

## Developing robust assessment criteria for postgraduate research oriented papers

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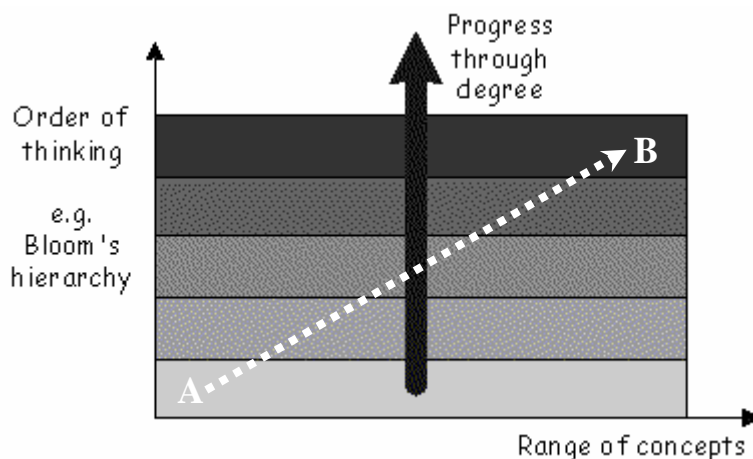
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***Abstract:** Assessment criteria designed to fully evaluate prescribed learning outcomes is a significant aid to both student and staff alike. For the student, it allows them to fully understand the requirements for a specific grade and for staff, it simplifies marking (grading) and minimises the likelihood of student appeals against assessment. Whilst criterion referencing is common place in the more traditional analytical type taught papers common in the Engineering degree curriculum it is perhaps less commonly utilised for research based papers. Presented here is a case study where both learning outcomes and achievement criteria have been proposed for a postgraduate research methodology paper which prepares students for their thesis. It has significant cross over to a descriptor for the thesis paper itself and is considered a template which could be equally applied to other subject domains where research methodology is taught.*

### Introduction

Delivery of papers based around learning outcomes has been common place in the Higher Education sector for some time. Learning outcomes are intended to give the student an indication of what they will be capable of achieving having studied and successfully completed the paper (Shupe, 2007; Tagg, 2007). These paper based learning outcomes should be linked back to either level outcomes, if they exist, (i.e. outcomes for a particular year of a degree) or to the graduate profile which the student develops over the duration of the programme. In the more analytical subjects the development of learning outcomes is relatively straight forward as the student is primarily focussing on application and analysis. However, in developing learning outcomes for research based papers where a much broader range of skills combine the student will be required to demonstrate competence in all of Bloom's (1984) cognitive domain learning objectives from Knowledge and Comprehension, through Application and Analysis, to Synthesis and Evaluation. When the further complication of delivering a higher level paper, such as for a postgraduate cohort, the exact mix of objectives and necessary self review and reflection must also be included to warrant differentiation from undergraduate papers.

It is well established, by such people as (Fry, Ketteridge, & Marshall, 2002; Moon, 2002), that students cannot merely be assessed based on learning outcomes moving up in common with the level of their degree, or for that matter postgraduate degree, as depicted in Figure 1 below, but rather through a greater mix of intentions.



**Figure 1: Simplistic view of student progression and the adaptation of Bloom's Taxonomy (Engineering Subject Centre, 2007)**

The above diagram illustrates a hypothesised relationship between 'order of thinking' and 'range of concepts' – subject content. The bold arrow represents a student's progress through a programme of study. A different arrow (in white), might start from point 'A' and end at point 'B', representing learning of an increasing range (or depth) of concepts as well as mastery of knowledge, comprehension and synthesis (Bloom's hierarchy (Bloom, 1984)).

A student's intellectual development Perry position (Perry, 1999) might also be mapped on to the above diagram illustrating the appropriate level at which a student should be operating in relation to the paper they are undertaking. Perry proposed nine stages of development ranging from dualistic, multiplistic to relativistic and commitment. Rapaport summarises the highest position, 'commitment' as 'integration of knowledge learned from others with personal experience and reflection' (2006, section 4, Para 1) clearly the level of operation expected from postgraduate students.

Recently, a review of the paper (course) entitled 'Research processes in Engineering' within the School of Engineering at AUT University resulted in a new and significantly more uniform and robust approach to the assessment through the examination of clearly defined learning outcomes appropriate to the cognitive and intellectual development level of the paper. The purpose of the paper is primarily to introduce students to the arena of research methodology but more specifically to consider how to write a research proposal. The rationale for this is obvious since before entry into the thesis element of the masters programme all students must submit a research proposal which is subject to approval by the School Postgraduate Board and ultimately by the Faculty Postgraduate Board. In previous years this had proved problematic with submissions often being late and insufficiently detailed. The paper also introduces the students to what can be expected during their thesis paper encompassing, amongst other things; the preparation of the research proposal, including general layout and content which follows the format expected during the subsequent development of the thesis itself. Lecture and tutorial topics, for the paper, start with 'what is a thesis, move through 'research question writing' and 'preparing literature' to more specific topics such as 'ethical considerations in Engineering and Science research' By the end of the paper the student is expected to not only have prepared a suitable research proposal which is sound and comprehensive in nature, but also, be fully equipped and prepared to commence work on their chosen thesis.

The outcomes for the paper are illustrated in table 1 and in the following section.

## Learning outcomes

The purpose of a learning outcome can perhaps be best summarised as: '... a statement of expectation that articulates what students will know, do or think/feel as a result of our interaction with students,

specifies how learning will be assessed, and documents the results of assessment and how those results will be used to improve learning.' Oxnard College (2006, para 3). Clearly, such a task is key to the educational development and maturity of a student and the engagement with this type of approach should be considered fundamental. Some argue that learning outcomes do not allow flexibility in delivery and give the student an insight into the assessment process which will allow all students to achieve top grades. However, in reality correctly written learning outcomes will allow for movement within a paper as they should be general in nature rather than being overly specific. Moreover, students should all be able to achieve the top grade – through knowing what is required but ultimately there will be natural differentiation by outcome as students approach things in differing ways and have differing intellectual ability. Note that we are talking about referencing against performance criteria rather than pass / fail type competency criteria referencing.

Mapping onto learning outcomes are 'Assessment Criteria'. These Criteria should be developed by considering and analysing the learning outcomes and identifying the specific characteristics that contribute to the assessment. A general model for generating good assessment criteria is that they should be:

1. specific for each task (and should have face validity(Fry et al., 2002))
2. clear and sufficiently detailed so as to provide guidance to student
3. transparent (i.e. stated in advance)
4. justifiable and achievable
5. where appropriate, supported by verbal or written statements about what constitute levels of performance.

In addition, assessment criteria should be robust and able to withstand the appeals process where students consider they have been unfairly graded. The developed criteria allow for easy differentiation by outcome making grading more a matter of benchmarking against standards rather than absolute marking resulting in improved efficiency and greater consistency.

A common approach to the incorporation of assessment criteria has been not to make them specific for each task but rather design them for generic implementation where a benchmark statement is written to encapsulate the expectations of the overall outcomes of the particular assessment. Whilst this approach has its merits, it does not go far enough in fully conveying to the student the exact requirements to achieve a specific grade. It is useful when blanket assessment criteria need to be developed for a particular programme – for instance where a postgraduate programme has specific expectations from students and these can be characterised through developing a general set of assessment criteria. Perhaps the best example of this would be where a student's performance with respect to a graduate profile (high level learning outcome) can be assessed against a generic set of criteria.

The most appropriate development of assessment criteria is for there to be a set of criteria for each specific grade available to the student for each particular element of the assessment. With this approach students have clear articulation of the specific requirements to achieve each grade at a base, rather than global, level.

## **A new paper descriptor**

The aims of the paper 'Research Processes in Engineering' are two fold:

1. To examine the role of research in developing new knowledge and provide practical understanding of the nature research.
2. To facilitate the formulation of a robust and comprehensive research proposal.

These two aims could be applied at almost any level from first year undergraduate through to a research degree candidate. What determines the level to which these aims are specifically applicable

comes in the design of the learning outcomes and these were rewritten as follows – after Anon2 (2007).

1. Formulate a workable research proposal on a chosen topic.
2. Demonstrate the principles of research within the context of a chosen topic through a research proposal.
3. Select an appropriate research design and justify its applicability through synthesis.
4. Develop and evaluate a research methodology appropriate to a research design in a research proposal.

These learning outcomes contextualise the aims of the paper and clearly define where in the hierarchy of levels they sit.

The next issue, having formulated the learning outcomes, is to design assessment criteria which allow for clear differentiation by outcome and these again need to be written with a certain level (Bloom and Perry) in mind. For instance, most assessment criteria, irrespective of level, will make some reference to presentation. However, the presentation expectations from a first year undergraduate student are significantly different to those expectations of postgraduate student. In other words, it becomes a matter of determining sub-categories for each assessment criteria which articulates the nuances relating to a particular level. In the assessment criteria presented for the paper in question here, six criteria were used each broken down into sub-criteria allowing for a clear benchmark standard to be highlighted. The assessment criteria are as detailed in Table 1.

**Table 1: Assessment criteria for the Postgraduate paper “Research Processes in Engineering” loosely based on Seymour (2005)**

<b>Assessment Criteria</b>	<b>“A” Grade</b>	<b>“B” Grade</b>	<b>“C” Grade</b>	<b>“D” Grade (fail)</b>
<b>Development...</b> 1. Strength of argument 2. Use of information to sustain argument 3. Awareness of strengths and weaknesses of approach	<i>Extremely strong internal consistency making the proposed research a convincing entity which addresses a research question. Impressive use of information gathered to support argument. Critical and reflective awareness of limitations in the development.</i>	<i>Evidence of internal consistency which relates to developed research question. Very good use of information gathered to support argument. Awareness of limitations in development.</i>	<i>Evidence of internal consistency which relates to research question but with some limitations in integration to the whole. Use of information gathered but limited in the integration of evidence. Limited awareness of the limitation in development</i>	<i>Limited evidence of consistency with the developed research question. Weakness in the integration into the whole. Argument unsubstantiated by information gathered. Limited evidence of an awareness of the limitations in the development.</i>
<b>Applied research problem, Including...</b> 1. Formulation 2. Focus 3. Rationale	<i>Very clearly formulated research question. Clear subject based focus with an excellent and convincing rationale.</i>	<i>Clearly formulated research problem. Evidence of subject basis. Clear and well thought through rationale.</i>	<i>Competently formulated research problem with some evidence of subject focus. Competent rationale developed and articulated.</i>	<i>Poorly formulated research question which does not have focus or is explicit. Rationale poorly articulated and justified.</i>
<b>Use and application of theory...</b> 1. Critical awareness of relevant theory 2. Analysis and evaluation of the state-of-the-art. 3. Grounding in theory	<i>Extensive and critical awareness of and grounding in theory. Convincing evidence of ability to analyse, evaluate and apply theory.</i>	<i>Clear and critical awareness of and grounding in theory. Very strong evidence of ability to analyse, evaluate and apply theory.</i>	<i>General clear awareness of and grounding in theory. Good evidence of ability to analyse, evaluate and apply theory</i>	<i>Some limited awareness of the grounding in theory. Little evidence of ability to analyse, evaluate and apply theory.</i>
<b>Literature review, including...</b> 1. Range and depth of reading 2. Relation to research question 3. independent research	<i>Extensive reading which has been thoroughly critically evaluated and explicitly related to the research question. Very good evidence of independent research with varied sources</i>	<i>Wide reading with critical evaluation and clearly related to the research question. Good evidence of independent research for sources.</i>	<i>Appropriate reading with some limited evaluation. Not consistently or clearly related to the research question. Some evidence of independent research for sources</i>	<i>Reliance on limited sources and a lack of evaluation. Poorly related to the research question. Little evidence if independent research.</i>
<b>Methodology, including...</b> 1. Appreciation of	<i>Very clear appreciation of relevant methodological issues.</i>	<i>Very good appreciation of relevant issues. Clearly presented</i>	<i>Familiarity with key methodological issues. Competent rationale for</i>	<i>Limited awareness of the methodological issues. Defensible rationale</i>

<p><i>methodological issues</i></p> <p>2. Explanation of information gathering and analysis</p> <p>3. Articulation of the limitations of the review</p> <p>4. Rationale for the research approach</p>	<p><i>Excellent rationale for research approach adopted and the data collection methods proposed. Extremely systematic and appropriate information gathering and analysis. Critical awareness of the strengths and weaknesses of the approach taken</i></p>	<p><i>rationale for research approach adopted and the data collection methods proposed. Very competent and appropriate information gathering and analysis. Some awareness of strengths and weaknesses of approach taken.</i></p>	<p><i>research approach adopted and the data collection methods proposed. Competent information gathering and analysis. Some awareness of the strengths and weaknesses of the approach taken.</i></p>	<p><i>presented for research approach but the data collection and proposed method is weak. Weak information gathering and analysis but sufficient information to allow for reworking. Little awareness of the strengths and weaknesses of the approach taken.</i></p>
<p><b>Presentation and expression, including...</b></p> <p>1. Accuracy of referencing</p> <p>2. Standard of presentation</p> <p>3. Appropriate and accurate use of language</p>	<p><i>Fully and appropriately referenced, well presented. Excellent use of language. Typography and spelling completely error free. Presentation standard to be submitted to a journal editor.</i></p>	<p><i>Very good referencing, well presented and clear use of language. Well formatted in terms of headings and subheadings. Minor typographical errors.</i></p>	<p><i>Generally well referenced and clear use of language. Due consideration given to formatting and layout.</i></p>	<p><i>Referencing present but with inconsistencies. Adequately well presented. Clear use of language but with significant errors.</i></p>

The provision of such a rubric, to both students and staff, overcomes at least one issue identified by Powell & McCauley (2003) in the UK. That is the situation where the ‘basic ground rules for research degree examination ... are not clear ...’ (p. 82).

## Discussion

From the developed assessment criteria utilised for the paper in consideration (which was based loosely on that presented by Seymour (2005) and is presented in Table 1) one can see that there is a clear avenue for differentiation by outcome into the four grades. There is substantive depth to the criteria in each category and it allows for clear and unambiguous benchmarks to be conveyed to the student. In terms of the assessment features, because of the large amount of self review and reflection necessary it was felt that both a research proposal and a 500 word reflective supporting document was required. This would allow for both the articulation of the process aspects through the proposal and would not deflect the specific focus by additional review sections.

In terms of marking of the assessment and grading of the two elements, this is a case of reviewing the student’s work in light of the criteria and identifying the key issues and how they have been reported. Furthermore, the approach presented obviates the need to write large amounts of feedback information to students but rather it becomes a matter pointing them towards the assessment criteria where their work lies. The student improves by working of the aspects of their assignment that is required to match the subsequent grade criteria. This results in transparency and simplification of the assessment process both for staff and for students.

Using such criteria raises one particular issue: what grade should be awarded overall once grades for each of the criteria have been decided? There are several ways of reaching this decision, each with its merits. Two possible options are: firstly, a student is awarded the grade that is achieved for the lowest of the criteria. For example if they are graded with Two As, two Bs and two Cs against the criteria in table 1 their overall result is a C. Secondly, the grades can be allocated numeric scores (A=3, B=2 and so on) and the grade scores aggregated and averaged. In the example above the student would average 12, a B. In this case the conflation of the results masks the student’s performance and the first example might be more preferable because of its simplicity. Burger & Burger (1994) conclude their review of the validity of performance-based assessment by noting that it has ‘the potential to measure important educational objectives related to indepth content and process’ (p. 14).

The decision about the awarding of an overall grade from the criteria is clearly something that needs to be shared with, and made clear to, the students who undertake the paper. In addition grading against such criteria should be used in conjunction with formative assessment in order for students to work in an ipsative way (Harlen & James, 1997). Such sharing of information with the students and the

Littlefair, G., & Gossman, P., Developing robust assessment criteria for postgraduate research oriented papers.

expectation that work will be revisited further reinforces the Perry 'commitment' position that a higher degree student should be seeking to adopt.

## Conclusion

This paper has provided an insight into the purpose of developing robust assessment criteria for a research based paper at a postgraduate level. Through considering a typical paper and understanding the various elements in writing a descriptor, the benefits and overall streamlining of the approach has been presented. Whilst there is perhaps room for deliberation and debate over the exact content of the assessment criteria and where exactly the benchmark lies, it serves as a significant leap forward and naturally requires incremental modification and refinement.

Whilst the debate about norm and criteria referencing continues in the educational world it is worth noting that the highest level of qualifications has always been criteria referenced, even if the criteria have not been overtly stated (Holbrook, Bourke, Lovat, & Dally, 2004; Johnston, 1997). The rubric presented here offers one solution for staff who are working in a similar context. However, the educational potential of this approach adopted when adopted and explained to students is worthy of further research.

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