

## Navigating a pathway

between the academic standards and a framework for authentic, collaborative, outcomes-focused thinking in engineering education

# Designing evidence-based assessment: Assuring academic standards



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## National Teaching Fellowship<sup>1</sup>

### **Navigating a pathway between the academic standards and a framework for authentic, collaborative, outcomes-focused thinking in engineering education**

#### **Program summary** (from the fellowship nomination)

The pending roll-out of Threshold Learning Outcomes (TLOs) devised by the National Learning and Teaching Academic Standards project will significantly impact curriculum design, pedagogy and assessment in all Australian tertiary institutions. By developing a transferrable framework for collaborative, outcomes-focused thinking, this Fellowship program will enable academic staff to constructively engage with the imperative for universities to enhance student learning outcomes.

First, during a Fellow-in-residence program at five Australian universities, an action-research approach will be used to support Engineering academics in designing and implementing assessment tasks that provide evidence of students' attainment of learning outcomes. This will be informed by the outcomes of an overseas study component to identify and evaluate relevant international initiatives for effective teacher engagement and curriculum reform, in the light of research findings and in the context described above.

Second, the Fellow will work as a collaborator and change agent with Heads of Schools, academic leaders including at least one course coordinator at five different types of Australian universities to support academics' effective teaching and assessment practices. The Director of the Learning and Teaching Development Unit in each institution will be informed of the Fellow-in-residence program and will be included in the dissemination and feedback cycle as a conduit to the broader institution and the Council of Australian Directors of Academic Development (CADAD).

The major outcomes of the program will be a shift to an authentic outcomes-focused approach to teaching demonstrated in the design and evaluation of assessment tasks and a set of guides and resources for mentoring, with an emphasis on supporting early- and mid-career academics.

This workshop is part of the fellowship engagement and dissemination program of activities. Further information on the Fellowship program may be obtained by email from: [w.boles@qut.edu.au](mailto:w.boles@qut.edu.au) or [h.beck@qut.edu.au](mailto:h.beck@qut.edu.au)

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<sup>1</sup> Support for this fellowship has been provided by the Australian Government Office for Learning and Teaching. The views in this workbook do not necessarily reflect the views of the Australian Government Office for Learning and Teaching.

## Workshop Summary and Objectives

Assuring the quality and standards of the learning experience and outcomes for engineering students has international significance. The development of academic standards for higher education in Australia is consistent with this renewed drive for excellence. It is therefore critical that high standards are maintained and that graduates are able to demonstrate their skills, abilities and attitudes.

This impacts not only on the design of engineering programs, but also on the preparation of academics to engage with these standards and implement them through their day-to-day teaching practice. It is therefore important to design assessments capable of providing concrete, observable, and measurable evidence of student learning.

### **Aims:**

The workshop aims to assist engineering educators to:

- Develop a systematic assessment design process, addressing learning objectives and accreditation standards, and
- Gain hands-on experience in systematically designing assessment items capable of providing evidence of learning.

### **Outcomes:**

Active participation in this workshop will:

- Provide insights into the principles of using assessment as a means for learning, and
- Obtain hands-on experience in systematically designing assessment items capable of providing evidence of learning.
- Participants will be encouraged to apply a SMART plan (Specific, Measurable, Achievable, Relevant, and Timed) for utilising the outcomes the process begun in this workshop.

## Designing evidence-based assessment: Assuring academic standards

### Workshop Program

#### Part 1

- **Introduction:** aims, and outline of activities.
- **Work groups:** Brainstorming a process for assessment design, linked to objectives and accreditation standards.
- **Applying** the design process to discipline-specific learning outcomes
- **Reporting:** Groups reporting and discussion

#### Part2

- **Summarising** a possible process from part 1
- **Work groups:** Groups work on selected assessment tasks to design, identifying the rubrics to be used.
- **Reporting:** Groups reporting and discussion
- **Take-away actions:** Participants nominate their own personal actions as a result of the workshop.

### Workshop Facilitators:

<p><b>Professor Wageeh Boles</b></p> <p>Queensland University of Technology QLD, Australia</p>	<p><b>A/Professor Mary Besterfield-Sacre</b></p> <p>The University of Pittsburgh, PA, USA</p>
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## 1. Developing an Assessment Design Process

“In *Assessment for Learning*, teachers use assessment as an investigable tool to find out as much as they can about what their students know and can do, and what confusions, preconceptions, or gaps they might have.

The wide variety of information that teachers collect about students’ learning processes provides the basis for determining what they need to do next to move student learning forward. It provides the basis for providing descriptive feedback for students and deciding on groupings, instructional strategies, and resources.”

Rethinking Classroom Assessment with Purpose in Mind, Page 29

“*Assessment of Learning* is the assessment that becomes public and results in statements or symbols about how well students are learning. It often contributes to pivotal decisions that will affect students’ futures. It is important, then, that the underlying logic and measurement of assessment of learning be credible and defensible.”

Rethinking Classroom Assessment with Purpose in Mind, Page 55  
Western and Northern Canadian Protocol for Collaboration in Education, 2006

### Group Activity 1

Consider the teaching scenario presented at the workshop (and Appendix A, page 17), and use the questions in page 6 as prompts to guide your process for designing the assessment. Use the space in pages 7 and 8 to record your responses and to write the assessment item.

1. Work in groups of allied disciplines (e.g. Civil, Mechanical, etc.) to define the details of an assessment task, considering the student’s perspective.
2. Define the knowledge, skills and attitudes you expect your students to demonstrate.
3. Address both the product (what students will produce or submit), and the process (how will students go about achieving the intended outcomes).
4. Examine the decisions you made while completing the assessment item in page 8. Did you focus on achieving students’ deep understanding of big ideas, with evidence to show for it?
5. Select one of your group members to briefly present the assessment item you designed.

## 1.1 Guiding Questions for Assessment Design <sup>2</sup>

### **WHY** is this assessment being done?

- What is its main **PURPOSE**?
- What students are given and what are they expected to achieve?
- What are the relationships to other course- or program-level objectives
- Do I want feedback on my teaching?
- Is this assessment item for motivation, revision, grading, or a combination?
- What outcome(s) will they produce?
- Are there specific ways to be used to do so?

### **WHAT** learning goals am I assessing?

- What learning goals are assessed?
- What are the main targeted knowledge, skills and attitudes?
- How are these related to the specific unit/subject/course/program objectives?
- What the students currently don't know/understand, what misconception they might have, what can they do/use to address this deficiency, or advance towards next level?
- What *don't* I need to assess?

### **How** can I choose assessment options?

- What processes or tools do I need to use?
- Does it need to be formal or can it be informal?
- How do I create multi-domain integrated tasks?
- What are the most appropriate assessment instruments?

A portfolio? A performance? A product? An oral presentation?  
 A checklist? Open-ended questions? A speed and accuracy test?  
 A formal test? A report? A combination of instruments?

<sup>2</sup> This activity has been modelled on a resource provided by the Department of Education and Early Childhood Development, Victoria, Australia, <http://www.education.vic.gov.au/>  
 Some questions are Adapted from "Evidence-Centred Assessment Design: Layers, Structures, and Terminology," R. Mislevy, and M. Riconscente, July 2005, <http://padi.sri.com> Last accessed 27/3/2012.

## 1.2 My Assessment Design Process

<p><b>WHY</b> is this assessment being done?</p>
<p><b>WHAT</b> learning goals am I assessing?</p>
<p><b>How</b> can I choose assessment options?</p>

### **1.3 The designed Assessment Item**

**Write your assessment item here (this is what the students will receive).**

#### **Comparing your process with that of other groups:**

Are there patterns that emerge across the groups?

What are they?

Why have they emerged here?

## 2. Completing the Assessment Design Process

Think about your assessment design as if you are about to build a multi-story apartment building<sup>3</sup>.

- In the first stage, the would-be apartment building exists only as an idea, far from complete but with decisions made for things like the geographic location, and budget.
- The plan would then start to be fleshed out with more detail in conversations among stake holders, but without sufficient precision to enable construction. This would correspond to discussions with those teaching the subject, program coordinator etc.
- A number of decisions are made that focus the design and provide a rough sketch of the final product, with alternatives. Consider assessment options such as individual versus group assessment, exam, lab report, portfolio, project report, etc.
- As these alternatives are debated and more design decisions are finalized, a set of blueprints would be generated in which all specifics (such as locations and sizes of windows, elevators, stairs, etc.) are determined. More details of the assessment are now determined, such as the number of questions, the criteria (rubrics), performance standards, the time o f the assessment, the weighting of the marks, etc.
- The final stage of development is the actual construction of the building, which corresponds to creating the operational elements of the assessment; that is preparing the assessment questions.
- The functioning of the actual building elements; the elevators, the revolving doors in the lobby, etc. correspond to the delivery, analysis, and reporting in an operational assessment.

### Group Activity 2

For the assessment item you designed in part 1 of the workshop, use the questions in the following page as prompts to guide your thinking about the evaluation criteria.

1. Considering your group's work in Part 1, use the questions in table 2.1 as prompts to complete table 2.2 to guide your thoughts for preparing a rubric to evaluate student learning.
2. Use Table 2.3 to write your **Rubric** in table 2.4, incorporating **evidence** and **standards**.
3. Select one of your group members to briefly present the assessment item you designed

<sup>3</sup> Based on: M. Riconscente, R. Mislevy, L. Hamel (2005), "An Introduction to PADI Task Templates," Technical Report 3, PADI Research Group. Report Series Published by SRI International.

## 2.1 *Evaluating student learning*

**HOW** do I make consistent judgements on student learning?

- What are the discipline specific and professional capabilities' elements of the evaluation **criteria**?
- What are the expected levels or **standards** and the evidence you will use to substantiate their achievement?
- How do I define and use a **rubric** and a marking scheme?
- Is there need for benchmarking or moderation?

## 2.2 *My evaluation of Student Learning*

**HOW** do I make consistent judgements on student learning?