students to start and run safely through the experiment and data analysis, developing their independent learning and their confidence in performing hands on engineering tasks. Students liked very much the blended learning environment of an e-tutor and a member of staff at hand to ask clarifications if in doubt and embraced the new technology seamlessly. Academic staff are able to focus on stimulating the critical appraisal of the experimental results by the students, which makes laboratories more enjoyable by students and staff.

1. BACKGROUND

The project built upon the success of the demonstrator e-tutor Lab Power Point for the axial and centrifugal fan experiment, by rolling out 10 e-tutors to 9 other existing second year thermodynamic and fluid dynamic experiments.

The e-tutor presentations were written by Dr Rona over the Summer of 2009 with the support of one third year MEng Mechanical Engineering student, Mr. Edward Jones, who was employed on an Occasional Work contract by the Department of Engineering. The project benefited the student by providing him with valuable work experience in Engineering, relevant to satisfying his training requirements for accreditation as Chartered Engineer. The student had taken a subset of the 9

experiments in his second year, which was an advantage when scripting the step by step guide in the e-tutor.

Ten e-tutor presentations were scripted and recorded over 9 weeks, giving a workload of about four hours a week for Dr. Rona and a full-time work for Mr Jones, who produced the artwork, assembled and tested the presentation and added the narration.

The existing axial and centrifugal fan e-tutor Lab Power Point provided the model for the new presentations, while the existing laboratory instruction sheets was used as the skeleton contents for them. The new e-tutors were be rolled-out in the Spring of 2010 to second year students. The success of the axial and centrifugal fan demo made this project low risk.

The e-tutors were produced using Adobe Presenter instead of PowerPoint as the software platform. The advantage of Adobe Presenter is the availability of the narrative alongside the slide presentation and a more intuitive navigation toolbar. For this the laboratory PCs were connected to the Internet. A Blackboard course module was created for the second year thermodynamics and fluid dynamics laboratories that linked to the Adobe Presenter servers, which is the University of Leicester e-repository for the e-tutors.

The project ran in accordance to the original plan and schedule, and was within budget.

2. PROJECT AIMS AND OBJECTIVES

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3. PROJECT OUTCOMES AND ACHIEVEMENTS

Students were able to start their active experimentation in second year thermodynamics and fluid dynamics laboratory session simultaneously, rather than having to wait up to half an hour for staff to give them a one-to-one introduction. This made the laboratory assessment fairer across the cohort. It also made supervising the laboratory less physically demanding for Dr. Aldo Rona, who used to find very little spare capacity for work other than routine administration after the end of the laboratory sessions.

Students built their confidence in familiarizing with a new piece of engineering machinery based on the equivalent of on-line help, without a demonstration from a physical person. This skill is something that is increasingly expected by engineering employers when dispatching service engineers in remote locations. This skill is now developed in the year 2 engineering laboratories in a safe environment, under the watchful eyes of academic staff that can focus on overseeing the safe running of all experiments instead of having to dedicate their full attention to the introductory speeches. This made second year laboratories safer.

The Resources section of each e-tutor gives additional information on the physics behind the experiments and tips on the interpretation of the results. At the end of the term, students were given one experiment to write up as a formal report. As the e-tutor was available off-campus through Blackboard, students were able to re-play the presentation from home and used it to make a more competent experiment write-up and improve their second year experimentation marks.

This project made a more effective use of staff and student time in second year laboratories, adding handing of e-resources to the laboratory experience and enabling a greater and deeper understanding of the outcomes of the experimentation by the students.

The e-tutor fits within the AccessAbility policy of the University of Leicester. As the presentations are both scripted and narrated, they advantage students with dyslexia, hearing impediments, or language difficulties, including non-native English speaking students. Individual slides in the presentations can be re-run, so students can make sure they have understood their content correctly.

4. EVALUATION

Feed-back from second year students was collected using similar questionnaires to the one used to assess the axial and centrifugal fan Lab Power Point demonstrator. The questionnaires were filled-in by each pair of student working at a specific experiment. Students commented that the e-tutor they worked with was “pretty good”, “very helpful”, “easy to follow”, as it “made the introductory session

feel more structured". It was "a good way of teaching the material". Some students found that the "presentation is too in depth", while others would have liked "more direction for further reading". Students indicated that the experiments can be further improved by giving "more background information on real-life applications" and by adding flow visualization.

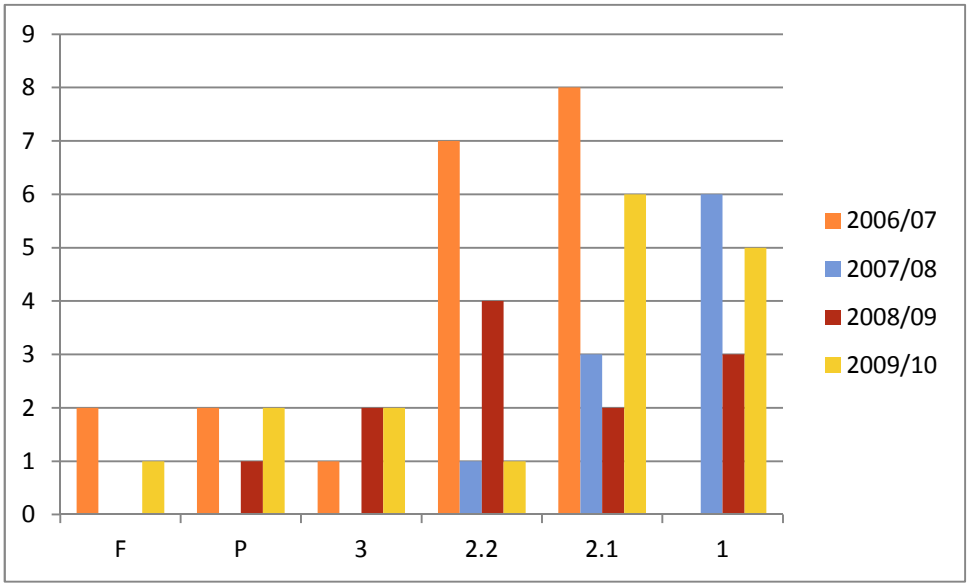

FIGURE 1: CLASSIFICATION OF SECOND YEAR FORMAL REPORTS. F=FAIL, P=PASS, 1=FIRST CLASS.

Figure 1 shows the classification of the second year thermodynamics and fluid dynamics formal reports submitted by the students in the academic years 2006/07 to 2009/10, ranked according to the University standard degree classification bands (e.g. 1st class >= 70%). The ordinate reports the simple frequency (the number of reports) that occur any one mark band. The small cohort size prevents from making conclusive statements with a high degree of confidence. However, some trends are noteworthy. The 2006/07 and 2008/09 cohorts have returned marks that are pretty aligned with the mark frequency distribution observed year on year in Engineering, featuring a high number of mid-range marks, in the second class honourous range (2.2 and 2.1). In 2009/10, there seem to have been more students demonstrating a 2.1 competence level or better. This, broadly speaking, corresponds to students being able to not only of reporting the procedural details of the experiments and the results for record keeping purposes, which is the minimum for a 2.2, but also to provide an intelligent discussion on the implications of their findings, which is a requirement for the higher degree classifications. This is indicative of a more contextual and analytical learning by the 2009/10 cohort, who used the e-tutors.

A practical lesson learnt from the e-tutor experience is the requirement to keep the volume of each e-tutor low so that the narrations do not overlap too much in the open space of the laboratory, when these are played simultaneously. Students need to be briefed about this at the beginning of the session.

One interesting aspect of the e-tutors derived from having contracted to Mr. Edward Jones the voice-over commentary. Students liked the idea of having the e-tutors narrated by one of their peers. The narration comes across more as a peer-support speech rather than a teacher to pupil speech. This was a positive unexpected outcome.

5. CONTINUATION OF THE PROJECT

The e-tutors are stored on the Adobe Communicator server long-term and are accessed via Blackboard. The Blackboard course site requires minimum maintenance that is performed by Dr. Aldo Rona. The PCs used in the Themodynamics and Fluid Dynamics laboratories are maintained by the experimental officer Mr. Paul Williams, who also maintains the current laboratory experiment instruction sheets. Mr. Williams and Dr. Rona have in place a system for reviewing annually the contents of these hand-outs.

The e-tutors are used in laboratory work that has been core to the Engineering curriculum from well before Dr. Rona's lecturer appointment at Leicester in 1998. It is therefore very likely that these resources will serve many generations of students to come.

ACKNOWLEDGEMENTS

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