Re-engineering assessment for engineering education
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Abstract
This project sought to enhance the student learning experience and engagement by re-engineering assessment. It started with identification of specific assessment issues in engineering disciplines and then explored possible solutions by building fit-for-purpose assessments to engage students with their learning, particularly in terms of supporting level 4 students’ transition onto their degree courses. Timely and effective feedback mechanisms were also developed to enhance the student learning experience.

The project team has successfully achieved the following outputs and outcomes:

- Development of more learning-oriented methods of assessment
- Enhancement of the student learning experience through re-engineered assessment activities
- Design of assessment that supports the transition into HE.

Keywords: assessment, learning-oriented assessments, learning experience

Background
As part of a year-long, university-wide assessment project, the school had started to review its assessment strategy and explore how well it was meeting the need for a student-centred and learning-oriented experience. The school found some excellent examples of learning-oriented assessment and wanted this to be the experience of all of its students:

- Embedding assessed tutorials to encourage students to keep on top of their learning
- Use of peer assessment to help students understand what is being assessed
- Use of phased assignments to encourage students to take notice of feedback
- Designing regular small assessments to encourage students to distribute their efforts more evenly across their studies.

In this project, the team aimed to extend these activities by identifying issues of assessment that are specific to engineering disciplines, for example assessing practical and analytical work and exploring solutions for issues/problems identified. The project also looked at how these solutions could support level 4 students’ transition onto their degree courses.

Rationale
The project outcomes directly benefited students by providing them with better and more continuous feedback; better engaging them throughout their studies to improve retention. Staff were supported to work through curriculum and assessment designs in order to ensure appropriate outcomes.

Figures 1 and 2 show that the assessment strategies were designed to:
- encourage consistent student engagement
- spread the assessment load for both staff and students
- give ample opportunities for feedback to help students
- allow student performance to inform teaching materials.

Figure 1. Assessment strategy (Example 1)

Figure 2. Assessment strategy (Example 2)

With these developments, the next step was to explore responses to the sector-wide potential challenges related to assessment (i.e. timing and bunching of assessments, plagiarism and collusion prevention, problem with large cohorts, staff loading and staff IT skills).

The approach

The project team inducted staff during school staff meetings. Leaders of 26 modules across the target programmes volunteered to take part in the project and review assessment strategies for their modules.

The project started with the process of evaluating current assessment methods, with a particular focus on identifying specific assessment issues in engineering disciplines. Particular attention was given to assessment of the outcomes/competences identified in UK-SPEC. The advice of sector employers and professional bodies was obtained to support this process. Based on the issues identified, the project explored possible solutions by building fit-for-purpose assessments to engage students with their learning, particularly in terms of supporting level 4 students' transition onto their degree courses.

An Assessment Workshop was organised within the school at which assessment strategies for the target modules were discussed and designed. The following good practice/strategies were derived as the outcomes of the workshop:

- Adoption of In-Course Assessment (ICA) methods that would not increase the time burden on students
• Development of timely and effective feedback mechanisms to enhance the student learning experience
• Targeting modules in early years and only using 100% ICA in the final year when an exam would be inappropriate
• Regular consultations with professional bodies
• Employment of postgraduate students to process computer-aided marking methods.

Based on the strategies developed, a school Learning and Teaching Away-day was held to enable staff to share good practice in assessment methods and prepare them for the design of new assessment tasks in the coming academic year.

The new assessment tasks were designed and implemented by the module teaching teams during Semester A in the academic year 2011/12.

Assessment

Whilst at school/college, students are given repeat attempts at assessments in order to gain better results, but this is not the case at university. The redesigned assessment strategies have narrowed the gap between these two systems by giving students regular low stakes assessment opportunities and helping them to adapt to the higher education (HE) environment more smoothly.

The generic redesigned assessment strategies consisted of several common elements: a series of laboratory exercises, laboratory report and phase tests, etc. Module leaders planned their module assessments according to the module content and student learning experience. A typical module is shown in Table 1.

Table 1. Typical module

<table>
<thead>
<tr>
<th>Lab exercises 1–5</th>
<th>Practical work</th>
<th>40%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formal lab reports/ phased assignments</td>
<td>Written report/ assignments</td>
<td>40%</td>
</tr>
<tr>
<td>Phase test</td>
<td>Class test – Multiple Choice Questions</td>
<td>20%</td>
</tr>
</tbody>
</table>

The redesigned assessment strategies and tasks were highly commended by the external examiners in the Semester A module exam boards:

• A variety of assessment tasks was designed and implemented, with particular focus on hands-on practices
• Assessment tasks were deemed suitable for module learning outcomes, with appropriate difficulty levels and feedback mechanisms
• Assessments were embedded with professional skills development to enhance student employability.

Evaluation

Evaluation was approached from three directions: the target students, module leaders and student performance data. Student feedback was obtained via Student View Point, the university’s student feedback portal for modules. Feedback from staff was collected via email and face-to-face discussions. Student performance data was obtained following the Semester A Module Boards.
Overall, feedback was very positive and the new assessment strategies and tasks were welcomed by all stakeholders.

**Staff feedback**

- Redesigning the assessment strategies, for example using the phased assignments and tests, lead to fairer assessments as student performance did not depend on a single exam mark.
- The Assessment Workshop and the school Away-day were very useful. The events provided effective support for module leaders to think, share and discuss different assessment ideas that would enhance student learning in their modules.
- Before the project, many students only started revising the material when an assignment was due and just before the exam. Low stakes regular assessments enhanced student engagement throughout the module. Student motivation increased as a result of more and earlier feedback from tutors.
- Academics felt rewarded as student performance was enhanced through the project.
- Redesigned (more practical and efficient) assessment strategies helped to spread the assessment load for both staff and students.

**Student feedback**

- ‘The regular and phased assessment elements helped me to break big and difficult topics into small parts that I can manage.’
- ‘The new approach encouraged me to keep it up so that I wouldn’t lose [sic] half way through the module.’
- ‘The tests every fortnight helped me to know I was in the right track [sic]. And I would not worry about my exam as I got the topics in my head bit by bit as the module went through.’
- ‘A very enjoyable experience. Regular tutors’ feedback helped me to understand where went wrong and how I should do about it [sic].’

**Student performance data**

With the redesigned assessment strategies and tasks implemented in Semester A of the academic year 2011/12, the pass rate of all of the targeted modules increased as a result of better student engagement and an enhanced learning experience.

**Table 2. Comparison of module pass rates between academic years 2010/11 and 2011/12**

<table>
<thead>
<tr>
<th>Module title</th>
<th>Level Semester</th>
<th>Cohort size</th>
<th>Pass rate Academic year 2010/11</th>
<th>Pass rate Academic year 2011/12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction to Electronic Systems</td>
<td>Level 4 Sem A</td>
<td>49</td>
<td>36%</td>
<td>84%</td>
</tr>
<tr>
<td>Sustainable Business of Electronic Engineering</td>
<td>Level 4 Sem A</td>
<td>41</td>
<td>68%</td>
<td>93%</td>
</tr>
<tr>
<td>Materials and Electrical Science</td>
<td>Level 4 Sem A</td>
<td>263</td>
<td>87%</td>
<td>95%</td>
</tr>
<tr>
<td>Introduction to Manufacturing Technology</td>
<td>Level 4 Sem A</td>
<td>400</td>
<td>61%</td>
<td>80%</td>
</tr>
<tr>
<td>Material and Electrical Technology</td>
<td>Level 4</td>
<td>116</td>
<td>74%</td>
<td>95%</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>---------</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
</tr>
<tr>
<td>Mark-up Language and Meta Data</td>
<td>Year 2</td>
<td>58</td>
<td>72%</td>
<td>90%</td>
</tr>
<tr>
<td>Thermo fluid Experimental</td>
<td>Year 2</td>
<td>146</td>
<td>70%</td>
<td>80%</td>
</tr>
<tr>
<td>Engineering</td>
<td>Sem A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Real Time Systems and Programming</td>
<td>Year 2</td>
<td>43</td>
<td>80%</td>
<td>98%</td>
</tr>
<tr>
<td>Principles of Aircraft Systems</td>
<td>Year 2</td>
<td>97</td>
<td>17%</td>
<td>47%</td>
</tr>
<tr>
<td>Aircraft Systems</td>
<td>Year 2</td>
<td>27</td>
<td>68%</td>
<td>78%</td>
</tr>
<tr>
<td></td>
<td>Sem A</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Discussion, summary**

The project has successfully achieved the following outcomes:

- Development of more learning-oriented methods of assessment
- Enhancement of the student learning experience through the re-engineered assessment activities
- Design of assessments that support the transition into HE.

Whilst at school/college, students are given repeat attempts at assessments in order to gain better results, but this is not the case at university. It is very important for a degree programme to manage level 4 students' expectations of assessment and help them to adapt to the HE environment more smoothly. The redesigned assessment strategies have narrowed the gap between these two systems by giving students regular low stakes assessment opportunities. As well as giving them a sense of security by spreading assessments across the whole module, the approach helped students to understand the boundaries of the HE assessment system.

One of the targeted Semester A modules, *Material and Electrical Technology*, is a level 4 module with cohort size of 116. Five phase tests were built, one after another, and were supported by laboratory practical experience. Calculation of the final marks was based on the best four out of the five tests. Students appreciated the calculation method, as they felt they had no need to panic if, due to extenuating circumstances, they didn't perform as well as they should have in one of the tests. In fact, all of the students attended all five of the tests in order to achieve the best performance possible. Furthermore, this assessment strategy made them feel rewarded and motivated, as they could use the tutor’s feedback to improve their performance in the next test.

The project team sought numerous opportunities to both learn from and disseminate the project experiences and examples of good assessment. The project findings have improved the sector’s understanding of and practice in the use of assessment to enhance and engage students with their learning. The redesigned assessment models/strategies have been made available to other institutions wishing to introduce them into their engineering curriculum.

**Further development**

The project team has been working with staff on their values and beliefs about good education and, in turn, good assessment, and it is important to ensure that the project is sustainable and not
just a one year “fix” that is allowed to drift. Moreover, the redesigned assessments will be reviewed regularly by the programme teams, together with advice from employers and professional bodies, so that the sector’s development trends can be embedded into the continuous development of the programmes to ensure that the latter meet the changes and dynamics of both employer and student expectations.

**Further reading/bibliography**


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Publication Date: 30/04/2012