

For developing effective curricula which motivate student performance and improve student satisfaction and retention in large, diverse foundation Anatomy and Physiology classes

Overview

My aim as a teacher is to stimulate the curiosity of my students and encourage them to confront challenging intellectual perspectives in a supportive environment. I create a climate in which respect for ideas and spirited inquiry are valued, and in which theories and ideas are actively contested. I believe that this approach supports the development of critical thinkers and heightens students' sensitivity to the evolution and provisional nature of knowledge (Baldwin 2005). I aim to help students develop their ability and self-confidence to comprehend complex concepts, to express them with clarity, and to confront unfamiliar problems. I believe that these transferable skills benefit students far beyond the realm of scientific study and allow them to contribute effectively to their communities wherever they chose to live and work.

First year Anatomy and Physiology subjects lay the foundations of knowledge and generic skills that influence student success throughout the degree programs of Sports and Exercise Science, Occupational Therapy and Physiotherapy and as such, promoting increased student performance and satisfaction in these subjects has far reaching implications for the Faculty of Medicine, Health and Molecular Sciences and James Cook University. Commencing in 2005, two Anatomy and Physiology subjects (Anatomy and Physiology for Rehabilitation Sciences 1 and 2) were developed to cater for the combined needs of the first year students from the disciplines of Occupational Therapy, Physiotherapy and the Institute of Sports and Exercise Sciences. This large (~250) and diverse group contained students from a range of academic abilities, backgrounds (many with no previous experience in basic biology) and maturity (with strong representation from mature entry students). Both the first and second semester Anatomy and Physiology subjects were problematic in their inaugural year with low student satisfaction, low retention rates and poor student performance. I was appointed to JCU in July 2005, and was given both the bulk of the physiology teaching in these subjects and the redevelopment of the subjects to improve student performance. Based on critical analysis of student and staff feedback and of assessment performance, I have implemented a number of strategies to increase student performance, retention and satisfaction including alterations to subject design, pedagogical approaches, support materials and assessment. These alterations have lead to 18-23% increases in final examination scores (Fig 1) along with significant increases in both student retention (from 77 to 93%) and satisfaction.

Criterion 1: Approaches to teaching that influence, motivate and inspired students to learn

My teaching contributions at JCU are varied, encompassing large first year classes (~250 students) to small third year specialist classes (~30 students). My range of teaching commitments requires a flexible and malleable approach combined with careful consideration of the unique backgrounds, aspirations and abilities of each class. In 2005 students from 3 degree programs (Sports and Exercise Science, Occupational Therapy and Physiotherapy) formed the student body for the newly formed foundation Anatomy and Physiology for Rehabilitation Sciences subjects. These subjects were fraught with low student performance, low retention rates and poor student satisfaction. From 2005 to the end of 2008, I redeveloped these subjects in light of multi-perspective feedback, critical reflection and performance analysis (Brookfield 1995) with the specific aims of increasing student performance, increasing retention and increasing student satisfaction. This was achieved via improvements to subject design, pedagogical approaches, support materials and assessment.

Subject Design: Beginning in 2006 the original two subjects were partitioned into six semi-independent subjects, one per semester for each of the participating disciplines of Occupational Therapy, Physiotherapy and Sports and Exercise Science. While the lectures for these subjects remained co-taught, separation of the original joint subjects into distinct subjects for each discipline enabled the redevelopment of the practical classes into discipline specific sessions that were tailored to address both the unique needs of each discipline and the diverse backgrounds and academic abilities of each distinct cohort. Unique practical classes for each discipline also enabled different teaching methodologies to be applied to individual cohorts aimed at fostering engagement and active learning. For example, during the inaugural year of the subjects I learnt, through informal student feedback, that many Sports and Exercise Sciences students regarded Renal Physiology as irrelevant to their discipline and to their future career paths. However, the concepts of water balance and dehydration (which are taught during the Renal Physiology section) are essential areas of knowledge for a successful Sports and Exercise Scientist. The student feedback inspired me to redesign the Renal Physiology practical session specifically for the Sports and Exercise Science students with the aim of highlighting the relevance of the material to

their degree program. The newly designed practical session (entitled "The Hydration Game") now incorporates many of the key elements of Renal Physiology within the context of maintaining hydration status and performance in an elite cyclist during the *Tour de France*. Student evaluations of the "Hydration Game" activity indicated that 90% believed that the applicability of the activity to their field of study was very good to excellent. 89% of students also indicated that the group work involved in the "Hydration Game" activity facilitated their learning and 97% indicated that the activity extended their knowledge and skills beyond that presented in lectures.

Pedagogical Approaches: The pedagogical methods used within the 6 newly formed foundation Anatomy and Physiology classes were carefully re-evaluated and modified with the aim of increasing student engagement and promoting deep learning (Biggs 2003). The adoption of a problem solving approach for many practical sessions was successful not only in increasing student participation and engagement but also in promoting small group work and providing the opportunity for more direct personal contact between individual students and the lecturers (which can be challenging to achieve with large class sizes). Students responded very favourably to these changes with comments in student feedback questionnaires centring on themes such as; *"the best aspect of this subject were the practical sessions. It was good to sit in a group and discuss what has been said in the lectures earlier in the week and ask the tutors for help"*, *"the practical sessions were great, they helped you to piece together all the material learnt from that week. I really valued the contact time with lecturers during these practicals"* and *"the interactive learning and the one on one time with the lecturers that we had at our practical sessions was excellent"*.

The JCU First Year Experience Committee identified that first year students across the disciplines frequently ask "why do I need to know this?" indicating a level of disillusionment with the relevance of their subject material. In response this feedback, I increased my focus on emphasising the relevance of subject material to the students in each specific discipline, thus promoting student engagement. The redevelopment of the Renal Physiology practical sessions (discussed above) is just one example of the refocusing of material to emphasise the discipline specific relevance of the subject content. As a result, the level of student interest in the subject on SFS evaluations increased by up to 14% relative to the original 2005 offering.

Feedback from the inaugural offering of these subjects indicated that students were unsure of the assessment requirements and assessment criteria used within the course, with ratings of 58% (2.9 out of 5) on both criteria. The adoption of constructive alignment throughout all the subjects, with clear learning objectives directly linked to assessment tasks (Biggs 1999), was aimed at increasing student clarity on both the primary focus of each teaching session and on the related assessment tasks. Student feedback reflects that these alterations were successful in improving student clarity on assessment requirements (increasing up to 22%) and assessment criteria (increasing up to 18%). Written feedback from students also reflected that the introduction of constructive alignment helped the students to focus their learning: *"the learning objectives have been most useful when studying"* and *"I could always understand what was wanted of me and the lecturers always outlined where we could find the resources that we needed to utilise. This isn't always easy being a first year student"*.

Support Materials: The large class sizes enrolled in these subjects present many challenges for an instructor. Not only are the students from a diverse range of academic backgrounds encompassing a wide range of tertiary entrance scores, but, as is common in regional universities such as JCU, students from a low socio-economic status and those being first in their family to attend university are represented in relatively high numbers. A range of support materials have been incorporated into the Anatomy and Physiology subjects to cater for the diverse needs of the enrolled student cohort. These support materials aim to foster independent learning and frequent revision of content material as well as providing materials that target all the major learning styles (auditory, visual and kinaesthetic). Lecture notes and practical guides are made available to students online prior to classes with the aim of encouraging students to come to class prepared for each learning activity. These lecture notes incorporate a large proportion of pictorial and diagrammatic representations of the material that are designed to target the students with a visual learning preference and students have found that *"the detailed lecture notes gave a good foundation for study"*.

Audio recording of the lectures in the form of podcasts are also made available to the students, which provide not only a study tool for the students with an auditory learning preference but a useful revision tool for all students. The introduction of lecture podcasts met with an overwhelmingly positive student response. Online monitoring of student usage demonstrated that 95% of students accessed the subject podcasts with usage rates increasing significantly in the periods immediately prior to assessment tasks reflecting the usefulness of this tool for revision purposes. 74% of

students believed that the availability of lecture podcasts improved their assessment performance and 86% of students supported the future use of podcasting in their Anatomy and Physiology subjects. Student's comments on podcasting were likewise overwhelmingly positive with comments such as; *"I love podcasts! They help my learning and retention", "podcasts are excellent, they help consolidate everything covered in lecture and you can listen to them as often as you like, whenever you like"* and *"I have found that podcasts are very useful when combined with lecture notes and readings, they have definitely increased my performance without them I believe I would be finding this subject a lot harder"*. My critical evaluation of the impact of podcast on student performance and satisfaction is currently in preparation for publication.

The practical sessions also provide students with a kinaesthetic learning preference the opportunity to actively engage with a broad range of activities designed to reinforce the key learning objectives for each week. The students have been particularly positive in their feedback on the usefulness of the practical sessions to their learning with comments centring on themes such as: *"the practicals were great, very hands on!", "the practical classes were a very positive learning environment"* and *"the best aspect of this subject was the format of the practical lessons, which I have found to be helpful. The extensive help provided by the lecturers and the other tutors during these practicals is appreciated"*.

Additional support materials also include the use of an interactive CD-ROM which allows students to explore interactive and dynamic tutorials on each subject area at their own pace. A series of weekly online formative quizzes were also introduced to foster frequent revision of material and as well as providing both rapid and frequent feedback on student performance. These weekly formative quizzes also received substantial positive feedback from the students with comments such as: *"the online quizzes were a helpful tool for revision"* and *"it was great that there were weekly quizzes so I had an understanding of what I knew"*.

Assessment: Foundation Anatomy and Physiology courses invariably contain a wealth of information delivered in a language that can be unfamiliar to students without previous training in biology. Students often find that both the complexity and volume of material that they are required to cover to be both challenging and daunting. In order to foster ongoing revision of content material and to decrease the stress associated with the final exams representing the bulk of assessment, I have increased the contribution of in-course assessment pieces (from 15 to 30%). The in-course assessment pieces consist of 5-8 quizzes which encourage students to frequently review the subject material throughout the semester and provide students with both rapid and frequent feedback on their performance. The level of stress created by the final exams also appears to have decreased as students now have feedback on their performance over the entire semester and can gauge their preparedness for final examinations. While students initially grumble at the when faced with frequent assessment, their opinion markedly changes once final exams approach and students realise that they have already studied most of the content material for previous quizzes. *"The quizzes throughout the semester were a great way of keeping you on track and on top of the huge work load."* It has been very rewarding to experience the change in student opinions to these ongoing assessment pieces over multiple semesters. My aim is that the students' growing appreciation for the value of ongoing and frequent revision will benefit them not only in their study of Anatomy and Physiology, but in all their future subjects.

Contribution to student learning, engagement and experience

The implementation of a range of carefully considered changes to subject design, pedagogical approaches, provision of a range of support materials and adjustments of subject assessment have resulted in significant improvements in final subject results for all cohorts of students. The success of the continual critical review and redevelopment of the Anatomy and Physiology subjects is evidenced in the final subject scores which show progressive improvement since 2005 and increased by 18-23% in 2008 (Figure 1). Student retention rates have also increased from 77% in 2005 to 93% in 2008 as a result of the implemented changes. The first year Anatomy and Physiology subjects are prerequisites for student progression into the second year of 3 degree programs in the Faculty of Medicine, Health and Molecular Sciences (Sports and Exercise Science, Occupational Therapy and Physiotherapy) and as such, increasing retention rates in these first year subjects plays a crucial role in maintaining second year student enrolments and supporting overall completion rates. Improving student performance, satisfaction and retention in these subjects also helps address the Faculty's and University's strategic objectives of improving the quality of teaching, improving the learning experience for students and delivering appropriately skilled graduates. These very significant increases in student performance and retention have been welcomed by the Disciplines of Occupational Therapy, Physiotherapy and the Institute of Sports and Exercise Sciences. Dr. Anthony Leicht (Acting Head, Institute of Sports and Exercise Sciences) has confirmed *"learning readiness of the Sports and Exercise Sciences students during the teaching of a second year exercise*

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physiology subject (SP2007), with 10-11% increases in final grade performance attributed to the acquisition of a greater and sound knowledge base in the Anatomy and Physiology subjects". Positive feedback has also been received from Dr. Yvonne Thomas (Academic Advisor, Occupational Therapy): "the Occupational Therapy results are really promising and I want to thank you for all the effort that you have gone to, to make this year so very different from previous years". Prof. Phillip Summers (Head of Physiology and Pharmacology) has also praised my efforts in redeveloping the Anatomy and Physiology subjects in a peer review of my teaching; "Dr. Munns has done a fantastic job in significantly improving the learning experience for students and improving the student pass rate".

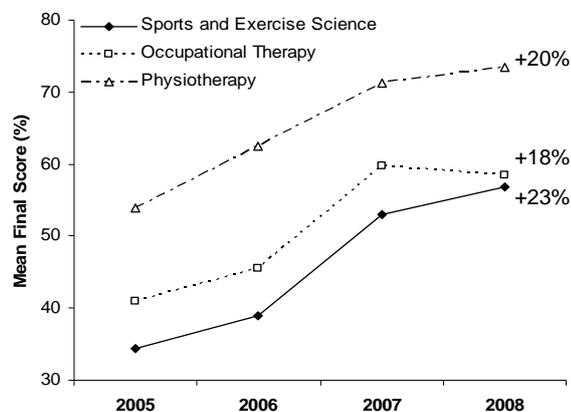


Figure 1: Mean subject scores for Anatomy and Physiology subjects for Sports and Exercise Science, Occupational Therapy and Physiotherapy from 2005 (prior to my coordination) to 2008. Final subject scores demonstrate a progressive increase in student performance, with an 18-23% increase in final scores over 4 years.

Significant gains have also been measured in the student feedback about subjects (SFS) and teaching (STF) questionnaires, with consistent increases in all areas. Improved student ratings of the quality of teaching experiences (10-12%) and subject organisation and structure (12-20%) have been measured in SFS feedback, as well as 24-26% increases in the rating of staff interest in helping students to learn, and 8-14% increases in the level of interest generated by the subjects. The effect of my teaching on student learning, engagement and experience has been well documented. Student feedback (SFT) on my teaching in the 6 Anatomy and Physiology subjects has received consistently high ratings, scoring 4.1-4.8 (out of 5) on all questions and consistently exceeding the JCU average (3.6-4.3). 85% of students rate my understanding of the subject as outstanding, and 70% rate the overall quality of my teaching as outstanding. In addition, 96% of students rate the quality of my explanations as very good to outstanding. Student comments on my teaching also reflect the positive manner in which my teaching style is viewed by students (in addition to the effectiveness as demonstrated by increases in final scores and retention rates). Students regard me as "the best prepared", "very approachable" and "more than happy to help". Students also praise my "easy to understand explanations" and the "great lengths she went to ensure the material was interesting and well understood by students". My outstanding efforts in teaching were formally recognised by JCU via my promotion to Senior Lecturer in 2008.

The redevelopment of the Anatomy and Physiology subjects for Sports and Exercise Science, Occupational Therapy and Physiotherapy has had far reaching positive effects. The success of the pedagogical techniques introduced into the foundation Anatomy and Physiology subjects has encouraged me to introduce similar activities and teaching approaches in other subjects. Strong student responses to the activities designed for the muscle physiology practicals in Anatomy and Physiology lead me to successfully incorporate these activities into the Physiology subject for first year nursing students (BM1011). Positive feedback on the cardiac and renal physiology sections also lead me to introduce similar pedagogical approaches to the teaching of similar material for first year pharmacy students (PC1001 and PC1002) and second year medical physiology students (PP2101 and PP2201). The strong student response to the introduction of podcasting of lecture material, along with the critical evaluation of podcasting effectiveness, has encouraged other academic staff to implement podcasting especially with the first year physiology subjects for nursing (BM1011 and BM1022). My commitment to quality teaching and learning is also evidenced by my successful completion of the Graduate Certificate in Education (Tertiary Teaching) in 2008.

In conclusion, I strive to continually re-evaluate my teaching in light of multiple sources of feedback, critical reflection and recent pedagogical advances. I aim to inspire student learning, improve performance and retention rates and develop motivated self-directed learners. The redevelopment of 6 Anatomy and Physiology subjects over 4 years has resulted in 18-23% increases in student performance, 16% increases in retention rates and significant improvements in student satisfaction to the benefit of 3 professional degree programs within the Faculty of Medicine, Health and Molecular Sciences.