

FOR ENABLING DIVERSE TEACHER EDUCATION COHORTS TO EXPERIENCE PROFOUND ENGAGEMENT IN SCIENCE AND SUSTAINABILITY THROUGH A BLENDED LEARNING APPROACH

Education for sustainability (Efs) represents an important national and international agenda. In 2010, I had the privilege of co-developing a first-year core subject, *Foundations of Sustainability in Education*, with a view to systemically incorporate a distinctive focus on sustainability in the Bachelor of Education (B.Ed.) at James Cook University (JCU). My role is to provide a large cohort of first-year students enrolled in Early Childhood and Primary majors with an introduction to the principles and practices of Science and Sustainability Education (mean subject enrolment, 2010-13: 305 students). Science Education is foregrounded in my teaching as an understanding of the Earth system is critical to empower students to engage critically with the key sustainability issues that we explore in the subject (Morse, 2000)¹.

Successfully motivating and inspiring the students that I teach is complex and demanding for three key reasons. Firstly, many students commence their initial teacher education underprepared with requisite science knowledge and lack the confidence to engage with science content and pedagogy. Secondly, my teaching must effectively engage a diverse student cohort, comprising a wide range of tertiary entrance scores and including approximately 30% low socioeconomic and rural and remote students, 63% of students first in family and 7% Indigenous students (average figures, 2010-13), so as to support students' successful transition into university and the first-year experience. Finally, I teach students across multiple modes of delivery: 'internal' students studying on the Townsville campus, and online students enrolled in the Early Childhood Education (ECE) Online program and a community-based Indigenous teacher education program (i.e., the 'RATEP' program). 'External' (online) students comprise approximately one quarter of the students I teach (average, 2010-13). Engaging students online and providing experiential learning that is inherent to Science and Sustainability Education is a significant challenge. Furthermore, the provision of high quality learning resources alone is not sufficient to 'hook students in'; quality teaching is essential.

To meet these challenges, I have developed and implemented a blended learning approach that purposefully combines face-to-face and online pedagogical choices to successfully support students to engage with, and learn about, Science and Sustainability Education. This citation showcases my approach which is exemplified by the provision of [interactive and aesthetically engaging online learning modules](#) that motivate and inspire students to learn; the use of an [overarching pedagogical framework – an inquiry framework](#) – to structure and scaffold students' learning online, as is necessary in the first-year experience; the [purposeful selection of experiential learning activities](#) that provide flexible and accessible learning options for students, regardless of their place of study; and the [transformation of face-to-face lectures](#) that provide an opportunity to share my passion and enthusiasm for the subject, and promote deep learning of the concepts explored.

ASSESSMENT CRITERION 1: APPROACHES TO THE SUPPORT OF LEARNING AND TEACHING THAT INFLUENCE, MOTIVATE AND INSPIRE STUDENTS TO LEARN

A blended learning approach that is responsive to the diversity of students that I teach is essential to support their learning during the first-year transition. The approach that I have developed may be described as an 'enabling' and 'enhancing' blend (Keppell, 2010); that is, it *enables* students' participation by providing flexibility and overcoming issues of access and equity; and *enhances* learning and the student experience through complimentary face-to-face and online pedagogical choices. Through this approach, students develop a strong foundation in important science and sustainability concepts and engage in authentic, experiential learning opportunities appropriate for classroom practice. Innovative use of learning technologies provide ECE Online and RATEP students with a learning experience that is as rich and engaging as that of their on-campus peers. Student feedback drawn from formal university evaluations of the subject and of my teaching, across 2011-2013 cohorts and modes, provide outstanding evidence that my practice has had a significant impact on my students' interest, motivation and learning. Specific aspects of my teaching continue to be rated very highly by students and benchmark at or above average scores for JCU (Table 1). The unique opportunity to teach a subject from its very first delivery has also enabled me to continually refine my practice, as shown by the significant improvement in students' ratings over time.

My blended learning approach is comprised, in part, by [interactive and aesthetically engaging online learning modules](#) hosted by 'Google Sites' linked directly into JCU's learning management system (referred to as 'LearnJCU'). In an online learning environment, aesthetics are important to motivate students and initiate their interest. With a view to foster independent learning skills, I have adopted an [inquiry approach as an overarching pedagogical framework](#) to structure the modules. The phases of *tuning*

in, finding out, sorting out, and reflecting and taking action guides students through a scaffolded narrative to navigate them through the weekly learning. The inquiry framework provides **explicit guidance and structure** that enables me to clearly convey my expectations to students – as is necessary in the first-year experience. The modules require students to explore key sustainability issues such as climate change, the energy crisis, water resource management, biodiversity and food security, and consider their roles as future teachers of Science and Sustainability. I provide students with interactive learning activities and resources that support their understanding of the underlying science, as well as economic, socio-cultural, and political dimensions. For online students in particular, engaging with the modules comprises a significant part of their teaching and learning experience, and I have received overwhelmingly positive student feedback. Students' ratings of my teaching are consistently high, as are my teaching evaluation response rates, which provide further evidence of student engagement (Table 1).

Table 1. Mean teaching evaluation scores (on-campus, ECE Online and RATEP students, 2011-2013).

Aspects of teaching performance	2011 42%* (89/210)	2012 42%* (81/192)	2013 38%* (73/190)
Approachability for student support	4.1	4.4	4.2
Provision of useful feedback to improve learning	3.9	4.0	4.0
Overall satisfaction with helping students to learn successfully	4.3	4.4	4.2

Notes: * Mean response rate. 5-point scale.

Students' comments also refer to the high quality of the learning materials and activities that I provide, and the easy-to-navigate learning environment that conveys clear expectations.

The best aspect of the subject was the interactive learning made interesting through the online colourful and engaging modules. I found them very easy to work through and knew exactly what was expected of me (Subject evaluation, 2012).

Your use of LearnJCU was unlike anything I had seen – it was interactive and fantastic! (Teaching evaluation, 2010).

Weekly tutorials provide opportunities for experiential learning and modelling of pedagogies for Science and Sustainability Education. The challenge here is to engage *all* students in hands-on ways. My approach incorporates the **purposeful and deliberate selection of activities that acknowledges the diverse context of students**, enabling them to effectively engage and participate in Science and Sustainability Education, regardless of their place of study. For example, students perform simple science experiments and activities like the simulation of the greenhouse effect in a jar, the identification of soil samples, and using dichotomous keys to classify plants and animals. All of the activities and experiments delivered in the tutorials have been designed such that they can be performed with simple everyday materials, making them **accessible to off-campus students**. I have developed online tutorials facilitated using wikis in the LMS for ECE Online students. Like the learning modules, the tutorials provide a scaffolded narrative that guides students through the weekly activities. They include task instructions, links to resources, examples of work, model responses and opportunities to respond to the activities using a discussion board. I work with RATEP students directly to complete synchronous tutorial activities in real-time using Blackboard Collaborate, an interactive virtual classroom. A formal peer review of the online tutorials for online and RATEP students found that I "... *have used the tools to create the feel of a face-to-face science lab workshop very expertly*" (Dr Cecily Knight, Associate Dean of Teaching and Learning [ADTL] – Faculty of Arts, Education and Social Sciences, 2012). Online students also appreciate the opportunity for active learning through the tutorial activities – "*Having tutorials for online students was beneficial in understanding the content in a more hands on way*" (Subject evaluation, 2012) – while the links to classroom practice is valued and appreciated by students: *The tutorials had great practical experiments for implementation in classrooms* (Subject evaluation, 2013).

The different approaches to student learning enabled through the online affordances that I provide have allowed me to **transform face-to-face lectures and enhance the student experience**. My lectures are vodcasted for ECE Online and RATEP students, who appreciate receiving the same explanation of the material as their on-campus peers. Constant setting of high expectations of engagement with the online modules prior to lectures enables me to adopt a blend of direct teaching of the more challenging concepts, as well as short videos, the exploration of online resources, discussions, case studies, role-plays and hands-

on demonstrations. For example, in a module that engages students with the issue of sustainable water resource management, we begin by learning about the physical and chemical properties of water and how these relate to its chemical structure, so as to understand better how water behaves in the environment. Students enjoy role-playing solid, liquid and gaseous molecules as they act out the states of matter. They also compete to see how many water droplets they can fit on a five-cent coin and manipulate magnetic models of water molecules to demonstrate hydrogen bonding. Activities like these not only make learning fun and but demonstrate how abstract concepts can be taught in a hands-on way by modelling classroom pedagogies suitable for school children. For my students, they also successfully engage their interest in a way that can be difficult in a traditional mass lecture:

I really enjoyed attending the lectures. They are fun and always interesting (Teaching evaluation, 2013).
Louisa made the subject interesting using various methods and media to explain ideas and themes presented (Teaching evaluation, 2013).
Louisa was great! She made the content interesting, fun and easy to understand with a variety of methods used to demonstrate concepts ... Louisa's skills made it fun and exciting and provided personal challenges (Teaching evaluation, 2012).

I also provide [explicit scaffolding to support students' learning in lectures](#). I begin each lecture with a short 10-minute activity that revises a key concept from the previous week, such as a 'think-pair-share', quiz or 'jigsaw' activity, followed by an explicit statement of the intended lecture outcomes. I finish lectures with a 'quick review' activity that provides students with an opportunity to identify and summarise the new concepts that they have learned.

Given the challenging nature of the subject matter, particularly the science that underlies the sustainability issues that we explore, the style of teaching that I adopt in the lectures – [the 'human' element in my blended approach](#) – is particularly important to help students develop their own understanding, to make them feel comfortable with the uncomfortable (learning new and challenging concepts), and 'switch them on' to Science and Sustainability Education by breaking down their preconceptions that science, in particular, is too difficult for them to understand or teach. For me, the lectures are a great opportunity to break down these barriers and to share my passion and enthusiasm for the subject, and have some fun with my students.

There is never a dull moment when Louisa is teaching as you are always interested in what she has to say (Teaching evaluation, 2013)
Louisa is clearly passionate about the subject area and this shows in her teaching (Teaching Evaluation, 2013).
I have never done a science subject in senior schooling or other uni studies and although much of the concepts were new to me I was able to follow and understand effectively through lectures, modules and the text selected ... Well done (Teaching evaluation, 2012).

Student feedback has shown that the face-to-face experience that I provide is exemplified by my [accessibility](#), [explicit teaching practice](#), the provision of [formative feedback](#), [clear explanations](#) of the science content, [enthusiasm](#), [high-level communication skills](#), and being "[an extremely good teacher](#)" (Teaching evaluation, 2013) who motivates students to learn.

[The best aspect of this staff member's teaching was] Her enthusiasm! Wonderful to learn about something that the lecturer actually wants to share with us. Lectures were great and very enjoyable. Her knowledge about sustainability was very broad and she taught it to us in a way that was easy to understand (Teaching evaluation, 2013).
Louisa is a very organised and enthusiastic lecturer who is committed to sharing her extensive knowledge of this subject area. She gives thorough feedback, is efficient and approachable. She is a wonderful lecturer who is committed to always giving her best. She is effective in all aspects of her teaching (Teaching evaluation, 2010).

RECOGNITION BY FELLOW STAFF, THE INSTITUTION AND THE BROADER COMMUNITY

I am actively sought out to showcase my blended learning approach to promote student engagement and learning in presentations and workshops across the University. In 2013, I was asked to participate in a two projects conducted by JCU's Teaching and Learning Development Unit to develop a video that showcases my use of new learning spaces in the University, and produce a 'Blending Learning Exemplar' and that shares examples of best practice with the teaching and learning community.

Further recognition from the institution has followed. In 2013 and 2014, I was awarded a *JCU Citation for Outstanding Contribution to Student Learning*, and, in a University-wide competitive process, a *JCU TropEco Curriculum Award* for enhancing EfS through excellence in learning and teaching (2013). In response to the TropEco award, Prof. Nola Alloway (Pro-Vice Chancellor, Faculty of Arts, Education and Social Sciences), wrote: *“Louisa, like the judges of the TropEco award, I would like to congratulate you on the way that you have so fulsomely engaged students, encouraging them to stay and succeed, and inspiring them to achieve in a challenging science-based approach to EfS. Given the qualitative and quantitative data that I have seen on your teaching, I have no doubt that it is your repertoire of pedagogical practices that is the ‘sticky stuff’ that holds students in their seats and is part of the magic that you weave through the multiple modes of delivery that you employ. What’s most impressive is that you do this with a corpus of students that draws from low SES, Indigenous, and rural and remote communities at a rate that exceeds national access and participation targets ... Thank you for modeling excellence of this kind amongst your colleagues.”* I also have been awarded a \$10,000 *JCU Teaching and Learning Development Grant* to further enhance the blended learning approach in my subject in 2014 by developing a suite of videos and active learning pedagogies to support a ‘flipped classroom approach’ and to bring new teaching and learning spaces at JCU to the online environment.

External evaluations of my teaching by experts in their respective fields provide further excellent recognition of the quality of my teaching practice. Amy Cutter-McKenzie, A/Prof. in Sustainability, Environment and Education at Southern Cross University, and recipient of OLT Teaching Citation and Teacher Excellence awards (2008 and 2010), wrote, *“... it is clear that Louisa is an outstanding teacher educator in sustainability and science education. The student feedback fully endorses Louisa’s excellence which clearly shows that she is passionate, knowledgeable and motivating to her students”* (2014). A/Prof. Carl Reidsema, an Engineering educator at the University of Queensland, undertook a peer review of my blended learning approach, given his current leadership of an OLT Innovation & Development grant that is re-imagining engineering education through a flipped classroom approach. A/Prof. Reidsema wrote that the following aspects *“stand out as best practice”*: *“Your learning modules in Blackboard demonstrate a very well thought out and innovative approach to a complex and mixed-mode curriculum. The learning resources that you have developed are really nicely designed, with a clear structure and framework to support students. This level of quality is admirable and sends a positive message to students. Providing meaningful, yet engaging hands-on learning activities is a huge challenge even for more traditional on-campus learning modes. Your design and development of contextually relevant experiential learning activities that can be equally engaged with by all students, either on- or off-campus, represents a level of excellence in educational practice. The high degree of thought, effort and innovation you’ve put into your subject is of a standard that will be required nationally if we are to address much needed growth in, and quality of, STEM [Science, Technology, Engineering & Mathematics] education”* (2014).

CONCLUSION

This citation has showcased my enabling and enhancing blended learning approach that has successfully engaged a diverse cohort of first year students in Science and Sustainability Education. My purposeful pedagogical choices enacted in both face-to-face and online learning environments has motivated and inspired the next generation of Science and Sustainability Educators by supporting students to engage positively with Science and Sustainability Education, and to build a solid foundation for their initial teacher education and future classroom practice.

I just wanted to say thank-you for your hard work in teaching this subject, you really know your stuff! ... I have immensely enjoyed the subject and am even more passionate about the environment than I was before. I have gained a great deal of knowledge and built on what I already knew. I hope one day I can assist running some fabulous sustainability programs in a school as a teacher... Thanks again for such an enjoyable start to my ECE degree (Unsolicited student feedback, 2011).

REFERENCES

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