

## Case Study: The University of Queensland (Brisbane, Queensland, Australia)

The University of Queensland (UQ) is based in Brisbane, Australia with approximately 40,000 students enrolled across undergraduate and post-graduate programs. Established in 1909, UQ is a member of the research-intensive Group of Eight universities in Australia and a member of the global Universitas 21.



**Science at UQ:** The Faculty of Science offers a [Bachelor of Science](#) (BSc) program with 20 majors along with a series of smaller, more structured named degree programs and a suite of dual degree programs. The program has an average annual in-take of 1000 students. The entry requirement for the BSc is an overall position of 10 (OP; range of 1-25 with 1 being the top rank).

**Mathematics requirements for entry into Science:** The BSc requires Mathematics B or equivalent, which is a calculus based high school Mathematics unit. Queensland has three mathematics units, Mathematics A (basic unit), Mathematics B and Mathematics C (advanced Mathematics taken in parallel to Mathematics B).

The UQ case study focuses on the [Biomedical Sciences major](#) in the BSc, and is framed around a model of educational change based on the work of [Michael Fullan](#).



## Initiation of Change

### *“Who prompted need for QS in science and why?”*

At an institutional level, a [cycle of review for generalist degrees](#) occurs every 7 years. This prompted a substantial review of the BSc in 2007 leading to sweeping changes to the program from 2008. The review documentation was compiled into a [single, publically available document](#). A [report on the UQ BSc Review](#) process was published on the Australian Universities Quality Agency good practices website as well.

During the institutional review process for the BSc, QS were recognized as a core attribute for UQ science students. Inspired by [BIO2010](#), building QS across all majors in the BSc became a stated goal for the curriculum. In the Biomedical Sciences, the belief that QS were an essential attribute was widely accepted.

## Vision for Change

### *“What do QS in Science look like?”*

At an institutional level, [University-wide graduate attributes](#) were first developed in 1996 with a series of reviews and subsequent modifications.

The BSc Review, building on the University-wide graduate attributes, established a set of Science-specific graduate attributes, listed on page 247 of the [BSc Review document](#).

More broadly, the 2006 BSc Review committee listed 12 recommendations, the first three of which explicitly addressed QS in Science:

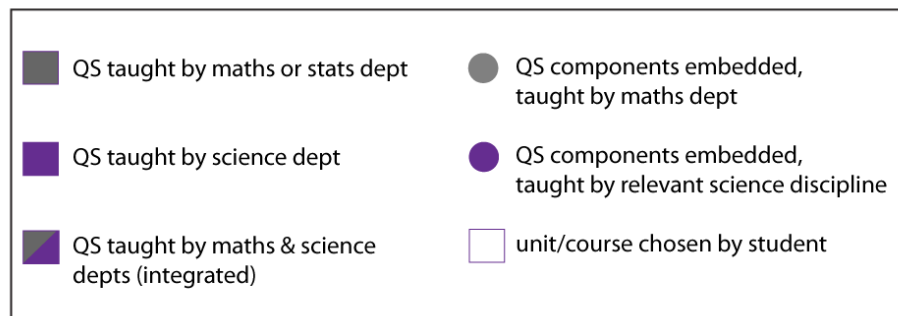
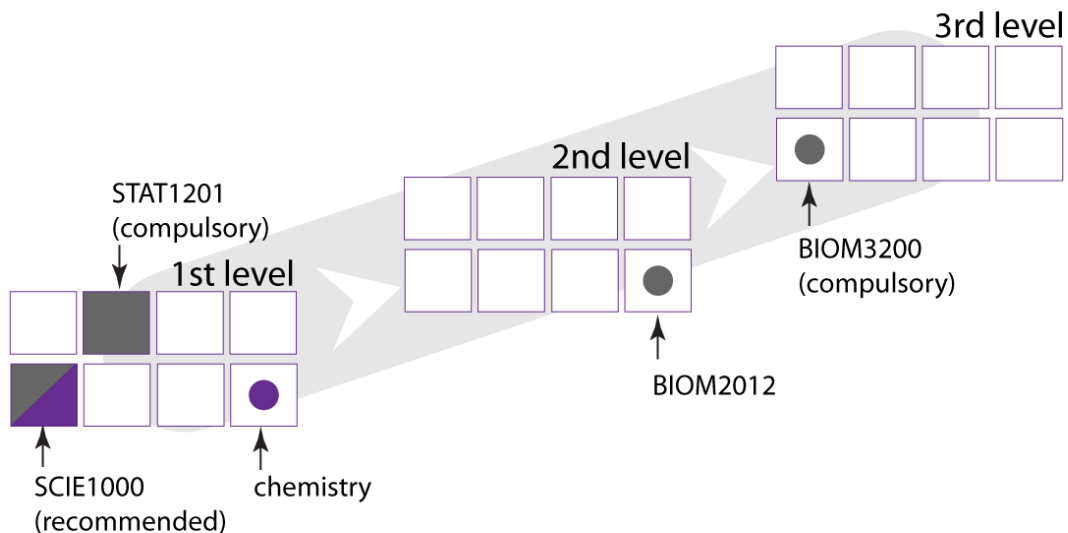
1. Development of a proposed structure that focuses more on the quantitative and information aspects of science, in which all students are required to take the courses entitled (i) Foundations of Science (SCIE1000) and (ii) Analysis of Scientific Data and Experiments (STAT1201).
2. A concerted effort to teach a range of courses in a more interdisciplinary manner, rather than as isolated entities.
3. Strong recognition that mathematics, physics, chemistry and biology are enabling sciences and this is reflected in the expectation that all students who graduate with a UQ BSc will have achieved a level of competence in all of these areas.

In the Biomedical Science major, a team of academics drafted a set of major specific attributes that explicitly included QS, which are listed on page 252-253 of the [BSc Review Document](#).

## Implementing for Change

*“How is need for QS in Science translated into practice?”*

The Biomedical Science major in the BSc recommends a common first year for students and then includes some core units with greater flexibility to choose electives as student progress in upper levels of study.



**1<sup>st</sup> level** features a highly recommended interdisciplinary Science-Mathematics unit, [SCIE1000: Theory and Practice in Science](#), introduced in 2008. [Statistics](#) is a compulsory unit for all BSc students. Prerequisites for the major include chemistry, which relies on a high level of QS, and two biology units, neither of which relies heavily on QS. The first year study planner is posted [online](#).

**2<sup>nd</sup> level** features a breadth of choice with the philosophy that QS will be embedded into the Biomedical units. From 2011, QS is explicitly incorporated into one of the core units, [System Physiology](#), with a statistics lecture teaching into the unit.

**3<sup>rd</sup> level** features a breadth of choice with the philosophy that QS will be embedded into the Biomedical units. A [capstone unit](#) is required for ALL Biomedical Science majors in the BSc and includes a substantial QS component.

**Extra Curricular QS:** The University has some support structure for BSc students needing assistance in QS-related learning such as:

- [First Year Learning Centre \(FYLC\)](#) – is run by the School of Mathematics and Physics and is open to assist in all first year units taught by the department.
- [Peer Assisted Study Sessions \(PASS\)](#)-is offered in first year statistics, chemistry and biology and offers students additional weekly study sessions facilitated by 2<sup>nd</sup> and 3<sup>rd</sup> year students.

**Interdisciplinary QS:** Sporadic, individual interdisciplinary collaboration is common at UQ. However, the concept of systemic adoption is now gaining grounds and being explored through the initiative of the Faculty of Science.

## Evaluating the Change

*“How effective has the change to build QS in Science been?”*

Institutional standardised evaluation procedures are in place at UQ, including general unit surveys.

**Evaluation of QS specifically has been under-taken at a few levels**

**Unit level: QS in level one interdisciplinary unit (SCIE1000: Theory & Practice in Science)**  
Research investigating the impact of learning mathematics in the context of science was completed during the first iteration of the unit ([Matthews, Adams and Goos, 2009](#)). Evaluation of SCIE1000 among biology students was conducted by Matthews, Adams, & Goos (2010). (Fig 2.)

**Program-level: QS learning outcomes in the new BSc**

A research project into the implementation of capstone units in Biomedical Science (publications in progress) has resulted in a benchmarking project across UQ and Monash. This involves the administration of the Science Students Skills Inventory (SSSI) which explores graduating students' perceptions of their attainment of science specific learning outcomes including QS.

Outcomes of the 2010 benchmarking will be published online under [2011 proceedings](#) in September.

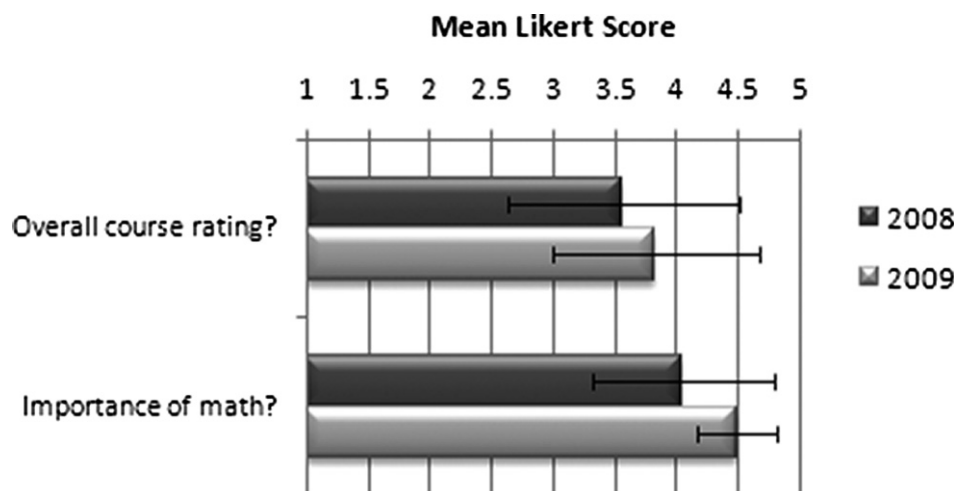


Fig 2. Biology student perceptions of SCIE1000 in 2008 and 2009 on a 5-point Likert scale with standard deviation. The first survey question was, Think about your whole experience in this course. Overall, how would you rate this course? (1 \_ poor, 5 \_ outstanding). The second survey question was, How important do you think mathematics is in science? (1 \_ not at all important, 5 \_ very important). Source: [Matthews, et al.\(2010\)](#)

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Thanks to the following people at Macquarie for collaborating with us to document this case study:

- [Peter Adams](#), Associate Dean Learning and Teaching, Faculty of Science
- [Jon Curlewis](#), Assoc Prof, Biomedical Science, School of Biomedical Sciences, Faculty of Science
- [Michael Bulmer](#), Senior Lecturer in Statistics, School of Mathematics and Physics Mathematics, Faculty of Science

If you have any questions, comments or thoughts on the UQ Case Study, you are welcome to contact them directly.

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This case study is up to date as of August 2011. The interviews to gather this data were conducted in May 2011.