



Engaging students through authentic research experiences

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Introduction

Student involvement is vital to engagement, making learning experiences more meaningful, and can be enriched by student-faculty interactions and diversity of learning environments (Smith et al. 2005). Experiential learning, in particular ‘hands on’ opportunities, can enhance undergraduate experiences and engender increased enthusiasm for the subject, as well as confidence on the part of students that they are being adequately prepared for science-related careers or postgraduate study (Gawel and Greengrove 2005). At the same time, quantifying the positive influence of student engagement with learning through authentic research experiences can be difficult (Griffiths 2004).

Despite curricula emphasizing student-led enquiry, some students still struggle to find relevance and excitement in their undergraduate courses. Working from the Garnett and Holmes’ (1995) model of how both students and academics can benefit from research, we have designed an incremental suite of learning activities across the three years of the zoology undergraduate curriculum that extends and enhances the student experience. The aims of the program are to extend and challenge our undergraduate students by exposing them to current ‘hot topics’ in zoological research; enhance students’ appreciation of methodology, philosophy and outcomes of scientific research; enthuse students about the exciting research being carried out in zoology in Tasmania and encourage them to think of themselves as the researchers of the future. Here we describe several components of this program (summarised in Figure 1) which have been implemented and evaluated via student feedback.

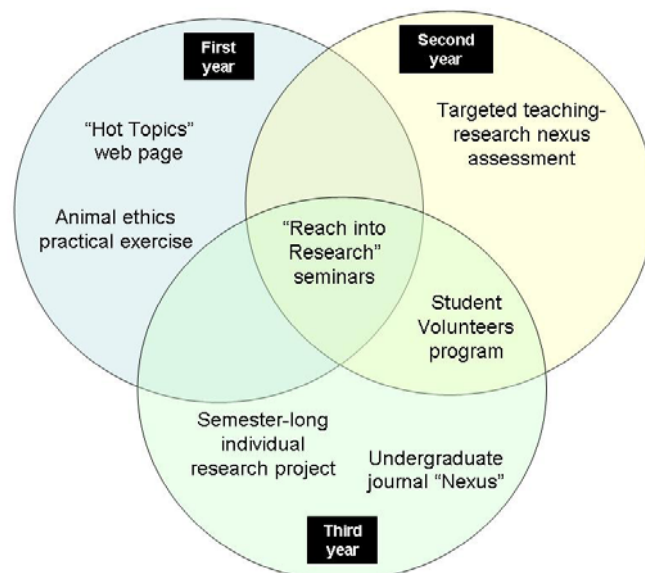


Figure 1

At first year level

All first year students (approximately 200) are invited to engage with the on-going research of the School of Zoology in a range of settings. A primary consideration here is providing extension material without overloading students new to university learning. Opportunities include an



introduction to the use of animals in research (run as an interactive workshop-style practical session). Students put themselves in the position of researcher, considering experimental design and animal ethics to complete an animal ethics application form, guided by postgraduate and academic staff researchers.

Throughout the year, students are also encouraged to interact with a purpose designed web portal (<http://www.zoo.utas.edu.au/rir/rir.htm>) with links to 'Hot Topics' in Zoology related to lecture material, and are invited to attend 'Reach into Research' seminars held several times each semester (<http://www.zoo.utas.edu.au/rir/rir2&3.htm>). In these seminars, invited speakers from industry, collaborating institutions, and even School of Zoology PhD students present their research, and then all non-undergraduate audience members except the facilitator leave the room. The idea is to create an environment in which undergraduates can interact with and question the presenter, without feeling intimidated by the presence of teaching staff.

At second year level

From second year onwards, all students (approximately 70) are invited to participate in our Student Research Volunteers program (<http://www.zoo.utas.edu.au/Staffpg1/summvolunteer3.htm>): volunteers are matched with research mentors, usually Postgraduate or Honours students in the School, for short-term, in-house research placements that may offer either laboratory or field experiences ranging from half days in the laboratory to 10 day camping field trips around Tasmania. In 2005/2006, 13 undergraduates participated, while in the second year (2006/2007), the number of participating undergraduates volunteering to help with research projects rose to 34. the beauty of this part of our program is that it attracts not just the top students strategically looking for research experience before Honours, but many students who routinely perform less strongly academically, allowing them to see a career in Zoology as something they could realistically achieve. Evaluation surveys support this and have been overwhelmingly positive:

'It made me see a future for myself as a research scientist, it made what all our lecturers talk about seem like a possibility rather than a myth!...It was a fantastic opportunity to gain some hands-on experience which I think is one of the most valuable learning tools there is'

Research-led teaching also plays a direct role in the second year assessment process, in which real, unpublished experimental data is given to the students for guided analysis and preparation as a manuscript for publication. The exercise extends over several weeks, with interactions in a workshop-style practical session, a follow-up tutorial, and one-on-one discussions for feedback and 'fine-tuning' if required, modelling the reality of the manuscript preparation process.

At third year level

Third year teaching in the School of Zoology focuses upon developing our students' scientific research skills through learning activities such as group research projects, critical reviews of current literature, writing research grant applications, lectures from scientists outside the school, and training in scientific communication (approximately 70 students). Such individualised research opportunities are advocated by Baum et al. (2006) as positively affecting career planning. Our third year students are offered multiple "real-life" research experiences through novel and self-designed group and individual research projects, in addition to Undergraduate Volunteer Program experiences. Further, in 2007 we introduced the Zoology Research Unit (<http://fcms.its.utas.edu.au/scieng/zoo/unitdetail.asp?UnitId=3349>) into the third year curriculum in which individual students are matched with an academic supervisor to complete a semester-long research project. The impact of this unit is yet to be evaluated.



An opportunity for building on previous experience in writing for publication is the Nexus Journal of Undergraduate Science, Engineering and Technology (<http://www.utas.edu.au/scieng/nexus/>). Academic staff nominate a student whose high quality work is able to be formatted as either a research paper, a review article, or a short paper, and then act as a mentor throughout the process of drafting, reviewing and preparation of the work into publishable format in Nexus, Australia's only undergraduate science journal.

Nexus also serves to highlight the intersection and inter-dependence of the endeavours of research and those of teaching and learning by emphasising the essential inclusion of research material in undergraduate classes, and additionally by illustrating the transition of study into research and publication. Professor Jim Reid (Dean, Faculty of Science, Engineering and Technology, University of Tasmania)

At honours and postgraduate level

The authenticity and perceived value of the volunteer research experiences is evidenced by our increased intakes into our Honours program since this project began in 2005/6. Figure 2 shows Honours student numbers from 2000-2007, with an obvious decline in recent years, prompting our efforts to improve student retention and recruitment into the honours program. A current honours student has told us that undertaking honours study this year is, for her, the direct result of a Reach into Research seminar attended as an undergraduate – the guest speaker became her honours co-supervisor. This comment is typical of informal feedback gathered from the current cohort of honours students.

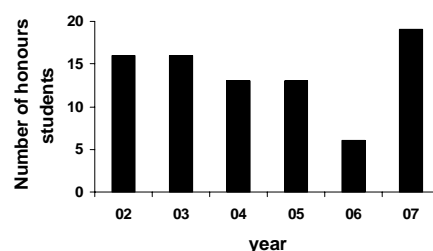


Figure 2. Honours student numbers

In addition to the incremental design of exposure to opportunities to engage with zoology research offered to undergraduate students, the program also provides current honours and postgraduate students with the opportunity to serve as role models and mentors to undergraduates. They learn about the responsibilities of briefing volunteers on safety and risk assessments, about leading a research program, and have the opportunity to share their research and the ideas behind it with interested undergraduates. A Postgraduate student who offered placement to two undergraduate volunteers was pleasantly surprised about the benefits to herself:

'I offered to have volunteers as after trying to look for volunteer work in Africa I knew just how hard it is to get volunteer work unless you have a fair bit of volunteer experience behind you. With this in mind, I expected for the volunteers to actually be more work for me, and cost me time. I was incredibly wrong... Once I'd trained them up in relation to these animal husbandry skills they saved me so much time, and provided me with company and constant interesting and intelligent questions about my research.'



Outcomes

A step away from the ideas behind conventional research-led teaching (Holbrook and Devonshire 2005), this program aims to show students what ‘could be’, and to clarify the path from first year studies through to Postgraduate research or discipline-oriented employment, which traditional teaching programs sometimes do not facilitate (Regassa and Morrison-Shetlar 2007). This is tangibly demonstrated in the short term by increasing Honours student numbers, but continued evaluation is required to strengthen this assertion over the medium to long term. In keeping with the premise that undergraduate students display deeper learning when actively involved (Healey 2005), in the coming one to two years, we hope to see an increase in retention rates into second and third year undergraduate programs (including increased enrolment in non-core second year units), and also to foster a culture of support, community, and positive interaction between academic staff and undergraduate students in Zoology.

References

- Baum M.M., Krider E.S. and Moss J.A. (2006) Accessible research experiences: A new paradigm for in-lab chemical education. *Journal of Chemical Education*, **83**, 1784–1787.
- Garnett, P. and Holmes, R. (1995) Research in teaching and learning: a symbiotic relationship. In: B. Smith and S. Brown (Eds). *Research, teaching and learning in higher education*. (49–57). London, Kogan Page.
- Gawel, J.E. and Greengrove C.L. (2005) Designing undergraduate research experiences for nontraditional student learning at sea. *Journal of Geoscience Education*, **B**, 31–36.
- Griiffiths R. (2004) Knowledge production and the research-teaching nexus: the case of the built environment disciplines. *Studies in Higher Education*, **29**, 709–7251
- Healey M. (2005) Linking research and teaching to benefit student learning. *Journal of Geography in Higher Education*. **29**, 183–201.
- Regassa L.B. and Morrison-Shetlar A.I. (2007) Designing and implementing a hands-on, inquiry-based molecular biology course. *Journal of College Science Teaching*. **36**, 36–41.
- Smith K.A., Sheppard S.D., Johnson D.W. and Johnson R.T. (2005). Pedagogies of engagement: Classroom-based practices. *Journal of Engineering Education*, **94**, 87–101.

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