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BE (Hons) final year project assessment – leaving out the subjectiveness

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Abstract: Final year projects for BE(Hons) programmes are the linkage between the academic and the industrial domains. Projects are often judged by respective employers as the measure by which students are considered and are also closely surveyed by professional bodies when accreditation is sought. In some instances, final year projects can lead to publications in conferences and journals and also allow students to continue their academic study into research degrees. However, the assessment of both the final thesis and the process of conducting the project are often subjective and open to challenge. This paper discusses a comprehensive strategy for removing some of the inconsistencies and proposes a transparent and robust assessment model which can be applied in similar areas elsewhere. This approach has been developed at the School of Engineering at AUT University in Auckland.

Introduction

Final year BE(Hons) projects are often considered the “capstone” of a demanding four year qualification and one in which the aspiring engineer is expected to be operating at a level consistent with that of a graduate in industry. In general, projects can be varied with different deliverables, be they physical, virtual or conceptual, although all must clearly demonstrate the Level 8 (final level) requirements. Broadly, projects fall into one of three categories:

- Innovative projects which are proposed or formulated by a supervisor, often they are linked to the particular interests of the supervisor;
- Original projects proposed by the student themselves;
- Standard projects which have been tackled before and have a known result or proven methodology. Students may wish to improve on one of these, or use one in a different context or location.

In completing the project, students are expected to demonstrate a number of elements. Perhaps most importantly, students should clearly meet the course Graduate Profile or the Programme Outcomes. In Engineering, these outcomes are more tightly defined than in many other disciplines due to the professional nature of the qualifications and the requirements of international accreditation under the Washington Accord. The so-called “Graduate Profile” is a comprehensive description of what exactly a graduate from a particular programme is capable of achieving. Whilst this is not directly assessed at any point as a whole, all assessments on the programme, particularly those final year subjects should be considering elements of the profile. In designing assessments for a BE(Hons) final year project, the graduate profile must be closely considered and the establishment of transparent learning outcomes together with appropriate assessment criteria becomes a key requirement and these must be robust (Littlefair & Gossman 2007).
Littlefair, G., & Gossman, P., BE (Hons) final year project assessment – leaving out the subjectiveness.

John Biggs (1999) notes that the rationale for criterion referenced assessment (CRA) is “stunningly obvious: say what you want the students to be able to do, teach them to do it, and then see if they can in fact do it” (p. 147). He and Dunn et al (2002) note how CRA is becoming the generally accepted form of assessment in modern universities. At the heart of the assessment method is the requirement for students to achieve against known standards which can either be competence (can do / can not yet do – think of your driving test) or achievement (in which criteria for levels are written).

Any assessment involves compromise but should strive for the ‘big three’ of validity (face, construct and impact), reliability and fairness (see Wakeford (1999) for further details). In the context considered here, the variation between the projects gives the achievement standards, for the stated outcomes, a generic engineering feel as opposed to a specific content knowledge focus. This is not an unusual approach in a university since research degrees are examined in a similar way. Although the criteria for admission to the academy may not be overtly stated, they are ‘known’; a detailed literature review, standards of presentation, and so on, yet it is the whole dissertation that passes. Inevitably some judgement has to be made and this can depend upon the clarity of the achievement criteria.

One of the criticisms of a CRA approach is that the given criteria homogenise the submitted work. Dunn et al (2002) also identify atomisation of tasks, a focus on outcome at the expense of process and that they are unreliable because they require professional judgement. Set against these are the claims (Petty, 1998) that CRA increases student motivation and focuses effort on specific aspects of a course. He argues that “if students know what to aim for, they are more likely to be successful” (p. 253) and Biggs observation (1999) that all assessment involves judgement.

Within engineering Gibson (1998) notes that “the assessment of design projects can only be performed objectively if one states the aims of the course, the standards accepted within it, and a scheme is developed which gives an accurate and repeatable measure of performance” (p. 390). He goes on to note that any such statements should be reviewed in the light of feedback, both from staff and students. Stewart and Nesbitt (2005) give a list of four features for student assessment that they identify as of general importance within engineering education; precise criteria to mark, quantifying marks for each criteria, final mark validation and uniformity in marking. Like the work described here they start from a point where they define the learning outcomes they expect for their students on Glasgow Caledonian University’s (GCU) final year Engineering BSc honours project. These include both generic skills - “demonstrate problem solving skills” as well as specific engineering understanding – “show a deep and broad technical understanding of a relevant engineering topic.” Below we describe how a CRA approach was applied to our context broadly based on those described by GCU.

BE(Hons) project

The final year BE(Hons) project at the School of Engineering at AUT University is 45 credit points and studied over the course of two semesters. During the first two weeks of the academic year, students work closely with supervisors and formulate a proposal which is then moderated and reviewed by an academic panel. The purpose of the review is twofold. Firstly, there needs to be a judgement as to the rigor of the proposed project to ensure there is level 8 content likely to be applied and developed. Secondly, there needs to be an assessment of the resources required for the conduction of the project and an indication of whether other staff need to become involved for their particular expert knowledge. Once the student has had their proposal accepted, work commences on the project with continued (weekly) support from the supervisor.

Whilst this approach to the initiation of a project is probably universal across the world, models for the assessment of the conduction and outcomes differ greatly. Recently, the School of Engineering at AUT University revisited their project assessment and set about developing a more transparent and robust approach. One of the drivers for this was the significant discrepancy that sometimes existed between various assessors who each had their own experiences, subjective views and bias towards certain elements of the project. Students too, were often left in a partial vacuum with supervisors...
insisting on certain requirements that could be at odds with advice from other quarters and not necessarily grounded in fact.

**Developing assessment criteria**

If allowed to be, assessment of BE(Hons) projects can be subjective when assessment criteria are not closely controlled and written in an appropriate context. Furthermore, students require guidelines and criteria in order to be able to deliver on the requirements of the Graduate Profile. Practice does differ between universities regarding the assessment elements of a final year project but AUT University is probably not uncommon in that there is a mix of assessment elements based on oral, written and performance criteria. The precise allotment of these elements is given in Figure 1.

![Figure 1: Assessment programme for AUT's BE(Hons) final year project.](image)

The purpose of any assessment criteria under a CRA system is to allow for the evaluation of the learning outcomes and Sadler (2005) describes four models, in use in universities, which can be applied to differentiate between levels of performance. When assessing different elements (of a project) there should be different assessment criteria for each element and these should clearly differentiate between the various grades available to the student. In this case, this necessitated the development of criteria for both the final written report and the two oral presentations. It was decided not to overly define criteria in the academic supervisors report in order to allow for them to exercise their expert professional judgement. The supervisor’s (holistic rather than analytic / atomistic) assessment is based around the approach the student has taken to completing the project. It specifically examines the learning initiative, ability of the student to communicate as a professional engineer as well as rate the student achievement of the project objectives. Whilst this element is assigned solely to the supervisor there is evidence available for moderation, although not a formal part of the assessment portfolio, via the student's logbook which is a means of assessing the progress of the project.

In terms of a particular student’s project, it was decided that due to the very varied range of topics to take the analytic approach to final grading. This is to say, that the final grade is an aggregate of all the individual marks (grades) achieved throughout the project and at the end in terms of the final report. Whilst this could be challenged philosophically, pragmatically it appears to be solid and furthermore, reflects how engineers are likely to be judged when the first enter the industry. A counter argument could well be that an engineer’s primary concern is on the specific correctness of their design, calculation/analysis or conclusion, in reality these are naturally based on a much wider range of skills and approaches and the end result is very much a part of the management of the task.
As with any assessment criteria development, the ones for the BE(Hons) project needed to be robust, and hence open to challenge as well as enabling providing enlightenment to the student in order that they can fully appreciate the requirements in order to achieve a particular grade. A further consequence is that they allow for simplified post event moderation (PEM) as a particular grade has to stand up against the given criteria rather than it is compared to a grade awarded to another student. In formulating assessment criteria for the BE(Hons) final year project report an approach was taken to divide the respective criteria into eight specific grades from “fail” to “marginal fail” all the way to what would be required for an outstanding piece of work. Furthermore, in order for there to be sufficient coverage of criteria to accommodate all types of project available, the criteria developed incorporated specific elements against which the report could be graded, these included: general, literature, project management, analytical content, design, experimental approach, and presentation. Whilst all of these would be appropriate for the majority of projects in any particular year, if one or exceptionally more of them could not be successful applied then these would be dropped from the assessment schedule for that particular project. Whilst weightings could be applied to individual criteria in order to perhaps more representatively reflect the focus of a particular project, it was decided that at this point the criteria would be bedded-in and settled upon before the next step would be taken. The full criteria for the grading of the final report including the execution of the projects are given in Table 1. The development or oral assessment criteria took a similar approach to that of the report criteria although it was considered only necessary to have six grades in total and criteria which covered: relevance, analysis, support, deliver, engagement, supporting media and time management. These criteria deal with both the engineering and the communication aspects of project presentations and ensure that due regard is given each by the students and graders.

Discussion

The main problem with such work is the development of achievement based criteria that fulfil the requirements of good assessment. It would be possible to consider each of the outcomes and their attendant achievement criteria in turn but this is not the aim of this paper. We argue that by preparing and presenting criteria the subjectiveness of marking without criteria is removed. Whilst the criteria presented here are suitable for our purposes within our institutional context they are probably not transportable directly to other situations with different stated graduate capabilities. That said, they may well be a template for adoption with modification and refinement to suit particular situations.

Moving forward, these criteria will be reviewed and modified based on both the staff and student experiences. Furthermore, there will be a comprehensive analysis on the spread of grades both with these newly developed criteria and on the traditional more subjective approaches taking in the past. The results of such an evaluation are likely to reveal much about the two approaches and the findings may be useful for future dissemination to the engineering education community.

Conclusion

Whilst no claim is made to completely exclude subjectivity by undertaking the work described above it is felt that significant steps have been taken to provide, both for staff and students, a framework of expectations which, at the very least, gives focus and direction for assessment. There is still room for staff professional judgement but not at the expense of creating assessment mystery for the students. The assessment rubric presented goes some way to meeting the requirements identified by Stewart and Nesbitt (2005).

Assessment of Engineering final year projects can be a problematic task. Furthermore, the task of communicating to students the precise requirements necessary for success is often, similarly, difficult. By adopting the approach reported here, it is possible to go some way to achieving both of these tasks in a way which is transparent, fair and generally not subjective and with inherent bias.
Table 1 – Summary of final report assessment criteria for the BE(Hons) final year project

<table>
<thead>
<tr>
<th>Mark</th>
<th>Unsatisfactory Report</th>
<th>Satisfactory Report</th>
<th>Good – Excellent Report</th>
</tr>
</thead>
<tbody>
<tr>
<td>Out of 10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>03</td>
<td>Almost no work shown or reported which has been conducted</td>
<td>Aims not met. No evidence of progress or result although work recorded</td>
<td>Most aims met. Little evidence of independent thought or initiative</td>
</tr>
<tr>
<td>34</td>
<td></td>
<td>Aims largely met. A competent technician could have achieved this</td>
<td>Reasonable ambitious aims met. Ability and application required for completion</td>
</tr>
<tr>
<td>45</td>
<td></td>
<td></td>
<td>Contains something extra. Ambitions fully met</td>
</tr>
<tr>
<td>56</td>
<td></td>
<td></td>
<td>Outstanding. No student could have achieved more. Staff member quality</td>
</tr>
<tr>
<td>67</td>
<td></td>
<td></td>
<td>In the top 5% of projects. Best project of the cohort</td>
</tr>
<tr>
<td>78</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>89</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9-10</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### General
- Little or no evidence of literature.
- Comprehensive review providing a good basis for the project.
- Literature very well planned and systematically executed and recorded.
- Students able to discuss their work in the broader context of the field of literature.
- Demonstrates mastery of difficult material, and significant original thought.

### Theoretical and analytical content
- Demonstrates a little understanding and cannot relate work to the underpinning theory.
- Theory applied but not fully reflected in report.
- Through understanding of the theory and can apply this to other similar problems.
- Demonstrates comprehensive understanding of the theory even stretching the subject to some degree.

### Design
- No evidence of design engagement.
- Design conducted but flawed.
- Clear understanding of the design process. Design shows flair and innovation.
- Very clear understanding of the design process shown. Proceeded in a logical manner, considering all the options and fully justifying all decisions. Design shows considerable flair and innovation.

### Experimental
- No evidence of any experiments where these were required.
- Some success with experiments but uncertainty remains. Problems should have been overcome.
- Experiments replicated and errors estimated. Theory developed and applied. Comparisons between theoretical and experimental results.
- As 7-8 plus: experiments very carefully designed and executed demonstrating innovative thinking. Every reasonable step has been taken to verify the results and a thorough error analysis has been completed. Results may be publishable.

### Project Management & engagement with supervisor
- Complete failure in relationship with supervisor. Student effectively dropped out of the course.
- Contact maintained. Student required to complete project.
- Meetings with supervisor very productive and also involved a two-way discussion and exchange of information.
- Rigorous record of failures completed with feedback and supervisor Self management evident.

### Presentation
- Little nothing handed in which could be accepted as a report.
- Significant flaws exist in the referencing and formatting. Presentation is not consistent and errors exist with diagrams and graphics.
- The report is coherent and follows precisely the prescribed format. Well structured and very easy to follow and read. Few corrections required bringing it to a faultless report.
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References


