ANU Vice-Chancellor’s Award for Teaching Excellence 2009

Nominee Details
Christopher Fulton
Evolution, Ecology & Genetics,
Gould Building 116 Daley Rd,
Research School of Biology,
College of Medicine, Biology & Environment
The Australian National University
T: 6125 9892
F: 6125 5573
E: christopher.fulton@anu.edu.au

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Curriculum Vitae (3 pages)
References (2 pages)
   1. Prof. Bill Foley (Head, Evolution, Ecology & Genetics, Research School of Biology)
   2. Prof. Scott Keogh (Evolution, Ecology & Genetics, Research School of Biology)
Evaluation Information (4 pages)
   BIOL3116: Marine Ecology (sole convener & primary lecturer)
   EMSC3019: Carbonate Reef Field Studies (co-convener & primary lecturer)
   EMSC1006: The Blue Planet (contributing lecturer)
   BIOL2111: Australian Vertebrates & BIOL2112: Marine Biology (guest lecturer)
1. Synopsis

Chris Fulton builds student understanding of the marine world by using a problem-based approach to teaching marine science. Adapting his learning activities around student perceptions of marine environmental issues, Chris uses personal relevance to engage students with the science behind each issue. Emphasizing how marine science provides the tools to understand and solve real-world problems, Chris aims to give his students the skills and confidence to make their own judgement of the evidence and clearly convey their arguments. Chris’ student-centred approach and novel interactive activities have fostered outstanding student engagement and removed mismatches in student-teacher perceptions. Developed from his experiences as a young researcher and media communicator and his research of teaching-learning phenomena, Chris’ approach has influenced other teachers across the ANU. In recognition of his outstanding contributions to science education and communication, Chris received Fresh Science and Young Scientist of the Year Awards in 2008 and an ANU Colleges of Science Teaching Excellence Award in 2009.

2. Overview

In my teaching of marine science I focus on key issues that have personal meaning for students (e.g. How do you choose a sustainable seafood species to buy and eat?). Starting from this point of relevance – why we need to know – I motivate students to engage with the marine concepts, evidence and research methods they can use to better understand such problems. Combining clear communication, novel activities (e.g. virtual underwater census, lecture discussions, role-playing press conference) and my personal enthusiasm for the topic, my student-centred, problem-based approach has earned me the title of “myth-buster” – pointing to the fundamental changes in how students view the marine world as a result of their learning from my teaching.

Taking the perspective that science students are the future producers of knowledge, policy writers and decision makers in our society, I aim to provide both the skills and confidence they need to evaluate evidence and form their own judgments. I strive to give students the communication skills they need to publicly convey their arguments with clarity, regardless of the complexity of the topic (marine-related or otherwise). Embracing the fact that each student can have a different perspective on a problem, I reward and encourage independent thinking via student-focused assessments and formative feedback in multiple settings. I strive to remove mismatches between student-teacher perceptions arising from issues of communication, by treating lectures as conversations, tutorials as interactive discussions, and pivoting assessment tasks around student interaction.

Since 2006 my engagement in teaching at the ANU has involved convening the interdisciplinary Marine Science program, coordination and teaching of five undergraduate courses, and supervision of numerous student research projects. My approach to teaching has been informed by my experiences as a young researcher and public communicator, my educational training (Grad Cert Higher Education), and my research into teaching and learning phenomena. I provide examples below to illustrate how my approach to teaching has a wide-ranging impact on students by making marine science accessible, enjoyable and relevant to their lives and careers.

3. Selection Criteria

a. Approaches to teaching that influence, motivate and inspire students to learn

Why should students care about marine science? Answering this question is one of my key concerns when designing teaching and learning activities that forge a connection with students and trigger their intrinsic motivation to engage with the topic. Making such connections involves finding personal relevance and meaning. This can be problematic for marine science, given the heavy abstract theory, unglamorous experiments on sea stars and mussels, and the fact that marine processes aren’t easily seen and touched by students in a land-locked classroom. To address this problem, I arrange my course activities around key issues or problems facing marine ecosystems (e.g. overfishing, coral bleaching), then introduce the relevant theories and evidence as the tools needed to understand such problems. Combining relevance with student-led discussion, I am able to foster student’s personal interest and engagement with new ideas and concepts in marine science.
**Engaging students through personal relevance**

Students are generally curious about how fisheries are managed and how overfishing can occur. However, fisheries science is heavy in mathematical models, abstract assumptions and statistical analyses that make the concepts very difficult for students to engage in without sufficient motivation. So to start off a lecture series on fisheries science, I ask my third year class: *How do you choose a sustainable seafood species to buy and eat (mussels, oysters, fish, prawns)?* Class discussion often ranges widely, then settles on a need to understand the biology of fished species, methods of capture and how we decide catch sizes. Putting these student-led priorities on the board, I then link relevant theories, case studies and other evidence to each of these points so students can fit each piece into the jigsaw of how they understand the seafood industry. Generating a personal need to understand, I stimulate a student-led desire to engage with fisheries science and build the concepts into their understanding of real-world issues, e.g. “*I finally see why total allowable catches led to such a dramatic collapse of the Orange Roughy fishery*” (BIOL3116 student online post, 2008). Using this approach, I guide students towards a fundamental shift in their thinking about fisheries, from an initial view that “some ways of fishing are bad,” to an evidence-based appreciation of why some ways of fishing are less sustainable than others.

**Lectures as interactive conversations**

Finding personal meaning requires students sharing their thoughts and views. Treating lectures as conversations, I start off with a class discussion on what we understand about the topic. Such discussion brings up examples that have personal relevance to students so I can gauge their current perceptions. I then link these examples in my presentation of the topic in shaping them towards a new and deeper understanding of the marine world. For instance, I ask first year students in The Blue Planet: *Why should we care about plankton?* Many answer that plankton are tiny creatures eaten by larger (more exciting) animals. Adapting my lecture to suit, I link the concept of marine primary production with the notion that plankton support oceanic food webs. However, I build on this to illustrate how phytoplankton also keep land-based organisms alive by producing ~60% of the world’s oxygen supply. By extending the importance of tiny plankton to organisms small and large (including humans), student thinking about plankton shifts towards a more global appreciation of their impact. Evidence of these fundamental shifts can be found in the fact that students see me as a marine science myth-buster: “*Myth-busting*” – “Interesting myths were busted, e.g. whales and lung compression” – “The fact that we have explored only 0.016% of the ocean blows my mind!” – “*Who knew plankton could be so cool?*” (EMSC1006 student surveys, 2007-2009).

Viewing lectures as a forum for two-way student-teacher interaction allows me to emphasize and confirm changes in student understanding. With this goal in mind, I developed a method that seeks to consolidate student understanding in each and every lecture. Nicknamed the “summary slide” by my students, at the end of the lecture I put up one or two key questions that relate to the main idea(s) I intended to convey (e.g. *Why is prawn trawling unsustainable?*). I then ask for several of the students to give their version of the answer and we discuss. This approach has provided two things: (i) a way of judging whether each lecture has delivered my intended change in student perceptions; and (ii) a regular opportunity for students to discuss and defend their ideas on marine concepts, promoting student confidence and independent thought. Several measures suggest that this has a significant impact on student learning: (i) increases in lecture attendance ranging from 50% (BIOL3116) to 70% (EMSC1006), (ii) a doubling of online discussion posts regarding lecture content, and (iii) student comments: “*The summary slide really helped me understand what I’d just heard so that it just stuck better and stayed with me*” – “Summary slides were a great idea that encouraged me to go to lectures” – “The summary slide gave me an idea as to whether I actually understood the lecture or not” – “summary slides = excellent” (BIOL3116, 2007-2009).

I deem this technique so important for student learning that I have re-arranged my curriculum to leave abundant time for class discussion. For example, in my third year Marine Ecology class, I have released myself from the constraints of delivering a set body of content, and focused on providing an introduction to eight key problems confronting marine ecosystems. Effectively, this
“tool-box of marine ecology” allows me to take time in teaching critical evaluation, problem-solving and communication skills, and new insights that students can apply to any situation. Using 26 lectures to focus on six key problems (climate change, pollution, coral reef collapses, overfishing, aquaculture, marine reserves), I can take time over 4-5 lectures to present several lines of evidence/examples that continually link back to the one main issue/problem – “The fact that Chris explained everything in different ways to reiterate & enforce the points/principles was so useful” (EMSC1006 student survey, 2007). I then back up this technique with my approaches to assessment, where problem-solving and building evidence-based arguments is the focus of assessment rewards.

Formal student evaluations of my teaching indicate these approaches are working. In the three years since I started my first lecturing position, I have received ratings (7 = excellent) of 6.3 for stimulation of interest (ANU-wide average = 5.4), 6.3 for intellectual challenge (ANU = 5.5), 6.2 for encouragement of student participation (ANU = 5.3), and 6.3 for overall effectiveness of teaching (ANU = 5.5). These averages cover a range of my courses (first to third year), sample 266 students, and are well above the university-wide scores (5.3-5.5) for the same class sizes. I have also received many positive comments from students regarding how my approach generates:

- Interest: “Each lecture was always thought-provoking and interesting” – “Lectures were inspiring and captivating” – “Chris’ enthusiasm is inspiring, and makes learning easy” – “Very enlightening, inspiring and enjoyable course” (BIOL3116, 2007-2009), “Chris was very enthusiastic about the subject & his energy was contagious” (EMSC1006, 2007); and

- Engagement: “Chris really engaged us when he gave lectures & got us to think about what he was saying rather than let it wash over us” – “He made important points or arguments very clear and actively engaged in expanding our interest” (EMSC1006, 2007), “Your lecture approach is very engaging – even when listening to the recordings!” (student e-mail, 2008).

b. Development of curricula and resources that reflect a command of the field

In designing curricula I focus my teaching and learning goals towards changing how students think about problems facing marine organisms, communities and ecosystems. In particular, I aim to take students who are passive in their thinking about environmental problems (marine or otherwise), and provide them with the skills and confidence they need to actively make their own critical judgments of the evidence and become active participants in the solution. By arranging my learning tasks around real situations, students can use this as the focus for forging links between theory, evidence and problem solving tools developed in the lectures, tutorials and assessment tasks. This problem-solving focus also provides clear communication of my intentions in an assessment, as students clearly see how they are rewarded for developing arguments using whatever tools and evidence they choose. Combining this with formative feedback prior to submission, I work to focus student intentions on this goal. A concurrent theme in my curriculum planning has been to use targeted research to develop activities that provide both cognitive enrichment and occupational utility.

Contextualising learning tasks within real situations

Based on my own interviews of marine science students, many are frustrated with the lack of connection between university learning activities and what they will do in their future careers. So when I developed the curriculum for a new third year Marine Ecology course, my priority was to develop goals and activities that provided both cognitive enrichment and real world utility. To achieve this I sought out the perceptions of students, researchers, marine science teachers and potential employers. Via structured interviews, I identified what each group perceived as desirable attributes for a marine science graduate of higher education. At the program level, I used this research to develop program learning goals that encompass the attributes of graduate flexibility and employability. In my role as convener of the Marine Science major, my intention for these goals was to provide greater alignment in the marine science curriculum by providing: (i) a framework to identify gaps in the current curriculum with regards to course-level learning goals (e.g. curriculum analysis matrix); and (ii) an explicit communication of the intended learning outcomes of the ANU marine science program to students, graduates and employers.
Within my courses, I have used this research to build novel activities with real world connections. One example is the Environmental Status Report in third year Marine Ecology, which I designed based on comments from colleagues in public and private-sector agencies. My intention with this task is to show students how to use the marine science skills and understandings they have gained in their studies to assess a marine environmental issue and communicate their findings to Government. We start with a list of high-profile issues (e.g. desalination plants, deep sea mining) and a student-led discussion on whether they pose a threat to Australia’s marine resources. Dividing the class into smaller working groups, each group picks an issue and works as a team to develop a status report. This can be challenging, given their previous experiences have largely been in scientific writing, which uses precise language, field-specific jargon, careful qualifications of their findings and rarely (if ever) a clear statement of solutions. In introducing the different format of a status report, we draw on insights from guest lecturers working in relevant government agencies. These guest lecturers describe first-hand the way they approach a problem, how they find relevant information, legislation and policy, and draft solutions. I follow this up with a team tutorial mentored by myself, where we form a strategy for each group to divide their tasks. The emphasis is on using convincing arguments in clear, jargon-free English and making suggestions for action (e.g. targeted research, change in public perception or policy). Students are strongly motivated by this task, which is made authentic and contemporary by basing it on current issues debated in the media and by Government, e.g. “It was really interesting and motivating because it was clear how this knowledge could be applied in a job in this area and how useful this is for conservation” (BIOL3116 student survey, 2008).

**Digital approaches to teaching marine ecology**

Providing regular, direct connections to marine science has been a challenge in a land-locked university. While I employ the usual technique of field excursions to provide adventure learning, I am limited in the amount of time I can take students off-campus as they must attend other classes. I developed digital resources that allow me to bring marine ecology into the classroom. An example is my virtual underwater census, where students use a computer to view real underwater footage of reef fish communities. Collecting class data for a scientific report on Marine Parks, students work in pairs to record the number of fish species they see within digital video transects previously taken in the field. Using this digital resource has three key advantages: (i) introducing my students to a cutting-edge technique currently used in marine research, (ii) providing students with first-hand experience in collecting real data on a current topic of public debate (marine parks), and (iii) allowing me to train fish census techniques in a far more efficient and safe manner than if I were to take all 40 students on a SCUBA dive!

Formal evaluations for my courses indicate exceptional levels of student satisfaction, with average scores of 6.3 for course organization & structure (ANU average = 5.3), 6.4 for clarity of communication (ANU = 5.5), 6.4 for organization of activities (ANU = 5.3), 6.2 for effectiveness of teaching and learning methods (ANU = 5.3), and 6.1 for overall impact (ANU = 5.4) from a sample of over 200 students, plus numerous positive comments about my courses in terms of:
• Relevance: “The information was applicable to real situations” – “[BIOL3116] included solutions that I as an individual can try to achieve” – “I found conservation and management most interesting because it brought all the biology together & showed how it’s applied to the real world” – “It’s interesting to see how useful current management techniques are and critically analyze them” – “This course was well taught & developed a range of skills practical to the real world” (BIOL3116, 2008);

• Clarity: “I liked the use of primary studies to make points clear in the lectures” – “By far this lecturer was the most articulate lecturer of [my] two years of study at the ANU” – (BIOL3116, 2007-2008), “Well organised, clear, well communicated” (EMSC1006, 2007); and

• Structure: “Honestly I think it’s brilliant. Any improvement and the course borders on perfection” (BIOL3116, 2008).

c. Approaches to assessment and feedback that foster independent learning

Each group of students enrolled in a course can have unique prior experiences and perspectives that shape their learning. Indeed, the ANU marine science program is inter-disciplinary in nature, with students coming to my courses from biology, geology, chemistry, mathematics and physics backgrounds. Using adaptive feedback and assessment, I embrace and encourage this diversity. In designing my assessments, I use student interviews and ongoing feedback to discover how students perceive and approach each learning task so I can tailor formative feedback, examination strategies and student-driven assessments that encourage and reward individual thinking.

Formative feedback in multiple settings
I treat feedback as a means of relaxed formative assessment for students to instill confidence in their own way of thinking. I work hard to provide activities with student-teacher and student-student interactions in as many settings as possible. A primary example is the forum for formative feedback I provide in each lecture via the summary discussions (described in section a). Providing this pressure-free environment detached from the concerns of earning marks allows students to freely ask questions and assess whether they are on the right track in understanding the course content. I also learn from this kind of two-way feedback whether my intended meanings are reaching my students, and correct any misunderstandings before they become entrenched.

Traditional post-mortem approaches to providing feedback on written assessments limits the opportunity to shape student understanding to just one occasion. I take a proactive approach by providing feedback prior to final submission of student assignments. For instance, in preparing third year students for the Environmental Status Report, I mentor a planning tutorial with each team to help develop their approach to the task. For individual assignments where the topic spans the whole class (e.g. Scientific Assessment of a Marine Park), I hold a pre-submission Q&A session where students can raise their concerns in an open forum. As with the lecture summaries, this approach is exceptionally useful in removing mismatches in student-teacher perceptions arising from issues of communication, rather than each student’s ability to complete a task. By minimizing confusion and any loss of summative marks, my students have been exceptionally positive about this approach. I think this has led to far better learning outcomes in that it removes much of the uncertainty and doubt that can rob students of the motivation and confidence they need to do well in their work.

Examining for student understanding and conceptualization
Written exams are generally stressful for students. A large part of this stress stems from perceptions that they must remember large quantities of content. Based on published research and my own interviews of students, I have taken an approach to exams that focuses rewards on evidence of individual thinking, interpretation of evidence, and development of cogent arguments. I do this through question structures such as: (i) case study questions, where all necessary content is provided (methods and a results figure) and I ask students to interpret and evaluate the result based on their understanding of the design of marine ecological experiments; and (ii) essay-style questions, where I phrase the question to allow freedom for students to show in their own way what they understand about a topic (e.g. How would you assess the sustainability of a fishery?). I give rewards based on their strength of interpretation, clarity of argument and use of evidence.
Importantly, I provide guidance to demystify how I construct these exams through open communication of my intentions at the beginning and end of semester. This kind of strategic guidance fosters a deeper approach to the lecture and exam components of the curriculum. For instance, my end of semester exam tutorial in third year Marine Ecology briefly reiterates the 6 main concepts discussed in the course, but focuses on how to prepare for the exam via worked examples drawing on multiple sources of information from various parts of the course (lectures, practicals, field trip, assignments) to develop an answer, and highlight the rewards for individual thinking. Importantly, I also indicate that I will NOT be examining isolated definitions and facts, so as to discourage pure memorization of content in their exam preparation. I developed this method of exam guidance based on my student interviews of how they perceive and prepare for exams.

**Student-driven assessments: role-playing press conference**

My assessments allow students to exercise freedom in deciding key aspects of each assessment, so they feel connected to the task and are rewarded for their input. For instance, in the Environmental Status Report I provide the framework for the task, but the students choose their group membership, the issue they wish to work on, and their individual role in the team (e.g. find data, interpret legislation, contact stakeholders). I also employ student-led activities to promote student independence. An example is a third year oral assessment I designed around a Role-Playing Press Conference. I ask a self-nominated group of students to present a press release and media-style briefing on a marine environmental issue of their choice, and then answer questions from the class. I give each student in the audience a role to play (e.g. Fisher, Chef, Environment Minister, Tourist, Dive Boat Operator) and task them with asking questions in the guise of their allocated role. Taking a back seat in the room, I merely moderate the student-led interactions, which produce outstanding debates on each topic that cover a multitude of views, driven largely by the independent questions posed by everyone in the class. Marks are given for participation, rewarding student engagement with the challenge of playing their part and interacting with each other.

**Promoting interdisciplinary connections**

My research is interdisciplinary in nature, so I naturally combine evidence from biophysics, oceanography, physiology, chemistry and biology when I address questions about interactions between marine organisms and their environment. In preparing a series of lectures on a given topic, I draw on my research skills to pull in evidence from multiple sources, rather than just focus on one view of the process. For example, in examining why species show different patterns of distribution on a rocky shore, I start with some of the physiological and biomechanical challenges that different parts of the rocky shore may present for a species, then build into this a description of how each species uses changes in internal chemistry, tissue strength or respiratory physiology to deal with each challenge and survive in the local environment. Combining this with an interdisciplinary approach during assessment (e.g. EMSC1006 exam question - *Using examples of your choice, describe the strategies used by intertidal organisms to meet the challenges of living on a rocky shore*), I provide an integrated view of marine systems, as well as the opportunity for students from a diverse range of disciplines to find their own connection with the topic.

Student satisfaction with my approaches to assessment and feedback are reflected in my average scores of 6.3 for communication of course content & requirements (ANU average = 5.5), 6.0 for feedback to assist student learning (ANU = 5.1), and 6.0 for methods of assessment (ANU = 5.2). Written comments reinforce these positive responses: “I like that [Chris] encouraged our own thoughts and views” – “The assessments were different & I liked that” – “The summary sessions at the end of each lecture provided really helpful feedback” – “The summary slides help ensure the key aspects covered in the lectures are clearly understood” (BIOL3116, 2007-2009).

**d. Respect and support for the development of students as individuals**

Within my courses I incorporate adaptive, novel activities that accommodate and reward students’ individuality. In particular, I provide space for self-directed learning and offer freedom of choice that enables students to develop their own individual interests. Students also feel supported and grow in their self-confidence through the comfortable and inclusive environment I create in the
classroom. I also demonstrate respect for my students’ experience by seeking and responding to their feedback on my teaching throughout the course. Essentially, I see my teaching role as one of facilitation - providing an encouraging learning environment where students can discuss their thoughts and are receptive to new ideas from both their teacher and their peers. Beyond the classroom, I help guide students in their overall development through speaking to residential colleges (e.g. John XXIII College), participating in science festivals (e.g. Science Week), and mentoring the study paths of students via my role as convener of the Marine Science degree major.

**Individually tailored projects**

Tailoring my course activities to encourage a variety of student interests and perspectives, and reward individuality, I have provided: (i) flexible group projects that encourage allocation of tasks among group members according to interests (e.g. legislation, conservation theory, scientific reports, public perceptions) and writing individualized reports at the end of the teamwork information collection; (ii) tailored coursework assessment where I substitute assessment items to suit students who wish to take up occupational internships while studying for my course. For example, a student who worked at ABC Catalyst developed a reflective journal of their experience to replace a portion of typical assessment done in the course; (iii) student-led research projects, such as the major assessment for Carbonate Reef Field Studies course, where we have students from geology, chemistry, physics and biology working together in the one field course. Starting with their own curiosity-based question that interests them most based on their few days swimming around the reef, I guide them through the process of developing a data collection program, provide the logistics and then advise on analyses; and (iv) individual research projects via my Special Topics in Fisheries course, which is basically a mini research project on any student-directed question about fisheries. For instance, a student who worked in an aquarium shop wanted to know where all the coral reef fish came from. Under my guidance, he conducted the first quantitative investigation of the ecological impact of the ornamental coral reef fish trade, and is now enrolled to conduct a full Honours project on this topic from mid-2010. I have found the these approaches are very effective in converting students into ardent researchers, as it demystifies the research process and instills confidence that they can produce new knowledge.

**Support of individual learning needs**

Creating a supportive environment is absolutely essential in demonstrating respect for students and developing their self-confidence, which is why I foster a “no stupid questions” culture in class interactions. While confidence takes a little time to build, my active and enthusiastic response to student questions and ideas quickly builds student confidence to speak up and discuss their own ideas. “Chris had an easy-going approach to dealing with students which made everyone feel comfortable and yet he was also very professional” (EMSC1006 survey, 2007). I have contact with the majority of marine science students through my role as the Convener of the ANU Marine Science Major program, allowing me to mentor students in their choice of educational path, as well as providing career support via references, advice on jobs and future postgraduate study. Indeed, I often have the pleasure of writing references for graduates to win graduate positions based around the skills I have seen them acquire in the program.

**Responding to progressive student feedback on my teaching**

Traditional feedback on teaching from students is often collected at the end of the course, past the time when changes can be made that affect that group of students. Students develop a fatalistic view of such feedback, thinking that they have little role in shaping the course to their needs. To address this problem I have shifted to a progressive system of online anonymous feedback, which I conduct during early (week 3), mid (week 7) and end of semester periods so that students can provide ongoing feedback and see that changes are being made as we progress through semester. Such changes have ranged from simple things like changing the format of online course notes and recordings, to larger structural changes such as holding a mid-semester exam when students raised concern over end-of-year workloads (see improvements in BIOL3116 student feedback over time in the Evaluation Information section).
Student satisfaction with my support is indicated by my average scores of 6.5 for demonstration of concern and respect for students (ANU average = 5.6), 6.4 for availability of contact (ANU = 5.6) and 6.4 for approachability (School survey question). Written comments highlight my flexible approach and concern for students: “[Chris] is genuinely concerned for his students and tries to ensure everyone understands and is not falling behind” – “Chris was very down to earth” (BIOL3116 surveys, 2007-2008).

e. Scholarly activities that have influenced and enhanced learning and teaching
I actively develop my teaching skills through formal training, keeping in touch with teaching and learning research and theory through the literature, and conducting my own educational research about learning phenomena to adapt my teaching. These activities have allowed me to guide improvements to my own individual practice, as well as those of other teachers through my position on the Teaching and Learning Committee for Marine Science (course-level changes), as convener of the Marine Science degree (program-level), and as a founding member of the ANU Summer Research Scholars Learning Community (interdisciplinary program).

Educational training
In my first year as a lecturer I recognized the need for educational training to complement my skills in research and media communication. Having won a Vice-Chancellor Staff Scholarship, I studied for the Graduate Certificate of Higher Education (GCHE) at the ANU while I developed my practice as the youngest Lecturer in my School. My goal was to deepen my understanding of teaching and learning so I would have an expanded toolkit of ideas for developing student-focused teaching and learning activities and curricula at both the course and program-level. Based on this, I developed my own methods of lecturing, feedback and assessment, as well as the curriculum analysis tools I needed to implement the first set of program-level learning goals for the ANU Marine Science degree.

Educational research
Being an active marine researcher, I have taken strongly to the use of targeted educational research to understand and adapt my practice. For example, in developing curricula and learning activities, I realized that having a student-focused intention was not enough, I must find out the actual student perspective, rather than use my own impressions of what students do and think. As part of my study for the GCHE, I designed and implemented several research projects to assess how students approach learning tasks, why different learning outcomes can result from different students undertaking the same task (differences in intention and motivation), as well as stakeholder assessments of what are perceived as desirable attributes for a marine science graduate. I have used these findings at all levels of my practice, and I am currently preparing the graduate attribute research for publication in a peer-reviewed journal (Fulton, Akerlind & Roberts - details in CV).

Cross-campus advocacy for improved teaching and learning policy
I have taken a premier role in cross-campus improvements to teaching and learning policy at the ANU. As Chair of the Marine Science major, I have drawn together the biology, geology, chemistry and physics teachers in the marine science program to provide a coordinated approach to the degree program and major. This has involved building a virtual Marine Science Department website (http://science.anu.edu.au/Marine/), and using my educational research to draft and implement learning outcomes that all of us can use to inform our design of course-level curricula that align with a range of science programs. In addition, I am a founding member of the ANU Summer Research Scholars Learning Community (SRSLC), in which we are developing a core set of learning goals and outcomes for summer research scholars at the ANU. These summer scholars are tertiary students that come from a range of Australian Universities to conduct a short research project at the ANU over the summer break. Summer scholar projects span every discipline across the ANU campus, so we are developing a set of SRSLC learning outcomes that transcend disciplinary boundaries to provide holistic approaches to research-led teaching. I am currently developing an ANU Marine Science Research and Learning Community with colleagues from RSES to enhance connectivity between marine scientists, teachers and students across the ANU.