Evaluating undergraduate research experiences

Context

I introduced was a research-integrated learning stream into a stage two biochemistry course. This stream provided 50 interested students from the large course over 300 students with an experience of research that is normally reserved for an honours year. The initiative aligns with the UNSW 2025 strategy to “embed research-integrated learning into all programs”. It also acted as a reference case for a federally-funded Office of Learning and Teaching project led by Associate Professor Susan Rowland, University of Queensland, on research experiences within large undergraduate science courses.

I decided on a bifurcated model for the research experience, with some students in the course electing to participate in traditional laboratory classes, and others applying for the research experience. Students in the research-integrated stream carried out experiments in their weekly laboratory classes to investigate the regulation of glutathione biosynthesis in Saccharomyces cerevisiae. Prior to each class, methods were optimised using wild-type strains by the technical staff member, but otherwise the results remained unknown to both staff and students until the conclusion of each lab. This aspect was key to the project’s success, as each week the experiments contributed to a body of data for interpretation, contrasting to the traditional laboratory where results are predetermined.

Tool

To evaluate learning, in the first iteration of the stream student perceptions were collected using a post survey, comprising students that elected for the research stream (n=35) and those that did not (n=175). The survey tool was an adapted Undergraduate Research Student Self-Assessment survey (URSSA), designed for internship-style research experiences. The survey investigates skills acquisition, awareness of the practice of scientific research and future plans.

Reflective responses from the research stream students (n=35) were analysed using an inductive method that focused on identifying the aspects that were either a help or a hindrance, and informed changes made to the subsequent iteration of the course.

Results

Quantitative

Questions on the theme of “thinking and working like a scientist” showed the research stream students students reported the highest frequencies (62.9%, n=22) of “good” and “great” gains for “displaying data in a scientific format” and “communicating the outcome of an experiment.” When investigating professional identity, such as whether students have a sense of belonging and ownership in their research activities, there were significant differences between the research stream students and the traditional-laboratory cohort for the items “engage in real-world science research”, “try out new ideas or procedures on your own”, “feel responsible for the project” and “work extra hours on the project”. The research stream students reported the highest percentage of gains for the items “engage in real-world science research” and “feel like a scientist”.

When looking at personal gains related to research work and gains in skills, the research stream students reported significantly higher gains for “understanding what everyday research work is like” and “keeping a detailed lab notebook” (a practice encouraged, but not assessed for the research stream). No significant differences were reported between groups for items related to their interactions with the lecturer and tutor during class and working with their peers (in and outside class). Of interest, the research stream students reported significantly higher gains for the item “my research experience has prepared me for postgraduate research (including honours).”

Qualitative

Reflective responses from the research stream students (n=35) were analysed using an inductive method that focused on identifying the aspects that were either a help or a hindrance, and informed changes made to the subsequent iteration of the course. Two thirds of students (66%) suggested an improvement and some of these suggestions I implemented the following year, such as including more timeslots for explanation and discussion. Over a third of students (37%) described gaining a personal benefit from the experience. Students reported skills acquisition (34%), including both technical and non-technical skills, such as using literature and writing a laboratory report. Many students (54%) made comments related to experiencing “real” or authentic research, and their appreciation for its challenges.

Impact

The results indicated introduction of the research stream achieved its aim of offering a lower stakes “taster” experience for students before committing to a lengthy research program, with students feeling engaged in real-world or authentic research. Results also demonstrated the students in the stream felt they were more prepared for an honours year or postgraduate study, meeting the school aim of the initiative.

References

Slides to selected presentations available on request:

LeBard, RJ A team approach to research-integrated learning *Bioscience Education Australia Network*, Australian Academy of Science, Canberra, Australia, November 2016

LeBard, RJ; Habeeb R; Lawandos A, 2016, Embedding research-integrated learning into a large biochemistry course. *UNSW learning and teaching forum,* October 2016.

LeBard, RJ An authentic large-scale research experience*. UNSW Engineering Faculty Education Event*, UNSW, October 2016

Kappler, U; Rowland, S; LeBard, RJ; Lawrie, G; Pedwell, R and Howitt, S ALURE: The apprenticeship-style large-scale undergraduate research learning experience. *HERDSA Conference*, Melbourne, Australia, July 2015

Recommendations

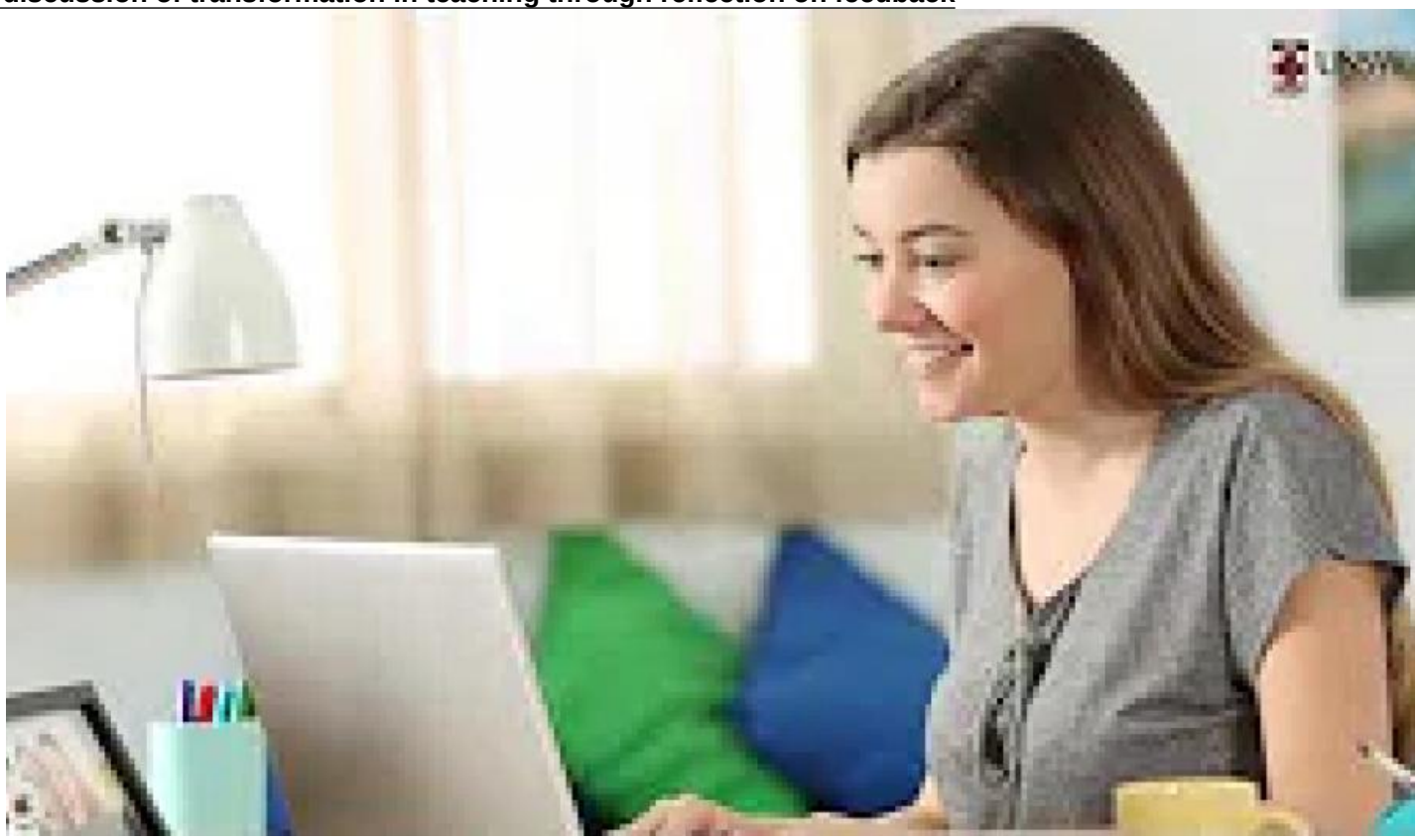
Watch video
Evaluating student essays using an innovative Moodle-based tool

Watch video

Assessing novel teaching tools that assist student learning in online health studies courses

Watch video

A discussion of transformation in teaching through reflection on feedback



Watch video

Evaluating gender based learning gains in Physics Education

Watch video

Evaluation of a novel way to build online resources