



## The Teaching-Research Nexus

A guide for academics and policy-makers  
in higher education

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### Examples from Australian universities

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## Using Computational Mathematics to Solve Real World Problems

Professor Ian Turner  
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**Broad discipline area:**  
Mathematical Sciences

- Computational science/mathematics; data visualisation

**Year level:**

- Third year undergraduate/Honours year

**TRN strategy:**

- Drawing on your own research in designing and teaching courses
- Building a small-scale research activity into student assignments
- Designing learning activities around 'real world' research applications
- Infusing teaching with the values of researchers

**Teaching and learning context:**

- Group/team work
- Oral presentations
- Assessment item

**Brief description of the initiative:**

In the advanced *Computational Mathematics* units taken in the third year of the Bachelor of Mathematics program and Honours program, students use computers and numerical techniques to solve complex problems that do not allow analytical solutions.

Students typically work in small groups on case studies to solve topical and relevant real world problems that were aspects of the lecturer's own wider research projects. For example, students were given a small-scale problem from the lecturer's ARC-funded projects modelling water movement in porous media, such as coastal aquifer systems or the drying of wood. Students presented their solution strategies to these real world problems, both orally and as a written report, for an assignment worth 50% of the course mark.

This academic modelled the exploring, investigating, troubleshooting, problem-solving and critical thinking activities researchers engage in by discussing his own research process when working on large research projects such as the project concerning salt-water intrusion in aquifers (underground layers of permeable rock, sediment, or soil that yield water) at Bundaberg to assist water management in the region, without explicitly teaching research methods, techniques and skills. This academic also emphasised the benefits of research teams that draw on the different abilities of team members to solve the problems posed and used this to justify the use of small groups for the case study assignment.

This case study approach benefits the students because it:

- illustrates that mathematics is a transferable science that can be applied to a number of different disciplines and problems
- enables students to recognise that mathematics can be applied to important issues that need to be solved at state or national level
- enables the lecturer to infuse his teaching with the values of researchers.

**For further details<sup>i</sup>:**

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<sup>i</sup> While Professor Turner no longer teaches this course, he is happy to be contacted about the approach he used.