

# Introduction of inquiry-oriented activities into Biology of Animals: A first year unit at the University of Tasmania.

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## **Introduction**

The first year experience can be an overwhelming one for many reasons and early negative or boring experiences can result in reduced student engagement, motivation and retention. Our overall aim was to introduce hands-on inquiry-based exercises to a first year zoology unit to create a more positive and relevant learning environment for our students (Vernon and Blake 1993<sup>1</sup>).

The unit selected was Biology of Animals (KZA 161) this unit provides an introduction to the scientific study of animals. Students are introduced to the characteristics of the major invertebrate and vertebrate phyla from the perspective of an evolutionary interpretation of diversity. Lectures in comparative animal physiology, with an emphasis on Australian examples, provide a functional basis for an understanding of animal adaptations. In 2012 there were 290 students enrolled in the unit. The student base was broad and diverse, including international and mature-aged students, incorporating service teaching into multiple degree programs including Biotechnology and Biomedical Research, Agricultural Science and Natural Environment and Wilderness Studies.

Student feedback on the unit through the UTAS formal process of unit evaluation (Student Evaluation of Teaching and Learning, SETL) is overwhelmingly positive. However, our own qualitative assessment of examination results suggest that students do have difficulty dealing with the quantity of information they need to learn, and in seeing the big picture amongst a wealth of detail. We thought this problem could be alleviated if the students had a better understanding of the 'evolutionary story' presented across the unit, i.e. if there were a greater emphasis on the evolution of animals from earliest to more recent rather than a 'snap-shot' approach to each taxon.

Our specific aims were to modify two existing practicals, the first critical practical of the semester and a flexible-learning practical on the Phylum Mollusca. Dr Regina Magierowski developed the practicals with assistance from Dr Ashley Edwards and mentoring from Prof. Sue Jones. Zoology's laboratory manager Kate Hamilton was involved with developing and road testing new teaching materials and past and

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<sup>1</sup> Vernon, D.T.A. and Blake, R.L. 1993 Does problem based learning work? A meta-analysis of evaluative research. *Academic Medicine* 68(7): 550-563.

present PASS (Peer Assisted Study Sessions) tutors (Ben Haliwell, Ee Jon Yeoh and Bianca Deans) tested new teaching materials and provided feedback and fresh ideas. The students of KZA161 completed a feedback sheet and some participated in a focus group session with Assoc. Prof. Les Kirkup after completing their mollusc practical.

## **Methods**

### **Introduction of a self-paced activity to week 1.**

Students were asked to access (online) an interactive application “Introduction to Microscopy” recently developed by Dr Fiona Bird and team from the Department of Zoology at La Trobe University. Once the students had completed the activities within the application they were asked to complete a small inquiry-orientated activity within the first-year zoology laboratory.

The activity achieved a number of aims:

1. Shifted much of the introductory material from their first practical (week 2) into week 1. This provided more time for inquiry-orientated activities in week 2.
2. Encouraged students to come into the first year laboratory and meet their practical coordinator (Regina Magierowski) in smaller groups.
3. Gave the students the opportunity to complete their first piece of practical work in a less intimidating environment.
4. The inquiry-orientated component of the activity encouraged the students to get hands-on and thinking in the first week of semester.

### **Redevelopment of Practical 1 (Week 2)**

The aim of this re-development was to get students thinking/talking and excited about the evolutionary story about to unfold in lectures. Lectures were modified to include more in-depth coverage of the topics of natural selection and adaptation. These are important concepts to understand in this unit which covers the characteristics of the major invertebrate and vertebrate phyla from the perspective of an evolutionary interpretation of diversity.

Having students gain basic microscope skills through a self-paced activity in week 1 rather than during formal practical time freed up space in the first formal practical class (week 2) to implement an inquiry-orientated activity on freshwater invertebrates. This activity added a little fun to their first practical session and covered important concepts like natural selection and adaptation. The practical included a number of challenging questions that encouraged the students to think about diversity within this interesting group of organisms and how this practical would help them to understand the differences among the major animal groupings covered in the unit.

### **Redevelopment of an existing flexible practical on the molluscs (week 8)**

We redeveloped an existing flexible learning practical on the phylum Mollusca to make it more inquiry-orientated. During the redevelopment we held a focus group

session with past students and PASS leaders to discuss implementing inquiry-orientated activities into this practical. The aim was to test some of our ideas on this group. The group also came up with some great suggestions that were then incorporated into the practical.

To help us gauge the success of our redevelopments the students were asked to complete a short survey after they completed this practical. Les Kirkup visited this week and led a focus session with a small group of students to further gauge their response and feedback to the new practical.

### **Other activities**

- The grant allowed us to purchase new display material (e.g. prepared slides and animal specimens) and technologies for the 1<sup>st</sup> year laboratory.
- Regina and Ashley contributed to staff meetings in Zoology on implementing other inquiry-orientated activities into zoology units.
- We added an inquiry-orientated component to our demonstrator training workshop.
- Regina has begun developing an existing osmosis practical in a zoology foundation unit to make it more inquiry-orientated.

### **Analysis**

Student feedback in 2012 through the UTAS formal process of unit evaluation (Student Evaluation of Teaching and Learning, SETL) was again very positive (scores on average were >4 out of 5). We can also report that in comparison to 2011 student retention was proportionally higher and there was a clear improvement in final results.

Les Kirkup reported that focus group of students (9 students) spoke extremely positively about the flexible mollusc practical, concluding that the students had fun, engaged deeply and learnt more in comparison to more traditional practicals. He also reported that the students enjoyed the challenge of this practical and while it made them nervous they enjoyed the introduction to experimental design. This was encouraging as one of the particular challenges for redeveloping this unit was how to incorporate inquiry-orientated activities into a unit that has no experiments. We decided that we could help the students develop the skills necessary to participate in inquiry-orientated activities by focusing our redevelopments on flexible learning, group participation and the basics of experimental design (students were encouraged to form hypotheses and think about how they could design experiments to test these).

The survey conducted after the mollusc practical was completed by 119 students and was therefore more representative of the overall class response to the practical. Common responses among students included:

- They liked the flexible nature of the prac (no time pressure and opportunity to work in groups) and the opportunity to be creative and make decisions

independent of teaching staff.

- They didn't like the reduced opportunity for feedback and reassurance from demonstrators and some needed more detailed descriptions of what that had to do.

### **Conclusions**

Overall the developments to KZA161 were successful and appeared to get students enthused, thinking and participating right from week one. Incorporating inquiry orientated activities encouraged the students to think independently and helped them to understand the big picture in this unit. Student retention in this unit was proportionally higher in 2012 than 2011 and we saw an improvement in final results. We believe that this was due in part to the developments we made to improve links between the lectures and practicals, the incorporation of an evolutionary narrative and because the incorporation of inquiry-orientated activities fostered a friendly atmosphere where students felt comfortable approaching teaching staff and asking questions.

To further improve the first year experience we need to continue to develop the practicals in this unit and think more about how we can give students the skills to be independent and more confident in their own abilities. Our first job will be to address some of student's concerns about the new mollusc practical. While most students enjoyed this practical there was a clear need for additional guidance about what they needed to do and for additional teaching staff to provide feedback and help keep them on track.

This first step was encouraging and we plan to continue to look for opportunities to incorporate inquiry-orientated learning into other zoology units.