

Enhancing the design and assessment of practical work in the engineering curriculum

Study author: Liz Willis, Academic Co-ordinator, Engineering Subject Centre

Tutor in study: Sean Wellington, School of Computing and Digital Communications,
Southampton Solent University. Subject area: Circuit Theory

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This case study has been developed from data gathered through a demonstration of the teaching and learning materials available, interviews with the tutor and a student focus group.

Background

The laboratory programme for a first year undergraduate module in electrical circuit theory has been redesigned in order to provide a coherent and structured programme of practical activities. Essentially, the laboratory programme is divided into three discrete stages. All students are required to complete the laboratory activities for stage one in order to meet the learning outcomes for the practical work at “threshold level”. After stage one, students are able to progress to the more challenging tasks at stages two and three for a higher level of achievement.

Activities at stage one are fairly well defined for the students however the work at the next stages requires progressively greater independence and higher level intellectual and practical skills. For example, at stage one students are instructed to use a particular piece of test equipment to take a series of measurements, while at stage three students are required to design the experiment, selecting appropriate test equipment.

The laboratory programme complements a lecture and tutorial series. Students have a one hour lecture followed by either (on alternate weeks) a laboratory or tutorial session. The students are a mixed group of first year full-time electrical engineering students and part-time electrical engineering HNC/HND students.

Reasons for introducing this teaching method

Circuit theory has traditionally been seen as a difficult subject for students. It is quite mathematically intensive but is key in providing a range of tools and techniques which students need to build on and utilise throughout their whole course. The original laboratory programme required students to complete and document 12 separate practical activities. These activities were fairly closely prescribed for students, with the main challenge being the breadth and quantity of work required.

Recently the School has been considering assessment workload for students and staff and evaluating whether “assessment truly does align with the learning outcomes”. The new programme focuses on the learning outcomes of the unit and, in particular, the practical aspects of the unit, with the aim being to design a programme that would ensure that the learning outcomes were being met by all students at threshold level. The new scheme was intended to provide a progressive intellectual challenge which would lead to a better discrimination between different levels of achievement. The approach to assessment is designed to be easily understood by the students, with clear criteria for success. Ongoing

formative feedback is provided by the technician instructor as students complete the laboratory exercises.

Students' perspective

Students benefited from the lecture and laboratory series running in parallel: "It's good to see what you learn from a lecture, and maybe if it's a new subject it won't be quite clear, but as soon as you see it reflected in a lab, ...you can see it works". The students valued the support and feedback provided during the sessions by the technician: "In a lab you're given the opportunity to discuss your findings and if it hasn't worked out there's a reason why and you recorded that, but in an exam you don't get that opportunity."

Some of the students expressed concerns that they were initially unfamiliar with pieces of equipment in the lab and would have appreciated more demonstrations before being asked to complete the activities.

Students appreciated the revised programme, in particular they welcomed the explicit nature of the assessment process. They knew what was required to 'pass' the practical element of the unit and what they could then go on to achieve at a higher level. They welcomed being given the opportunity to make the decision about their level of achievement in the module; it gave them the flexibility to spend more time on the stage one laboratory exercises if needed or working on other aspects of their course. "It gives you the opportunity, if you're maybe struggling in other areas of the course to concentrate on them and, if you're confident that you've done six labs up to the standard required, you want to go for the additional marks then you've got the opportunity to do so."

Issues

Overall the student group seemed divided in their motivations. As the HNC and HND students will receive a script outlining each unit graded at pass, merit or distinction they tended to be more motivated to achieve above the threshold level of attainment. More of the undergraduate students made the tactical decision to get a "safe pass" and spend more time on other areas of the course.

Following student feedback from the first year of implementation, this module is now spread over the academic year rather than one semester. This has allowed certain areas to be covered in more depth in the lecture series and the laboratory programme to be better phased with the lecture materials.

Benefits

Since the changes have been implemented, student attainment in the summative assessments (end of unit examination and assignment work) are more in line with achievements in other level one subjects.

Because of the more continuous formative assessment style, the time spent on summative assessment has been reduced. The summative assessment is also spread more evenly over the course of the module as students now submit logbooks for assessment when they are happy they have reached their desired level of achievement.

Reflections

Overall students end of module exam marks correlated well with the marks gained for the in-course aspects of assessment, suggesting constant level of attainment of all of the module learning outcomes. The approach has been particularly commended by the external examiners.

The feedback from students has been positive, showing appreciation for the key developments across the whole module, including the development of course notes, tutorial support materials and the re-design of the practical work.

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