

Case studies: embedding sustainability in teacher education

2014

From the Final report *A state-wide systems approach to embedding the learning and teaching of sustainability in teacher education*

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PROFILES OF THE CASE STUDIES

Full case studies are available from the project coordinators. Each of the following profiles presented below is a selective summary of extracts from the case studies themselves. The guidelines provided by the project organizing for use by participants in framing their case studies are included at Attachment 2.

1	University of Southern Queensland (Dr Karen Spence)
Case Study Title	Education for Sustainability in the Bachelor of Education (Primary)
Representative	Dr Karen Spence: has a personal interest in education for sustainability because of my background in science and my commitment to sustainable living practices such as green transport.
Institutional context	Multi-campus institution with significant commitment to distance education. Currently undertaking course professional mapping and re-accreditation
Host program	Bachelor of Education (Primary)
Positional statement	We obviously assumed that the discipline of science was the most appropriate course to embed sustainability. However, over the course of my involvement with this project and through discussions with other course examiners as part of the BEDU accreditation, we have realised that an authentic, embedded approach to education for sustainability is required across the entire program.
Strategy	Yes -- USQ Environment and Sustainability Committee. Joined relevant peak bodies: Australasian Campuses Towards Sustainability (ACTS) and has attained membership of the Association for the Advancement of Sustainability in Higher Education. Thorough audit of Bachelor of Education core courses.
Outcomes	Specifically, the most significant changes that were encountered for education for sustainability in the BEDU include: <ul style="list-style-type: none"> • Sustainability is studied in context and the connections that are formed are local and personal • Capacity building has occurred across a number of courses in the BEDU and there are shared synergies between EDX2260, EDP2111 and EDP4130 • An understanding that education for sustainability is not solely the domain of science and there is greater potential to integrate sustainability across a number of courses and different disciplines as a cross-curriculum priority, a QCT priority area and as a USQ Graduate Attribute • A renewed interest in the theoretical and practical aspects of sustainability through professional experience and internship placements at the Amaroo Environmental Education Centre and at other outdoor environmental centres.
Challenges	The most important single barrier that was identified that could impede the successful implementation of education for sustainability is the rapid cycle of change. USQ is in the process of refreshing its strategic plan and restructuring the academic division of the university. In addition, the BEDU is in the process of

	re-accreditation with QCT and national accreditation. There have been considerable shifts in the educational landscape in Queensland schools with the Year 7 move to high school, delivery of the Australian Curriculum for maths, science and English, implementation of Curriculum to Classroom (C2C) and external pressures from NAPLAN testing. Within a very short time frame, a combination of many of these external and internal influencing factors are shaping the content and delivery of course material in the BEDU. However, this rapid cycle of change is an opportunity to embed education for sustainability because sustainability is both a part of the “journey” as well as the destination.
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2	The University of Queensland
Case Study Title	Embedding Education for Sustainability into Teacher Education Programs in the School of Education
Representative	Dr Louise Phillips Serves on the UQ Teaching and Learning education for sustainability working party. Has personal interests in the social value of environmental education.
Institutional context	The University of Queensland has an outstanding reputation as a research-intensive university and has demonstrated commitment to sustainability in curricula by becoming a declared participant of the Universitas 21 Statement on Sustainability and signing the Talloires Declaration in 2009.. UQ has a Sustainability Office within its Properties & Services Division.
Host program	School of Education courses, principally Bachelor of Education.
Positional statement	Yes. – a strong articulation of their theoretical positioning on EfS. Subscribes to the UNESCO (2010) definition of the four interdependent pillars of sustainability – 1. Natural/ biophysical systems - provide life support systems (air, water, food) for all life; 2. Economic systems - provide continuing means of livelihood (employment and money); 3. Social systems - provide ways for people to live together peacefully, equitably and respectfully; and 4. Political systems - exercise democratic power to make decisions about ways social and economic systems use the natural (biophysical) environment.
Strategy	A 4-step process: 1. Convene a focus group discussion 2. Audit course profiles of the Bachelor of Education (Primary) program in relation sustainability principles 3. Identify how teacher educators embed education for sustainability into course content & assessment via an online survey 4. Interview two course coordinators of courses that explicitly embed education for sustainability principles. EfS initiatives to be developed at School level. Inclusion of education for sustainability principles in the UQ graduate attributes, a web portal of resources, school and discipline reviews, pre-orientation courses, sustainable teaching spaces and elective information. The following actions were proposed:

	<ul style="list-style-type: none"> ● Embed education for sustainability across all courses; ● Make links with UQ Global Change Institute and UQ Sustainability; ● Add education for sustainability resources to School of Education weekly email newsletter; and ● Develop a survey for all primary program course coordinators to audit how they apply education for sustainability into their courses on a weekly basis in Semester 2 2012 and for secondary program courses to audit their courses in Semester 1 2013.
Outcomes	<p>UQ Chief investigator on this project (Dr Louise Phillips) is now a member of the UQ Teaching and Learning education for sustainability working party. Attention to embedding sustainability into UQ attributes was suggested and was supported by Deputy Vic-Chancellor for Teaching & Learning and is now included in UQ wide proposal.</p> <p>Education for sustainability now has a presence in the School of Education. There have been discussions, surveys, interviews and inclusion of education for sustainability resources in the school's weekly updates, and a sustainability focussed morning tea gathering (and another planned in October). All of these practices have brought sustainability issues to the fore of members of the School of Education's consciousness. From this new more visible position, greater scope for real action to address education for sustainability is possible.</p>
Challenges	<p>Myths: The greatest challenges to date have been attitudinal, with resistance being expressed that is not atypical to what Sterling (2012) outlines in <i>The Future Framework</i>. Such as the barrier of 'crowded curriculum', espoused through comments like "this is yet another factor for educators to address", and objections that it is an ideology and impinges on academic freedom.</p>

3	CQUniversity
Case Study Title	Education for Sustainability: Supporting our pre-service teachers in teaching sustainability
Representative	Dr Angelina Ambrosetti CQUniversity has recently introduced sustainability as a its sixth university value. A Community of Practice has also been established to share sustainability practices in program and courses in order to embed sustainability into the university. Dr Ambrosetti is a member of the Sustainability Community of Practice.
Institutional context	With the introduction of the National Professional Standards and a new national process for the accreditation of pre-service teaching degrees, the School of Education at CQUniversity is in the midst of a rewrite of our teaching degrees. Our current programs will be replaced with new programs. This provides an opportunity to consider the inclusion of sustainability explicitly into our programs.
Host program	Bachelor of Learning Management (a pre-service teaching course)
Positional statement	The following description of sustainability underpinned my research:

	<p>“Sustainability will allow all young Australians to develop an appreciation of the need for more sustainable patterns of living, and to build the capacities for thinking and acting that are necessary to create a more sustainable future” (ACARA, 2011)</p> <p>Three long term goals for the project were identified:</p> <ol style="list-style-type: none"> 1. Create an awareness of what sustainability is 2. Embed sustainability into our programs 3. Develop pre-service teacher’s knowledge, understanding and skills about, in and for teaching sustainability
Strategy	<p>The first step towards the achievement of the goals begin with a research component. The research component of my project involved surveying both the pre-service teachers and the academic staff in the School of Education. I used the Boon (2011) survey for pre-service teachers which investigates confidence levels of teaching sustainability concepts and explicit knowledge level of current sustainability issues. The survey for pre-service teachers was of a quantitative nature. I developed a survey for academic staff based upon the survey used for pre-service teachers, however this survey is both quantitative and qualitative in nature. Thus the survey for academic staff asked for a description of sustainability as well as which course may be most suitable in which to teach about sustainability. The survey also investigated confidence levels about teaching sustainability and investigated their knowledge level of current sustainability issues.</p> <p>Following the research component of the project, it is anticipated that a full report will be presented to the education staff at a school meeting. This will begin to address the first goal with academic staff in creating an awareness of what sustainability is. This goal will be addressed with pre-service teachers by way of an investigation into sustainability within the current course ‘Sustainable Communities’.</p>
Outcomes	<p>The research revealed a positive attitude among pre-service teaching students (~80%) towards the teaching of EfS, though self-confidence in their capacities to teach EfS was lower (~60%). Less than 50% of the pre-service teachers who responded were able to correctly select the correct answer regarding the following environmental issues: the biodiversity crisis, greenhouse gases, clearing of forests, carbon emissions, the water cycle and water scarcity. This result confirms the earlier response from pre-service teachers that they believe that a high level of knowledge and skills are needed to teach about education for sustainability in a classroom.</p> <p>Similarly each of the 12 academics also agreed that it is very important to educate learners about the environment and sustainability concepts from an early age. However academics were divided when asked about whether sustainability concepts could be embedded into their course with half of the academics agreeing or strongly agreeing and half remaining neutral or disagreeing. Similarly this was the case when asked about whether they could include sustainability in their teaching, just over half of the academics who responded agreed or strongly agreed with the remaining academics remaining neutral or disagreeing. Finally all academic staff indicated that they could embed sustainability concepts into their courses.</p>

	It can be seen from the following word cloud that academics used such terminology as <i>environment, environmental, natural resources, living</i> and <i>sustainability</i> in their responses. This terminology can be considered as typical descriptive language in education for sustainability.
Challenges	Although a 50% response rate by academics is considered to be a 'good rate', getting all academics interested and then involved will be a large challenge. Academics are time poor generally and at our university are possessive of their course/s. My challenge will be that of being 'let into' courses in order to offer ideas of how sustainability concepts can be included. The connecting challenge in regards to this will be whether I have the knowledge of how to do this.

4	James Cook University
Case Study Title	The James Cook University (JCU) Case: Embedding Education for Sustainability in the Bachelor of Education
Representative	Dr Michelle Lasen. From 2009-11, Michelle led the Curriculum Refresh project, <i>Embedding sustainability across the Bachelor of Education</i> in the School of Education. To support embedding of sustainability within existing subjects, Michelle worked closely with JCU Tropical Leaders in Sustainability, Professors Bob Stevenson and Komla Tsey. This year, Michelle is also leading a JCU Teaching and Learning Academy Fellowship, entitled <i>Higher Education for Sustainability (HEfS) in the Tropics: Curriculum innovation, pedagogical practices and student engagement and learning</i> .
Institutional context	James Cook University's strategic vision involves its positioning as a tri-city University for the Tropics. Its goal is to be 'a leader in teaching and research addressing the critical challenges facing the tropics, worldwide' (JCU, 1995-2012d, p. 2). The University Plan highlights a commitment to environmental, economic, cultural and social sustainability through an integrated approach to teaching and learning, research, operations and campus facilities, and community engagement. The JCU Staff Code of Conduct (1995-2012b) further recognises sustainability and social responsibility as a guiding principle. At the level of the University, a Sustainability Action Committee and Sustainability Action Group are in the process of being established as part of a revisioning and reshaping of JCU as the University for the Tropics, reflected in a newly articulated Strategic Intent (JCU, 1995-2012c) and University Plan (JCU, 1995-2012e). It is envisaged that the Sustainability Action Group will create and implement sustainability initiatives, ensure they are communicated and supported across the University, and consult with the Sustainability Advisory Committee on matters that require the endorsement of senior management and the Vice Chancellor. During 2009–2011, as part of an university-wide Curriculum Refresh Project, the School of Education adopted a whole of school approach to embedding Education for Sustainability (EFS) in its Bachelor of Education (BEd).
Host program	School of Education courses in Foundations of Sustainability in Education (a dedicated core subject), Early Childhood Education

	and Care; and Environmental Education for the Tropics
Positional statement	As such, the subject's learning outcomes (see Table 2) resonate with Fien and Maclean's (2000) definition of EfS as: ... a new paradigm for a lifelong learning process that leads to an informed and involved citizenry having the creative problem solving skills, scientific, technological and social literacy and commitment to engage in responsible actions to ensure an environmentally sound, socially just and economically prosperous future for all (p. 37).
Strategy	This research project investigates the extent to which active and engaged learning is promoted, for the external cohorts in ED1411, through the design of the assessment tasks, the adoption of an overarching inquiry model to organise weekly activities, and the use of innovative teaching strategies and LearnJCU technologies. External cohorts comprise pre-service teachers in an online BEd (ECE) and Indigenous students undertaking a BEd (Primary) through the Remote Area Teacher Education Programme. These pre-service teachers are located throughout Queensland and undertake their studies via the one LearnJCU platform.
Outcomes	<ol style="list-style-type: none"> 1. Engaging early childhood and primary pre-service teachers in EfS through innovative pedagogy, assessment and use of online technologies; 2. Promoting ECEfS pedagogical content knowledge through learning activities articulating with the <i>Early Years Learning Framework</i> and <i>Queensland Kindergarten Learning Guidelines</i> for children, 0-5 years; 3. Revisioning and reshaping a sustainability elective to embed education for climate change <p>There will be consolidation of the EfS research agenda through the establishment of the Centre for Research and Innovation in Sustainability Education, under the direction of Professor Bob Stevenson, the Principal Investigator of this OLT project. Further, there are structures, programs and policies within the University that support the embedding of sustainability within teaching and learning, research, operations and campus facilities management, and community engagement, as JCU positions itself as the University for the Tropics.</p>
Challenges	In spite of the momentum created in the School of Education and the recognition of sustainability as a cross-curriculum priority in the Australian national curriculum, one challenge in terms of bringing EfS into 'core curriculum business' remains the lack of explicit articulation of sustainability knowledges, skills and dispositions in graduate teacher professional standards. While understanding of how EfS may be meaningfully embedded within subjects has been deepened by staff engagement in research activity pertaining to diverse sustainability themes, there is ongoing need for professional development, especially in light of staff turnover and perceptions of some staff members that EfS remains peripheral to their core. As always, a lack of time and competing interests pose as challenges. It is also important that a 'holding pattern' does not become the default position or rationale for lack of activity in a time of Higher Education budgetary constraint; shift from state to national curriculum, teacher standards and course accreditation processes; and

	uncertainty regarding pre-service teacher entry requirements, exiting tests and course structures.
5	Queensland University of Technology
Representative	<p>Dr Lyndal O’Gorman</p> <p>I teach early childhood education at QUT, specialising in the Arts and Education for Sustainability (Efs). My interest in Efs is based on a lifelong love of the natural world and a passion for sharing my love of the environment with young children. My service within the field of Early Childhood Education for Sustainability is represented by my role as Vice-Chair of the Queensland Early Childhood Sustainability Network. I am also involved in research examining the ways in which preservice teachers’ attitudes and practices towards sustainability are challenged through their involvement with the integrated Arts and Humanities unit. One study involved in-depth interviews with a small number of students who had completed the unit. Another project examined students’ responses to engaging with an online ecological footprint calculator. Strategies such as these stand to strengthen preservice teacher preparation for education for sustainability and therefore influence cultural change for present and future generations.</p>
Case Study Title	A state systems approach to embedding the learning and teaching of sustainability in teacher education: A case study of QUT’s Faculty of Education
Institutional context	<p>Queensland University of Technology (QUT) is a university based in Brisbane, Queensland across three campuses at Gardens Point, Kelvin Grove and Caboolture. QUT has an applied emphasis in courses and research, with approximately 40,000 students currently enrolled, including 6,000 international students. The university has an annual budget of more than AU\$500 million and over 4,000 staff. QUT has six Faculties (Business School, Creative Industries, Education, Health, Law, Science and Engineering). Sustainability is a key priority in the University’s strategic plan, QUT Blueprint 3.</p> <p>The original intent of the Refresh process was for minor course changes to be implemented. However, the extensive requirements of the various bodies across the sector (e.g. requirements of AITSL, QCT, ACARA, AQF, TEQSA, ACECQA), resulted in major course restructuring across the Faculty.</p> <p>The case study research described here seeks to understand and enhance efforts to build capacity for QUT, during the <i>Refresh</i> process, to mainstream Sustainability education into pre-service teacher education. Data collection has documented how an intervention process and effort to enact change in a system has taken place and includes multiple sources of evidence such as institutional reports, policy statements, curriculum materials and guidelines for lecturers, email correspondence, minutes of Refresh meetings, transcripts of <i>Refresh</i> SIG meetings, and field notes.</p>
Host program	Graduate Diploma in Education (Early Years) in the Faculty of Education
Positional statement	<p>We have developed some key points regarding Education for Sustainability in collaboration with our Faculty’s Sustainability SIG as part of the <i>Refresh</i> process.</p> <ul style="list-style-type: none"> • All encompassing, global, broad, holistic, big picture view

	<p>of the ways in which we live – economic, social, ecological sustainability</p> <ul style="list-style-type: none"> • Sustainability is about ensuring the future on a large scale, with individuals and communities playing a part. • We recognise varied perspectives on sustainability, but the core concept being for humanity to live justly within ecological and resource limits • Importance of multidisciplinary perspectives working together to address sustainability. For example, the Arts and Sciences provide different ways of considering Sustainability. • Education has a key role to play. There is a lot of goodwill and knowledge in our Faculty but we want to see greater opportunities for students and staff to engage in real practices. • Our definition calls for a focus on changing minds, habits and behaviours. This is more than “ticking a box” to say that we have “done” sustainability in our courses. • Importance of change leading to new ways of living and behaving • Education should lead to authentic learning experiences leading to deep change for sustainability.
Strategy	<p>From February to May 2012 a consultation phase took place, when various teams were established to inform the <i>Refresh</i> process (e.g. leadership team, Think Tank, course structure teams, KLA and discipline studies advisory teams, special interest groups (SIGs) and external reference groups). Of particular interest to this case study research was the establishment of the Sustainability SIG which sought to develop Sustainability as a component and thread in preservice courses. The Sustainability SIG met twice in the first half of 2012 to advise the course structure teams on key design considerations relating to the allocation of units and potential linkages across courses, with the aim of ensuring that Sustainability was embedded consistently and meaningfully in and across all courses.</p>
Outcomes	<ul style="list-style-type: none"> ○ Consolidated relationships with other people throughout the Faculty, reflective of a range of discipline backgrounds (eg. Arts, science, SOSE, inclusive education) and pedagogical context (eg. Early childhood, primary, secondary, informal). ○ Robust discussions problematising nomenclature of units (e.g. History, Geography, SOSE) in relation to early childhood courses where terminology associated with compulsory schooling was successfully challenged to be inclusive of broader early childhood education contexts. ○ Sustainability likely to be embedded in two new units in undergraduate courses – Social Science 1 (History), Social Science 2 (Geography), replacing single core unit of SOSE and Health education. This allows for expanded opportunities to focus on Sustainability and EfS. ○ Proposed inclusion of an integrated Arts and Sustainability unit in the new two year Graduate entry program, which could extend beyond the Early Years course to include the Primary program.

	<p>Within the previous one year program, Sustainability had been integrated with the Arts and SOSE in the early years program. While this was to some extent very successful, sustainability now has a clearer focus in the unit title and content, and builds on current research supporting integrated approaches that bring together the Arts and Sustainability.</p> <ul style="list-style-type: none"> ○ Working with Library staff to establish a Sustainability library subject guide for the Faculty to go online in 2013. The example provided by James Cook University provided the impetus for us to consider this as a valuable tool for students and staff as they increasingly seek to gather resources relating to teaching and learning in Sustainability. ● Extending beyond the Faculty <ul style="list-style-type: none"> ○ Work to increase the profile of Sustainability through inclusion of interdisciplinary approaches in units such as EAB006 (Leadership and Management) which involves students in a collaborative project with students from the School of Design and Lone Pine Sanctuary.
Challenges	<p>Working within a context of fundamental change.: in 2012 QUT's Faculty of Education preservice teacher education courses underwent a <i>Curriculum Refresh</i> process in response to reaccreditation requirements, which provided both challenges and opportunities. The original intent of the Refresh process was for minor course changes to be implemented. However, the extensive requirements of the various bodies across the sector (e.g. requirements of AITSL, QCT, ACARA, AQF, TEQSA, ACECQA), resulted in major course restructuring across the Faculty. This was in itself a major shift in focus. However, this shift also occurred at a time in which the Faculty underwent a major restructuring process and a round of staff reduction through voluntary redundancy. These major employment issues have taken the focus away from efforts to think in new ways about course design, when so much uncertainty prevails at a fundamental level.</p> <p>When the current changes are implemented, we are confident that interest in Sustainability will continue to increase. Within the next 12 months, we expect to:</p> <ul style="list-style-type: none"> ● Create new multidisciplinary teaching teams across the Faculty with a focus on Sustainability ● Strengthen the focus on Sustainability through the design and implementation of two new units in undergraduate courses – Social Science 1 (History), Social Science 2 (Geography). ● Increase the profile of Sustainability through expanded opportunities for real-world Sustainability engagement within the Service Learning unit in the undergraduate programs ● Strengthen the focus on Sustainability through the design and implementation of the new Arts and Sustainability unit in the graduate entry program. ● Redesign assessment in response to Sustainability as a

	<p>cross-curricular priority</p> <ul style="list-style-type: none"> • Have a fully-functioning bank of teaching and learning resources hosted by the Library for staff and students to access. • Expand opportunities for research and scholarship relating to students and staff attitudes, knowledge and experiences with Sustainability.
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6	Australian Catholic University
Case Study Title	Education for Sustainability: Supporting our pre-service teachers in teaching sustainability
Representative	<p>Dr Gerard Effeny</p> <p>I joined the university in July 2011 fresh from a 20 year career as a high school Science Teacher and Outdoor Education instructor. A part of my teaching role at ACU is the provision of science education units for pre-service primary and secondary teachers and I am the course co-ordinator for the Graduate Diploma of Education (Secondary) and Master of Teaching (Secondary) programs. I am an early career researcher with an interest in educational psychology with maturational changes in self-regulation and motivation during adolescence being particular areas of interest.</p> <p>My involvement in this project has been fairly pragmatic. As a new member of the academic world, I saw my involvement in this project as a way of making professional connections with others and to begin building a research/publications profile. As this project progressed, I have become interested in Education for Sustainability (EfS) as a phenomena in education, the prescription of EfS in the Australian Curriculum and the challenges of preparing pre-service teachers to incorporate EfS in their future classes.</p>
Institutional context	<p>Australian Catholic University (ACU) has campuses in Ballarat, Brisbane, Canberra, Melbourne, North Sydney and Strathfield. The university provides undergraduate and postgraduate courses in Arts and Sciences, Business, Education, Health Sciences, Theology and Philosophy. Over 22800 students were enrolled in courses in 2011 and ACU is one of the fastest growing universities in Australia. The training of pre-service early years, primary and secondary teachers is a key focus of the Faculty of Education at ACU's Brisbane campus has approximately 760 students studying pre-service teacher education courses. These students are supported by 16 full-time academic staff and a large number of sessional staff.</p> <p>During the course of this project, the university was actively reviewing its pre-service teacher programs to include a greater emphasis on sustainability, in keeping with the increased presence of sustainability in the Australian Curriculum and the inclusion of a sustainability goal as part of the university's mission statement.</p>
Host program	Teacher training courses
Positional statement	Recent years have seen an increasing emphasis on sustainability in education and sustainability has been identified as a cross-curriculum priority in the Australian Curriculum and as such, is

	<p>embedded in all learning areas. However, while studies have shown that teachers believe that education for sustainability (EfS) is important, there is concern over the level of understanding of sustainability concepts in the teacher population as a whole (Taylor, Kennedy, Jenkins, & Cunningham, 2006) with reports of primary teachers appearing to operate at a level of ecological illiteracy (Cutter-McKenzie & Smith, 2003).</p>
Strategy	<p>The project explored two main goals:</p> <ol style="list-style-type: none"> 1. Establish the current status of EfS in ACU's pre-service primary education courses 2. Develop a deeper understanding of pre-service teacher's knowledge and self-efficacy for the teaching of sustainability <p>These goals were addressed in a two-phased study: a desk audit and mapping exercise addressed the first goal; and a quantitative survey on self-efficacy and perceived knowledge addressed the second goal.</p>
Outcomes	<p><u>Current status of EfS in ACU's pre-service primary education courses</u></p> <p>It appears that exposure to EfS for pre-service primary teachers at ACU is through the EDST107 unit (a first year science education unit that focuses on water and water catchments, land use and bush regeneration, plant identification, riparian zones, weeds, water quality tests, soil tests and also includes an 'Education for Sustainability forum'. This unit appears to incorporate a range of topics and learning experiences that support EfS. The context, and perspective, of this unit is that of science. There is a very real danger that the effectiveness of this unit may sustain the perception amongst students and staff that sustainability is 'a science thing' or 'is covered in science'. This perception is at odds with the placement of Sustainability as a cross-curriculum priority in the Australian Curriculum. The apparent lack of EfS terms in other units studied in this audit suggests that an integrated, 'whole school' approach to EfS that has a cross-curriculum focus has yet to be developed.</p> <p><u>Develop a deeper understanding of pre-service teacher's knowledge and self-efficacy for the teaching of sustainability</u></p> <p>While the typical scores for self-efficacy, perceived knowledge and real knowledge of environmental issues in the sample group are relatively pleasing, the lack of correlation between Self-efficacy and Knowledge scores and between Knowledge and Perceived Knowledge are of some concern. If the 'content' regarding sustainability is not well known, then it logically follows that a dearth in the pedagogical content knowledge (PCK) for sustainability also exists. To complicate matters, sustainability is often an emotive issue (it is hard to argue that encouraging sustainable practices is inherently bad or unimportant) that encourages a degree of 'urgency of action'. These factors have the potential to combine to produce a tokenistic approach to sustainability in education whereby pre-teachers see sustainability as important, are seemingly willing to engage with sustainability issues in their classes in the future, but their lack of knowledge and PCK means their efforts may be superficial.</p>
Challenges	<p>The findings of my small research project indicate that much more work needs to be done on incorporating EfS into our pre-service</p>

	teacher programs. Overt discussions and demonstrations of how EfS fits within the different curriculum areas is required with activities designed to address both knowledge and pedagogical content knowledge are necessary.
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7	University of the Sunshine Coast
Case Study Title	Embedding Sustainability in Teacher Education: Graduate Attribute Mapping.
Representative	Associate Professor Deborah Heck My research interests and engagement with teaching and learning in the area of education for sustainability spans the last 18 years.
Institutional context	The University of the Sunshine Coast (USC) is one of Australia's fastest growing universities. Its vision is to be 'regionally relevant and recognised, nationally and internationally, for excellence in teaching, research and engagement' (University of the Sunshine Coast, 2012c). This vision is achieved through four strategic priorities: 'enable access to the USC experience; deliver high quality teaching, learning and graduate outcomes: build research productivity and output significantly and develop USC for a sustainable future' (University of the Sunshine Coast, 2010). Sustainability has been part of the vision of USC for some time and has been infused into practice at the level of teaching, research, engagement and capital works (University of the Sunshine Coast, 2012b).
Host program	Discipline of Education with a School of Science, Education and Engineering: Graduate Diploma and Bachelors courses in Early Childhood, Primary and Secondary Education
Positional statement	USC redeveloped its suite of graduate attributes, qualities and generic skills and adopted these as part of university policy in 2009 (University of the Sunshine Coast, 2012a). In this process the sixth graduate quality was identified as 'sustainability focussed, responding to ecological, social and economic imperatives.' Figure 1 provides a summary of the descriptors for the six graduate qualities identified at USC. In addition to these graduate qualities six generic skills were also identified as outcomes to be achieved by all graduates from USC. These generic skills include: communication, collaboration, problem solving, organisation, applying technologies and information literacy. Figure 2 illustrates graphically the combined suite of graduate qualities and skills collectively known as graduate attributes.
Strategy	The key participants in this project were the program leaders across the range of initial teacher education programs. Some of these programs were involved in retrospectively mapping the graduate attributes against previously approved programs. While another used the newly developed graduate attributes as part of the process of constructing the program. The aim of the project was to authentically engage all program leaders and course coordinators in the process of mapping courses within programs. This process was followed up with a secondary analysis focussed on identifying the pattern of how the graduate quality sustainability-focussed across one program from each group namely: the Bachelor of Early Childhood Education and the Bachelor of Primary Education. The approach adopted within the Faculty of Science, Health,

	<p>Education and Engineering was to undertake a natural mapping of existing courses and programs. New programs under development would commence with reference to the new graduate attributes. In the discipline of education program leaders where the main drivers and discussed through their regular meeting the best ways to take this process forward. Therefore, the process of graduate attribute mapping has developed differently across the programs.</p>
<p>Outcomes</p>	<p><u>Substantive Outcomes</u> Knowledgeable was the graduate quality most often linked with courses across both programs that also identified as sustainability – focussed. Both programs also had a similar level of commitment to the graduate quality creative and critical thinkers. However, this is where the similarities between the two programs ended. The distinct differences between the two programs emerged in relation to the graduate quality engaged. In sustainability-focussed courses communication was clearly identified as the most common generic skill associated with this graduate quality across both programs.</p> <p><u>Process Outcomes</u> The most important part of the process of developing graduate attributes mapping has been the sustained conversations between staff. It has been the opportunity to talk about and identify the main graduate qualities and generic skills being developed within courses that has developed understandings about how individual courses contribute towards the development of program outcomes. Across both of these programs course outlines have been progressively developed and approved with the final courses planned for submission in semester two 2012.</p>
<p>Challenges</p>	<p>In a small regional university where the use of shared courses is a requirement the delivery of courses at different levels of progression within programs has been identified as a real issue. The concern raised by academic staff relates to the level of progression of learning for generic skills and qualities at various stages of the program. For example: in one program of study a course is offered as first year first semester while in another program the same course is offered to second year students. It was important to consider that these courses should be mapped at introductory level. This provided scope for academics to consider the kind of assessment tasks adopted within these particular courses. Academic staff really benefited from the conversation with both program leaders to consider how this particular course contributed to the program learning outcomes. The challenge is when program leaders would prefer that some courses develop skills at higher levels due to their location within programs.</p>

ATTACHMENT 2: CASE STUDY REPORT GUIDELINES

1. Introduce your project and case study

- The context and the issue or need
- Name of project, participants and their roles and responsibilities, etc.
- Your research question and expected outcomes

2. Give an account of what you and your project participants did and how you did this, including at different levels is applicable:

- Efforts to engage others
- Efforts to build capacity
- Pedagogy, resources and core curricula
- Any partnerships among partners within the system

3. Provide a personal account of your experience of the project and the process.

Reflection point

How can you give a voice to other participants/stakeholders in your project?

How will we write up the research? (How would you like to format your report to present your research and experience?)

What sub-headings would you use?

In what key ways would you like to present your findings and insights?

4. Findings, insights and unexpected outcomes

Reflection point

How might you structure and present your project, research and findings in a way that balances an objective account (findings supported by facts, validation, objective evaluation) and an account of your 1st person experience/s?

5. Examples of approaches to writing action research case studies

The following presents some approaches to writing case studies of action research in environmental education. Note: The following quotes are from Kyburz-Graber, R., Hart, P., Posch, P. and Robottom, I. (Eds). *Reflective Practice in Teacher Education, Learning from Case Studies of Environmental Education*. 2006. Peter Lang AG, Bern.

As an approach to writing a case study on action research for program improvement: ...action research was used in conjunction with a curriculum innovation – one interdisciplinary, cross-curricular cooperation. The case study report itself is organised in a way that represents action research principles. It sets out the planning phase, the action phase, forms of data collection used to gather perspectives on these activities, the reflection phase.

Reflection point

How might you structure your written case study to reflect your learning from this project and your research?

Of interest in this case study is the range of data collection methods used in gathering perspectives about the program. These methods included journals, lesson plans, questionnaires, focus group discussions, observation, a recorded final evaluation, students' project reports, and photography.

The authors are also frank about the methodological issues they encountered in conducting the research. These included the effects of perceived shortage of time, which precluded full participation of all stakeholders (most importantly, of teachers), and limited feedback from lecturers and students.

Participant Case Studies

Case Study 1 CQUniversity

Education for Sustainability: Supporting our pre-service teachers in teaching sustainability

Principal Researcher:
Dr Angelina Ambrosetti

Context/Background

This project is situated in the Bachelor of Learning Management, a pre-service teaching degree offered at CQUniversity. CQUniversity is a regional university that offers primary and early childhood pre-service teaching degrees at six regional campuses. Currently degrees are offered through internal face-to-face mode, however distance education mode is due to be implemented within the next two to three years. Being a regional university our student numbers are small, with approximately 400 students enrolled in the primary and early childhood degrees. There are 24 permanent academic staff who teach in the primary and early childhood programs, and 4 research staff who currently do not have a teaching role.

With the introduction of the National Professional Standards and a new national process for the accreditation of pre-service teaching degrees, the School of Education at CQUniversity is in the midst of a rewrite of its teaching degrees. Our current programs will be replaced with new programs. This provides an opportunity to consider the inclusion of sustainability into our programs. A course entitled Sustainable Communities Currently is located in The Bachelor of Learning Management (Primary and Early Childhood) degrees. This course teaches about sustainability only in general terms, as its main focus is on teaching the SOSE curriculum. A second course entitled Global Science, examines sustainability from a scientific perspective. However, the coverage of sustainability in this particular course is limited.

CQUniversity has recently introduced sustainability as its sixth university value. A Community of Practice has also been established to share sustainability practices in program and courses in order to embed sustainability into the university. I am a member of the Sustainability CoP.

Involvement in Project

As a former primary school teacher, one of my favourite curriculum areas was that of Studies of Society and Environment. It was during this time that I became aware of the interest in 'caring for our world' by the young learners I was teaching. Topics that focused on the environment sparked my learners' interest, and their willingness to actively participate in learning about sustainability at first caught me by surprise. I moved into the tertiary sector as a sessional staff member teaching into the course 'Sustainable Communities', which addresses both sustainability and the SOSE curriculum. Now as the course coordinator of the 'Sustainable Communities' course, taught at CQUniversity in the Bachelor of Learning Management, I soon realised that the interest I saw in school aged learners was similar to that of adult learners. As course coordinator of the Sustainable Communities course I was able to adjust the content and time spend on learning about sustainability concepts to suit the interest of the learners. I also was able to tailor the SOSE strands to incorporate sustainability concepts so that the learners were being provided with a holistic vision

of sustainability, rather than one that just focused on the ecological part of sustainability.

When approached to be involved in this project, my main thoughts were focused on the provision of networking and collaborative opportunities, especially those which provided me with access to experts in the field. As such, in an atmosphere of a national curriculum, whereby sustainability is an integral part, I was concerned that I had neither the knowledge nor the skills to be able to lead change and ensure that sustainability was embedded into our programs. A significant personal goal to achieve from involvement in this project was to be able to see how others were approaching the task, and learn from those who had previously undertaken similar tasks so that I could develop a pathway that was appropriate for my program's circumstance.

Key characteristics that have underpinned research

The Melbourne declaration for school education (Ministerial Council on Education, 2008) includes goals about educating our children for the challenges of the future, being confident, and creative problem solvers ready to deal with complex issues such as climate change and sustainability. The pre-service teachers that we teach in our programs are those who will need to 'educate' our children and assist them in building the skills they need in order to face the challenges of the future. Research undertaken concerning the teaching of sustainability by Cutter-Mackenzie & Smith (2003) found that primary school teachers in Queensland were ecologically illiterate, meaning that they had limited understanding of sustainability concepts. Similarly, recent research conducted by Boon (2011), which surveyed the knowledge levels of pre-service teachers about current sustainability issues, found that the participants had limited knowledge and understanding, with most only being able to explain current issues in general terms.

Therefore the philosophy I developed regarding the approach towards embedding sustainability into our pre-service teachers was one that included the academic staff as well as the pre-service teachers themselves. In this regard, I felt that it was important to include those that were teaching the pre-service teachers, and investigate their knowledge of sustainability as well as their confidence in teaching about sustainability.

The following description of sustainability underpinned my research:

Sustainability will allow all young Australians to develop an appreciation of the need for more sustainable patterns of living, and to build the capacities for thinking and acting that are necessary to create a more sustainable future.

(ACARA, 2011)

Three long term goals for the project were identified:

1. Create an awareness of what sustainability is,
2. Embed sustainability into our programs, and
3. Develop pre-service teacher's knowledge, understanding and skills about, in and for teaching sustainability.

The first step towards the achievement of the goals involved a research component. The research component of my project involved surveying both the pre-service teachers and the academic staff in the School of Education. I used the Boon (2011) survey for pre-service teachers, which investigates confidence levels of teaching sustainability concepts and explicit knowledge level of current sustainability issues. The survey for pre-service teachers was of a quantitative nature. I developed a survey for academic staff based upon the survey used for pre-service teachers,

however this survey is both quantitative and qualitative in nature. Thus the survey for academic staff asked for a description of sustainability as well as which course may be most suitable in which to teach about sustainability. The survey also investigated confidence levels about teaching sustainability and investigated staff knowledge level of current sustainability issues.

Following the research component of the project, it is anticipated that a full report will be presented to the education staff at a school meeting. This will begin to address the first goal with academic staff in creating an awareness of what sustainability is. This goal will be addressed with pre-service teachers by way of an investigation into sustainability within the current course 'Sustainable Communities'.

Key Players and roles in project

Angelina Ambrosetti – Principal Researcher, course coordinator 'Sustainable Communities'

Kerry April – Developer and writer of the new Primary and Early Childhood programs
Dr Sue Davis – Chair of the Noosa Biosphere, researcher who is acting as a critical friend

Professor Bruce Knight – Research mentor

Professor Helen Huntly – Dean of School of Education

Significant Stories

Story 1

One hundred and twenty-five (125) pre-service teachers responded to the Education for Sustainability survey. The responses provided by pre-service teachers regarding EfS were positive and encouraging in regards to their attitudes towards sustainability. Ninety-five percent (95%) of pre-service teachers agreed that it is important that childcare/primary/secondary schools promote education for sustainability and believed that it is very important to educate learners about our environment and sustainability from an early age.

Eighty percent (80%) of the pre-service teachers who responded to the survey indicated that they can play an important role in solving environmental problems through teaching. However, only 60% of students felt confident that they could teach about education for sustainability, as the pre-service teachers acknowledged that they need highly developed skills and knowledge in order to teach sustainability issues.

The survey asked pre-service teachers about their knowledge of environmental issues such as greenhouse gases, nuclear waste, forest clearing, water shortages, climate change, pollution and extinction of species. Approximately 45% of pre-service teachers indicated that they knew something about the above listed issues and could explain the general issue, apart from nuclear waste. Forty percent (40%) of the respondents indicated that they would not be able to explain what nuclear waste is, although they had heard about it.

The survey also asked about knowledge levels of specific current environmental issues. Less than 50% of the pre-service teachers who responded were able to correctly select the correct answer regarding the following environmental issues: the biodiversity crisis, greenhouse gases, clearing of forests, carbon emissions, the water cycle and water scarcity. This result confirms the earlier response from pre-service teachers that they believe that a high level of knowledge and skills are needed to teach about education for sustainability in a classroom, which they lack. Despite this result, pre-service teachers were knowledgeable about such issues as sustainable development, climate change, extinction of species, animals and plants and nuclear

waste.

Responses from the pre-service teachers indicate that they agree about the importance of education for sustainability, however their knowledge about issues are mixed as are their confidence levels of teaching about specific related issues.

Story 2:

The responses rate from academic staff reached 50% with 12 out of 24 academic completing the online survey. The survey concerned knowledge about education for sustainability and confidence levels of teaching sustainability concepts. as well, it canvassed knowledge of environmental issues. Those academics who participated have a solid knowledge base as well as confidence in teaching.

Each of the 12 academics agreed that it was important that education for sustainability should be promoted in childcare and school settings. Similarly, each of the 12 academics also agreed that it is very important to educate learners about the environment and sustainability concepts from an early age. However, academics were divided when asked about whether sustainability concepts could be embedded into their course, with half of the academics agreeing or strongly agreeing and half remaining neutral or disagreeing. This was also the case when academics were asked whether they could include sustainability in their teaching. Just over half the academics who responded agreed or strongly agreed, with the remaining academics remaining neutral or disagreeing. Finally, all academic staff indicated that they could embed sustainability concepts into their courses.

The survey asked also academics to describe what sustainability meant to them. One response encapsulated most descriptions of sustainability.

Sustainability means the capacity to manage change to ensure the management of environmental, economic and social aspects of life on earth thereby ensuring the long term well-being of both the planet and its ability to sustain the human species.

It can be seen from the following word cloud that academics used such terminology as *environment*, *environmental*, *natural resources*, *living* and *sustainability* in their responses. This terminology can be considered as typical descriptive language in education for sustainability.

Environment Environmental Generations
Living Manner Natural Resources Sustainability

The online survey asked academics to nominate the types of courses into which education for sustainability could be embedded. Several academics responded 'all courses.' However, other academics felt that because EfS covers so many different concepts, it should have a course devoted to it specifically. It was also noted that courses such as science, geography, citizenship, the arts and SOSE could embed specific EfS concepts or approaches that would complement a specific sustainability course.

Academics' knowledge of environment issues in the main was solid. The majority of the academics who responded stated that they could either explain the general issue or explain the issue well. The issues specifically asked about were greenhouse gases, nuclear waste, forest clearing, water shortages, climate change, pollution and extinction of species.

New connections/old connections

My involvement with the Education for Sustainability project has provided the School of Education at CQUniversity with a timely opportunity to bring an awareness of sustainability and its importance within the Australian curriculum. With the move to the development of new education programs at CQUniversity, this project has provided me with the opportunity to understand and investigate how sustainability could be embedded into an education program holistically rather than partially. Our current program is very fragmented, as only two courses explicitly address sustainability concepts, whereas it is hoped that sustainability will be embedded throughout the new programs.

Biggest challenges or impediments to change

Although a 50% response rate by academics is considered to be a 'good rate', getting all academics interested and then involved will be a big challenge. Academics are time-poor generally, and at our University are also possessive of their course/s. My challenge will be that of being 'let into' courses in order to offer ideas of how sustainability concepts can be included. The concurrent challenge in regards to this will be whether I have the knowledge of how to do it.

Biggest opportunities for change

Previously it was identified that the project endeavoured to achieve three goals. Goals two and three focused on embedding sustainability into our education programs as well as to develop pre-service teachers' knowledge, understanding and skills about, in and for teaching sustainability. Based on the current outcomes from the research component of the project, a starting point for the achievement of goals 2 and 3 is evident. Once an explicit awareness of sustainability is created amongst academic staff, goals two and three can be developed within the context.

Looking to the future

The design of our new education programs has begun. The involvement in the Education for Sustainability project has enabled the 'sustainability voice' to be heard. Our new primary and early childhood education programs have seen a specific sustainability course included, for which I am the course coordinator and, therefore, the developer of the course. The project has provided me with the opportunity to also offer suggestions to our program developer about where else sustainability can also be included. This can be done progressively during the development of the above mentioned sustainability course

The inclusion of sustainability as a University theme/value has been timely, as it provides a further voice which focuses on the importance of the inclusion of sustainability in all sectors. As such this provides the opportunities for academics to become role models for our pre-service teachers, which in turn leads to the development of knowledgeable citizens.

Case Study 2 Queensland University of Technology

A state systems approach to embedding the learning and teaching of sustainability in teacher education: A case study of QUT's Faculty of Education

Principal Researcher

Lyndal O'Gorman

Context/ background

Queensland University of Technology (QUT) is a university based in Brisbane, Queensland across three campuses at Gardens Point, Kelvin Grove and Caboolture. QUT has an applied emphasis in courses and research, with approximately 40,000 students currently enrolled, including 6,000 international students. The University has an annual budget of more than AU\$500 million and over 4,000 staff. QUT has six Faculties (Business School, Creative Industries, Education, Health, Law, Science and Engineering). Sustainability is a key priority in the University's strategic plan, QUT Blueprint 3.

The current study is situated in the Faculty of Education, which has over 5,000 students and 200 staff. QUT's Faculty of Education is one of Australia's largest providers of undergraduate and postgraduate education for teachers, and is recognised as one of the top three Australian Faculties of Education in research. In 2012 the Faculty underwent a restructure from four schools to three and a reduction in staff numbers facilitated by a round of voluntary redundancies. Prior to the restructure, the Faculty's schools were Cultural and Language Studies in Education; Mathematics, Science and Technology Education; Learning and Professional Studies; and Early Childhood.

The case study research described here seeks to understand and enhance efforts to build capacity for QUT, during the *Refresh* process, and to mainstream Sustainability education into pre-service teacher education. Data collection has documented how an intervention process and an effort to enact change in the system has taken place, and includes multiple sources of evidence such as institutional reports, policy statements, curriculum materials and guidelines for lecturers, email correspondence, minutes of Refresh meetings, transcripts of *Refresh* SIG meetings, and field notes.

Involvement in Project

I teach early childhood education at QUT, specializing in the Arts and Education for Sustainability (EFS). My interest in EFS is based on a lifelong love of the natural world and a passion for sharing my love of the environment with young children. I currently teach an integrated Arts and Humanities unit within the one-year Graduate Diploma of Education (Early Years) course. This unit focuses particularly on the Visual Arts and Education for Sustainability and the many ways in which the Arts may be used as a powerful language for expressing environmental and sustainability themes. In this unit, pre-service teachers are encouraged to engage with new knowledge around sustainability, to examine their own practices and to take up the challenge of implementing education for sustainability in their work with young children and families. My service within the field of Early Childhood Education for Sustainability is represented by my role as Vice-Chair of the Queensland Early Childhood Sustainability Network.

I am also involved in research examining the ways in which pre-service teachers'

attitudes and practices towards sustainability are challenged through their involvement with the integrated Arts and Humanities unit. One study involved in-depth interviews with a small number of students who had completed the unit. Another project examined students' responses to engaging with an online ecological footprint calculator. Strategies such as these serve to strengthen pre-service teacher preparation for education for sustainability, and therefore influence cultural change for present and future generations.

I was invited by Associate Professor Julie Davis to become involved in the ALTC project as an institutional leader for QUT. This opportunity resulted from my involvement with the earlier ARIES project (2008) and my ongoing teaching, research and service in the early childhood Education for Sustainability field.

Key characteristics of EfS that informed the QUT case study

We have developed some key points regarding Education for Sustainability in collaboration with our Faculty's Sustainability SIG as part of the *Refresh* process.

- All encompassing, global, broad, holistic, big picture view of the ways in which we live – economic, social, ecological sustainability.
- Sustainability is about ensuring the future on a large scale, with individuals and communities playing a part.
- We recognise varied perspectives on sustainability, but the core concept being for humanity to live justly within ecological and resource limits.
- Importance of multidisciplinary perspectives working together to address sustainability. For example, the Arts and Sciences provide different ways of considering Sustainability.
- Education has a key role to play. There is a lot of goodwill and knowledge in our Faculty but we want to see greater opportunities for students and staff to engage in real practices.
- Our definition calls for a focus on changing minds, habits and behaviours. This is more than “ticking a box” to say that we have “done” sustainability in our courses.
- Importance of change leading to new ways of living and behaving.
- Education should lead to authentic learning experiences leading to deep change for sustainability.

Key players and their roles

Dr Lyndal O’Gorman – Principal Investigator of this case study and Program Coordinator of Graduate Diploma in Education (Early Years)

Associate Professor Julie Davis – OLT Project Leader, Lecturer in SOSE/Sustainability

Professor Nanette Bahr – Assistant Dean (Teaching and Learning)

Dr Denise Beutel – Faculty of Education Learning and Teaching Designer, coordinator of the Curriculum Refresh process

Dr Derek Bland – Senior Lecturer and Sustainability SIG member

Associate Professor Peter Hudson – Sustainability SIG member, lecturer in Science Education

Most significant impacts and outcomes

From February to May 2012 a consultation phase took place, during which various teams were established to inform the Refresh process (e.g. leadership team, Think Tank, course structure teams, KLA and discipline studies advisory teams, special interest groups (SIGs) and external reference groups). Of particular interest to this case study research was the establishment of the Sustainability SIG which sought to develop sustainability as a component and thread in pre-service courses. The Sustainability SIG met twice in the first half of 2012 to advise the course structure teams on key design considerations relating to the allocation of units and potential linkages across courses, with the aim of ensuring that sustainability was embedded consistently and meaningfully in and across all courses.

The following summary of recommendations from the Sustainability SIG was included in a Phase 1 Summary Report to be considered by course developers:

The Sustainability group recommended that a comprehensive and cohesive approach be taken to sustainability across the undergraduate programs with sustainability as overt objectives in unit outlines. It was recommended also that students be provided with further opportunities to engage in projects or experiences that address sustainability. Creation of a Faculty Sustainability website was also suggested.

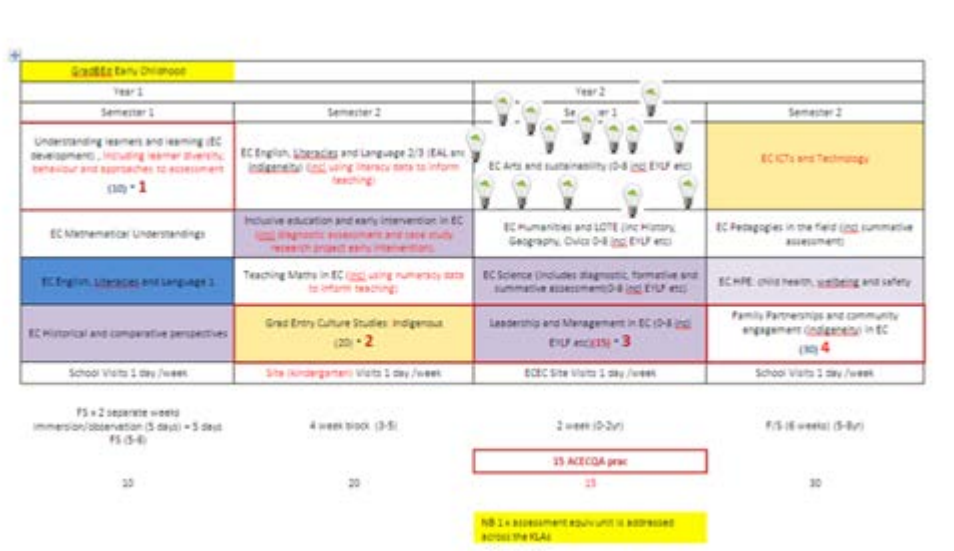
As a result of this process, a number of outcomes have been achieved, as follows:

1. Within the Faculty
 - a. Consolidated relationships with other people throughout the Faculty, reflective of a range of discipline backgrounds (eg. Arts, science, SOSE, inclusive education) and pedagogical contexts (eg. Early childhood, primary, secondary, informal).



Study 2 Figure 1 Faculty members

- b. Robust discussions challenging nomenclature of units (e.g. History, Geography, SOSE) in relation to early childhood courses where terminology associated with compulsory schooling was successfully challenged to be made inclusive of broader early childhood education contexts.
- c. Sustainability likely to be embedded in two new units in undergraduate courses – Social Science 1 (History), Social Science 2 (Geography), replacing single core unit of SOSE and Health education. This allows for expanded opportunities to focus on sustainability and Efs.
- d. Proposed inclusion of an integrated Arts and Sustainability unit in the new two year Graduate entry program, which could extend beyond the Early Years course to include the Primary program. Within the previous one year program, sustainability had been integrated with the Arts and SOSE in the Early Years program. While this was very successful to some extent, sustainability now has a clearer focus in the unit title and content, and the unit structure builds on current research supporting integrated approaches that bring together the Arts and Sustainability.



Study 2 Figure 2 Grad BEd Early Childhood map

- e. Working with Library staff to establish a sustainability library subject guide for the Faculty to go online in 2013. The example provided by James Cook University provided the impetus for us to recognise this as a valuable tool for students and staff as they increasingly seek to gather resources relating to teaching and learning in sustainability.
- Extending beyond the Faculty
 - f. Work to increase the profile of sustainability through inclusion of interdisciplinary approaches in units such as EAB006 (Leadership and Management) which involves students in a collaborative project with students from the School of Design and Lone Pine Sanctuary.

Working systemically

2. As a result of the requirement to redesign our courses, connections

within the School of Early Childhood have been strengthened. We have sought to establish a united and clear vision for the new early childhood courses within a context that includes a greater number of units than previously, to be shared across the Faculty.

3. Established relationships with staff from other Schools have been strengthened through this process.
4. ACARA cross-curriculum priorities (Indigenous perspectives, Australia's engagement with Asia, sustainability) have provided opportunities for interconnections with key personnel across the Faculty.
5. The Faculty Think Tank has provided opportunities for wider appreciation of the place of sustainability within our teacher education programs.
6. Collaboration to establish the sustainability subject guide has provided us with expanded opportunities to work alongside Library staff in order to source teaching and learning resources that will strengthen the profile of sustainability in all courses.
7. The Curriculum Refresh process has provided impetus for widening our connections outside the Faculty of Education. sustainability has provide the context a trans disciplinary project involving staff and students from the Creative Industries Faculty (School of Design). This project extends our work into the community as it is a real-world project contextualised at Lone Pine Koala Sanctuary.

Challenges

In 2012 QUT's Faculty of Education pre-service teacher education courses underwent a *Curriculum Refresh* process in response to reaccreditation requirements, which provided both challenges and opportunities.

The original intent of the Refresh process was for minor course changes to be implemented. However, the extensive requirements of the various bodies across the sector (e.g. requirements of AITSL, QCT, ACARA, AQF, TEQSA, ACECQA), resulted in major course restructuring across the Faculty.

This was, in itself, a major shift in focus. However, this shift also occurred at a time at which the Faculty underwent a major restructuring process and a round of staff reduction through voluntary redundancy. These major employment issues have taken the focus away from efforts to think in new ways about course design, when so much uncertainty prevails at a fundamental level.

Opportunities for change

Despite the significant challenges outlined above, there remains goodwill and optimism in the Faculty around the importance of embedding sustainability into our programs. While we have lost some momentum in the recent change processes, sustainability remains firmly on the agenda for the Faculty and for the University more broadly. With sustainability featuring strongly in the Australian Curriculum, Assessment and Reporting Authority, and in the QUT strategic plan, Blueprint 3, we are hopeful that once the current reforms are accommodated and the staffing changes are finalised, a renewed focus on curriculum design and implementation will provide opportunities for sustainability to be profiled more clearly.

Current research data and anecdotal evidence suggest that student commitment to sustainability will remain high, ensuring that focus will be retained and strengthened despite the uncertainties within the Faculty.

Looking to the future

While the current changes are implemented, we are confident that interest in sustainability will continue to increase. Within the next 12 months, we expect to:

8. Create new multidisciplinary teaching teams across the Faculty with a focus on sustainability.
9. Strengthen the focus on sustainability through the design and implementation of two new units in undergraduate courses – Social Science 1 (History), Social Science 2 (Geography).
10. Increase the profile of sustainability through expanded opportunities for real-world sustainability engagement within the Service Learning unit in the undergraduate programs.
11. Strengthen the focus on sustainability through the design and implementation of the new Arts and Sustainability unit in the graduate entry program.
12. Redesign assessment in response to sustainability as a cross-curricular priority.
13. Have a fully-functioning bank of teaching and learning resources hosted by the Library for staff and students to access.
14. Expand opportunities for research and scholarship relating to students and staff attitudes, knowledge and experiences with sustainability.

Case Study 3 James Cook University

The James Cook University (JCU) Case: Embedding Education for Sustainability in the Bachelor of Education

Principal Researcher:

Dr Michelle Lasen

Context/Background

James Cook University's strategic vision involves its positioning as a tri-city University for the Tropics. Its goal is to be 'a leader in teaching and research addressing the critical challenges facing the tropics, worldwide' (JCU, 1995-2012d, p. 2). The University plan states that as a comprehensive university with four faculties (Arts, Education and Social Sciences; Law, Business and Creative Arts; Medicine, Health and Molecular Sciences; and Science and Engineering), JCU is well placed to foster cross-disciplinary collaboration to meet these challenges' (p. 2). The Plan highlights a commitment to environmental, economic, cultural and social sustainability through an integrated approach to teaching and learning, research, operations and campus facilities, and community engagement. The JCU Staff code of conduct (1995-2012b) further recognises sustainability and social responsibility as a guiding principle.

During 2009–2011, as part of a University-wide Curriculum Refresh Project, the School of Education adopted a whole-of-school approach to embedding Education for Sustainability (EfS) in its Bachelor of Education (BEd). In 2011, there were a total of 1255 students enrolled in the BEd across two campuses (Cairns and Townsville), and various modes and majors (internally in ECE, Primary, Middle School, and Secondary majors; and externally in an ECE major and the Remote Area Teacher Education Programme [Primary]). In addition to a longstanding elective (*Environmental education for the tropics*), the Curriculum Refresh project saw the development of two new core sustainability subjects (*Foundations of sustainability in education* and *service learning for sustainable futures*) and the embedding of EfS across other subjects in the BEd.

Involvement in Project

From 2009-11, I led the Curriculum Refresh project, *Embedding sustainability across the Bachelor of Education* in the School of Education. To support embedding of sustainability within existing subjects, I worked closely with JCU Tropical Leaders in Sustainability, Professors Bob Stevenson and Komla Tsey, to engage whole-of-staff in a series of professional development workshops, and with research assistants to build an online resource bank, in the format of a JCU Library Guide (2012), for staff and students. In telephone interviews, School of Education staff communicated the desire for students to explore both environmental and social dimensions of sustainability over the course of the BEd, and a number of holistic sustainability frameworks—including the *Four pillars of sustainability* (United Nations Educational, Scientific and Cultural Organisation [UNESCO], 2010a), *Caring for the earth* (Fien & Tilbury, 2002), *Earth citizenship* (NSW Department of Education and Training, 2009) and *Smart by nature: Schooling for sustainability* (Centre for Ecoliteracy, 2004-11)—are presented in the school's EfS Library Guide, alongside diverse teaching resources, key policy documents and readings.

While the Curriculum Refresh project funded a baseline survey of pre-service teachers' knowledge and attitudes pertaining to sustainability (with findings published in Boon & Wilson, 2010), new research activity emerged within the School throughout this phase of staff engagement around numerous sustainability foci, including:

15. Student engagement in science and environmental education in schools,
16. Climate change education,
17. Mitigation and adaptation,
18. Service learning for sustainability in pre-service teacher education, and
19. Learning for rural sustainable development.

At the end of the project, a curriculum audit was undertaken to assess the extent to which sustainability principles, concepts, issues and pedagogies had been embedded across BEd subjects. In 2011, colleagues and I facilitated a roundtable outlining embedding processes and outcomes of the Curriculum Refresh at the World Environmental Education Congress in Brisbane; and, presented a symposium entitled, *Service learning for sustainable futures: Crossing the boundaries of traditional pedagogies in teacher education and beyond* at the Australian Association for Research in Education (AARE) conference in Hobart.

This year, I am also leading a JCU Teaching and Learning Academy Fellowship, entitled *Higher education for sustainability (HEfS) in the Tropics: Curriculum innovation, pedagogical practices and student engagement and learning*. Research activities, as part of the Fellowship, are being conducted by academics in three schools (Education, Earth and Environmental Sciences, and Engineering and Physical Sciences). These involve investigation into staff and student perspectives and understanding, and effective teaching strategies, assessment tasks, technologies and curriculum innovation processes, with regard to HEfS in tropical regional and global contexts. The overall aim is to enhance student and staff engagement in teaching and learning for sustainability in the Bachelor of Education, Bachelor of Sustainability and Bachelor of Engineering.

Research projects in the School of Education, as part of the Fellowship, include

20. Investigation of final year pre-service teachers' experiences and perceptions of service learning and sustainability prior to, during and after undertaking community-based projects in Cambodia in September, 2012, and
21. Third-year pre-service teachers' learnings through their conducting of formal interviews with supervising teachers in schools, focusing on factors that enable and constrain EfS within early childhood curriculum and school initiatives.

The Fellowship's external evaluator, Adjunct Professor Keith Skamp (Southern Cross University), will assess progress in terms of intended outcomes and collect data—primarily through focus group interviews with various stakeholder groups—to support research activities with a view to co-authored publications in 2013. This year, findings already generated through Fellowship projects will be presented at numerous conferences:

22. Chemeca's Quality of life through Chemical Engineering (Wellington, 23-26 September),
23. Australian Association for Environmental Education's Creating our next courageous steps (Melbourne, 30 September to 3 October), and
24. The joint International Conference of the Australian Association for Research in Education and the Asia Pacific Educational Research Association, entitled Regional and global cooperation in educational research (Sydney, 2-6 December).

Overview of OLT project activity and participants

The OLT project builds on the work of the Curriculum Refresh and the Teaching and

Learning Academy Fellowship, outlined in the previous section. It engages a number of staff and research assistants within the School of Education and focuses on three individual curriculum and/or research projects, as outlined in Study 3 Table 1.

Study 3 Table 1 Investigators and curriculum and/or research projects, as part of OLT project at School of Education, JCU

Lead investigators & research assistants	Subject	Research/ curriculum project title
Dr Louisa Tomas, Dr Michelle Lasen & Ellen Field	ED1411 <i>Foundations of Sustainability in Education</i> (dedicated sustainability core subject)	Engaging early childhood and primary pre-service teachers in EfS through innovative pedagogy, assessment and use of online technologies
Dr Reesa Sorin & Tamara Brooks	ED3590 <i>Early Childhood Education and Care</i> (embedded sustainability component in core subject)	Promoting ECEfS pedagogical content knowledge through learning activities articulating with the <i>Early Years Learning Framework</i> and <i>Queensland Kindergarten Learning Guidelines</i> for children, 0-5 years
Ass. Prof. Hilary Whitehouse & Jennifer Nicholls	ED4944 <i>Environmental Education for the Tropics</i> (dedicated sustainability elective subject)	Revising and reshaping a sustainability elective to embed education for climate change

ED1411 Foundations of Sustainability in Education

The first-year core, *Foundations of Sustainability in Education*, adopts an overarching inquiry framework (with tuning in, preparing to find out, finding out, sorting out, and reflecting and taking action phases) and online technologies (e.g. Collaborate, Wikis, Camtasia vignettes, video capture of lectures, accompanying Google website etc.) to promote pre-service teachers' understanding of the underlying science of key socio-ecological challenges and consideration of classroom pedagogies for EfS. The ED1411 assessment regime requires pre-service teachers to undertake an examination, report upon a solar still experiment, and investigate a local sustainability issue and communicate findings to a children's audience via a digital webstory. The subject caters to two external cohorts: Indigenous students enrolled in a BEd (Primary) through the Remote Area Teacher Education Programme, and students enrolled in an external Early Childhood teacher education program. In this research project, Dr Louisa Tomas, Dr Michelle Lasen and Ellen Field seek to investigate the extent to which ED1411 pedagogical techniques, assessment and use of LearnJCU instructional technologies promote active and engaged learning for these external cohorts. The intent is to disseminate findings in EfS, pre-service teacher education and/or online learning literatures.

ED3590 Early Childhood Education and Care

Early Childhood Education and Care 2 has run for many years as a core Early Childhood subject. While originally designed to engage pre-service teachers in the history, politics, economics and sociology of Early Childhood Education (ECE), in recent years it has also included curriculum and pedagogy for children from birth to

5 years, and professional development issues, such as ethics, child protection and bullying. Environmental sustainability is an important issue in ECE, both as part of curriculum and as a professional development topic for pre-service teachers. This project follows on from work, undertaken in the Teaching and Learning Fellowship project, in which third-year pre-service teachers were required to interview their supervising teachers in Professional Experience settings about understandings of EfS, and what enables and constrains its embedding in classroom practice. Upon entering ED3590, these same pre-service teachers will be asked in the first instance about their own understanding of ECEfS. This project will then attempt to extend their understanding of ECEfS through learning activities that utilise ECE and EfS frameworks. Pre-service teachers will complete an assessment task, where they are required to develop an ECEfS resource using the frameworks provided, applicable to children from birth to 5 years. Throughout this process, pre-service teachers will contribute their thoughts and ideas about ECEfS to an online Discussion Board. Following the subject, and with their permission, their Discussion Board postings will be examined for impact of the assessment task and related activities on their ECEfS understanding and practice.

Environmental Education for the Tropics

ED4944 was originally developed in 2002 and ran for ten years. It was a popular elective in its time, but after the JCU Curriculum Refresh process and the introduction of core sustainability subjects in the BEd, the subject needs to be revised and re-focused. As part of this OLT project, Associate Professor Hilary Whitehouse and Jennifer Nicholls (PhD student), made the decision to concentrate the revision on education for climate change mitigation and adaptation. ED4944 is taught online therefore it is easy to capture a range of highly contemporary information and pedagogical resources within the Learn JCU Blackboard platform. Hilary and Jennifer intend to research the extent to which climate change education practices have been conceived, developed and implemented in Australia and overseas, and evaluate which of those are of value to the JCU tropical context. A multi-stage learning module will be developed inquiring into the enablers and disablers of climate change education, including the phenomenon of climate change denial within education. The concept of the Anthropocene (Zalasiewicz, Williams, Steffen, & Crutzen, 2010) will be used as the over-arching framework for student discussions on current conditions. The subject will be reshaped according to findings from emerging studies, which emphasise that a 'hope-full pedagogy' has the greatest effect on climate change learning.

One project in depth: Engaging early childhood and primary pre-service teachers in EfS through innovative pedagogy, assessment and use of online technologies (Dr Louisa Tomas, Dr Michelle Lasen and Ellen Field)

ED1411 promotes foundation-level scientific understanding and literacy, critical and systemic thinking, and consideration of implications for problem solving, active citizenship and classroom pedagogy. As such, the subject's learning outcomes (see Study 3 Table 2) resonate with Fien and Maclean's (2000) definition of EfS as:

... a new paradigm for a lifelong learning process that leads to an informed and involved citizenry having the creative problem solving skills, scientific, technological and social literacy and commitment to engage in responsible actions to ensure an environmentally sound, socially just and economically prosperous future for all
(p. 37).

This research project investigates the extent to which active and engaged learning is promoted, for the external cohorts in ED1411, through the design of the assessment tasks, the adoption of an over-arching inquiry model to organise weekly activities,

and the use of innovative teaching strategies and LearnJCU technologies. External cohorts comprise pre-service teachers in an online BEd (ECE) and Indigenous students undertaking a BEd (Primary) through the Remote Area Teacher Education Programme. These pre-service teachers are located throughout Queensland and undertake their studies via the LearnJCU platform.

ED1411 is a Study Period 2 subject. As researchers, we are currently in the process of deciding upon an analytical framework and, in turn, refining our data collection instruments (survey and focus group interview schedules), for this project. In order to examine engagement in the learning process for our external pre-service teachers, we see a benefit in aligning the subject's learning outcomes and assessment tasks with Dettmer's (2006) three phases of learning: the essential (*What should learners know?*), the developmental (*What should learners be able to do?*), and the generative (*What do learners aspire to?*) (see Study 3 Table 2).

Study 3 Table 2 ED1411 assessment schedule as aligned with subject's learning outcomes and Dettmer's (2006) phases of learning and doing

Phase of learning & doing	Learning outcome	Assessment task
Essential <i>What should learners know?</i> Acquisition of essential material by all students.	Students will recall, identify and apply concepts and procedures of science and sustainability to local and global contexts.	Examination
Developmental <i>What can learners do?</i> Content is important but presented with flexibility.	Students will explore how the design and implementation of engaging and intellectually challenging learning experiences promote the development of scientific literacy.	Solar still fair test wherein students select independent variable, communicated in scientific report
Generative <i>To what do learners aspire?</i> The content is novel, processes are open ended, and each context encourages uniqueness.	Students will develop evidence-informed values and positions relating to sustainability through active citizenship, critical and systemic thinking, and reflection.	Inquiry into local sustainability issue of choice, communicated through written responses to strategic questioning (involving observation, feelings, visioning, change, personal inventory and personal action questions) and creation of digital webstory for children's audience

Given that ED1441 is a first-year/ foundation subject, its primary objective is to establish an essential scientific knowledge base; that is, targeting *What should learners know?* (Dettmer, 2006). The subject draws upon the natural and social sciences, and geographic and temporal scales, to engage pre-service teachers in exploring topics related to climate change,

25. Renewable and non-renewable energy,
26. Water availability and quality,
27. Biodiversity conservation and resource management,
28. Sustainable food production, and

29. Human population growth and wellbeing.

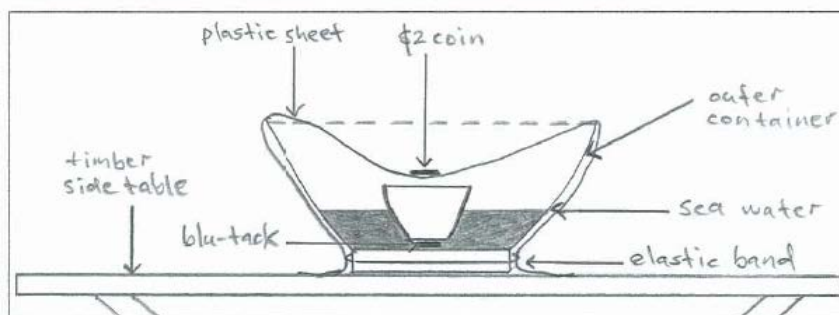
In so doing, foundational understanding of essential chemistry, physics, biology, earth and environmental sciences, geography and demography is promoted. Pre-service teachers are required to demonstrate requisite understanding in a written examination (see Study 3 Table 2). This foundational understanding will be drawn upon and deepened in curriculum studies in Science and Studies of Society and Environment (SOSE)/ Geography in the third-year of the Bachelor of Education.

To a lesser extent, ED1411 aims to promote pre-service teachers' investigative and inquiry skills, and consideration of implications for classroom pedagogy (i.e. *What should learners be able to do?*). In Assessment Task 2, pre-service teachers design a fair test to determine the effects of a variable of their choosing on the volume of water captured in a home-made solar still (see example in Study 3 Figure 1). They report upon their experimental design and findings in a scientific report. In it they draw parallels with processes of evaporation and condensation in the water cycle, and outline potential utility of solar stills, in terms of water purification in various societal contexts. This assessment task not only develops scientific investigative skills, but also models for pre-service teachers how they would support such an activity in the classroom.

Figure: 1 Photograph of experimental setup.



Figure: 2 Labeled diagram of the experimental setup



Study 3 Figure 1 Excerpt from first-year pre-service teacher's solar still experiment report

As part of the ED1411 assessment regime, pre-service teachers are also required to inquire into a local sustainability issue and consider its implications for active citizenship and classroom practice (see Study 3 Table 2). They conduct their inquiries through the *Six families of strategic questions framework* (UNESCO, 2010b), outlined as follows:

30. Observation questions e.g. How does the issue affect your local area?
31. Feeling questions e.g. Has this issue affected your own physical or emotional well-being?
32. Visioning questions e.g. How could the situation be changed?
33. Change questions e.g. What will it take to bring the current situation towards your vision?
34. Personal inventory and support questions e.g. What would you like to do that might be useful in bringing about these changes?
35. Personal action questions e.g. How can you get others to a meeting to work on this issue?

The *Six families of strategic questions framework* (UNESCO, 2010b) is conducive to promoting learning in Dettmer's (2006) generative phase, characterised by the overarching question, *What do learners aspire to?*, and by creating opportunities for 'original construction or production' (p. 73). Pre-service teachers respond to the *Six families of strategic questions* (UNESCO, 2010b) in a scholarly piece of writing and a digital webstory designed for a children's audience. The webstory is to be created through original photographs taken by the teachers, hyperlinked to educational resources, and aligned with relevant national Science content descriptions and SOSE Essential Learnings. While not directly engaging first-year pre-service teachers in participating in sustainability projects or actions—opportunities for which occur in the fourth-year capstone subject, *Service Learning for Sustainable Futures*—this assessment task involves them in inquiry, reflection, visioning and consideration of possible actions.



Study 3 Figure 2 Excerpt slides from first-year pre-service teachers' webstory

Note: Cattana Wetlands are a short distance from the JCU Cairns campus. Over recent years, pre-service teachers have visited the site in numerous capacities – as volunteers in tree planting days, as researchers in data collection exercises, and as assistants in a Future Leaders Eco-Challenge event.

Given this context, as lecturer-researchers, we are interested in investigating the extent to which our external cohorts are engaged and supported in tasks that call for depth of conceptual understanding of science content, hands on experimentation, and inquiry in the local environment. In fact, we have had contact from other Faculties within JCU considering the various challenges involved in delivering science courses online. We envisage that our findings may be relevant to diverse audiences.

The JCU network

In the School of Education, there are a number of lecturers and PhD and Honours students involved in EfS curriculum and research projects. Two Tropical Leaders in Sustainability, Professors Bob Stevenson and Komla Tsey, are jointly located in the School of Education and the Cairns Institute. They direct a recently established Research Centre, *The Centre for Research and Innovation in Sustainability Education*. As indicated in the Centre's mission statement (JCU, 1995-2012a) (Study 3 Figure 3), there are ever-expanding connections between School of Education academics, the Tropical Leaders, academics within other JCU schools and faculties, teachers in schools (involved in action research projects with JCU researchers), and communities (involved in projects with JCU students and staff). Thus, the EfS network involves participants across all levels of education (tertiary, secondary and primary) and beyond formal education to include learning in non-formal settings (community engagement and service learning projects).

The purpose of the Centre is to:

36. Develop enhanced understandings of productively engaging children and adults in deep and critically reflective inquiry and learning in relation to sustainability issues;
37. Critically examine the purposes, processes and outcomes of building individual and collective capacity to create environments in which people's well-being and the well-being of the social and ecological communities of which they are part flourish.

In the pursuit of this mission, the Centre facilitates and supports collaborative research projects both within the School of Education and with other Schools at JCU, as well as with other universities, government and community organisations at local, national and international levels.

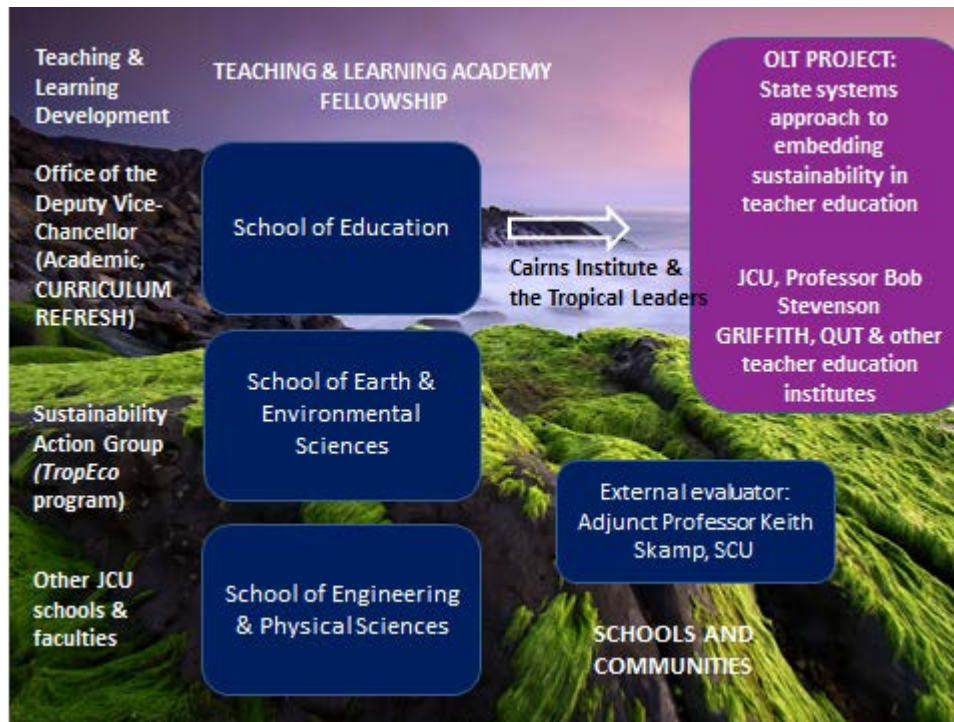
Study 3 Figure 3 . The mission statement of the Centre for Research and Innovation in Sustainability Education (CRISE)

At University level, a Sustainability Action Committee and Sustainability Action Group are in the process of being established as part of a revision and reshaping of JCU as the University for the Tropics, reflected in a newly articulated Strategic Intent (JCU, 1995-2012c) and University Plan (JCU, 1995-2012e). It is envisaged that the Sustainability Action Group will create and implement sustainability initiatives, ensure they are communicated and supported across the University, and consult with the Sustainability Advisory Committee on matters that require the endorsement of senior management and the Vice Chancellor. The Sustainability Action Group will utilise the *Learning in future environments (LiFE) index* (Environmental Association for Universities and Colleges, 2012) in order to identify priority areas and frameworks for action, identified in Study 3 Figure 4.

<p>1. Leadership and Governance Human capital Leadership</p>	<p>3. Learning, Teaching and Research Learning and teaching Research Student engagement</p>
<p>2. Partnership and Engagement Business and industry interface Staff engagement Community and public engagement Procurement and supplier engagement</p>	<p>4. Facilities and Operations Biodiversity Sustainable ICT Water Energy Transport Sustainable construction and renovation</p>

Study 3 Figure 4 Four key priority areas of the LiFE Index (Environmental Association for Universities and Colleges, 2012)

The intention then for School of Education academics, who are active in the field of EfS, is to work in truly interdisciplinary and creative ways with academics and professional staff in other schools, faculties and divisions, teachers and students in schools, and government and community organisations. The JCU network has been extended through Curriculum Refresh and Teaching and Learning Academy Fellowship projects and this OLT project (see Study 3 Figure 5).



Study 3 Figure 5 . EfS network generated through Curriculum Refresh, Teaching and Learning Academy Fellowship and OLT projects

Challenges, opportunities and future direction

In summary, academics in the School of Education at JCU have engaged with EfS in teaching and research over the last ten years. Associate Professor Hilary Whitehouse first introduced *Environmental education for the Tropics* in 2002. It's revising and reshaping is one of three projects outlined in this OLT project. From 2009-2011, JCU Curriculum Refresh saw the development of two new sustainability subjects, and professional development and other initiatives to support a wider embedding of sustainability across subjects in the Bachelor of Education. The Curriculum Refresh team worked closely with two recently appointed JCU Tropical Leaders in Sustainability, who in turn mentored a number of emerging research groups within the School with various EfS interests. There will be consolidation of the EfS research agenda through the establishment of the Centre for Research and Innovation in Sustainability Education, under the direction of Professor Bob Stevenson, the Principal Investigator of this OLT project. Further, there are structures, programs and policies within the University that support the embedding of sustainability within teaching and learning, research, operations and campus facilities management, and community engagement, as JCU positions itself as the University for the Tropics.

In spite of the momentum created in the School of Education and the recognition of sustainability as a cross-curriculum priority in the Australian national curriculum, one challenge in terms of bringing EfS into 'core curriculum business' remains the lack of explicit articulation of sustainability knowledges, skills and dispositions in graduate teacher professional standards. While understanding of how EfS may be meaningfully embedded within subjects has been deepened by staff engagement in research activity pertaining to diverse sustainability themes, there is ongoing need for professional development, especially in light of staff turnover and perceptions of some staff members that EfS remains peripheral to their core activities. As always, a lack of time and competing interests present as challenges. It is also important that a 'holding pattern' does not become the default position or rationale for lack of activity in a time of Higher Education budgetary constraint, the shift from state-based to national curriculum, teacher standards and course accreditation processes, and uncertainty regarding pre-service teacher entry requirements, exiting tests and course structures.

Recent years have presented a fluid and funded space to undertake interesting EfS curriculum work and research. It is important that, as a team, we now commit to publishing our findings from Curriculum Refresh, the Teaching and Learning Academy Fellowship and the OLT projects in EfS, teacher education and other journals. Curriculum Refresh was characterised by intense activity within the School of Education and the Teaching and Learning Academy Fellowship. It also involved a reaching and sharing across schools (Education, Earth and Environmental Sciences, and Engineering and Physical Sciences) and this OLT project. It was further characterised by a statewide systems approach involving all pre-service teacher institutes in Queensland. The future will involve consolidation and expansion of networks within the School, across JCU schools and across universities. Importantly, these networks will also involve partnerships with schools, students and community organizations and members.

Acknowledgements

I would like to acknowledge the student work of Christine Applebee, Christopher Bromell and Dean Burlock.

Case Study 4 Australian Catholic University

Education for Sustainability: Supporting our pre-service teachers in teaching sustainability - A Case Study of Australian Catholic University (Queensland)

Principal Researcher:
Dr Gerard Effeney

Context/Background

Australian Catholic University (ACU) has campuses in Ballarat, Brisbane, Canberra, Melbourne, North Sydney and Strathfield. The University provides undergraduate and postgraduate courses in Arts and Sciences, Business, Education, Health Sciences, Theology and Philosophy. Over 22,800 students were enrolled in courses in 2011 and ACU is one of the fastest growing universities in Australia. The training of pre-service early years, primary and secondary teachers is a key focus of the Faculty of Education. ACU's Brisbane campus has approximately 760 students studying pre-service teacher education courses. These students are supported by 16 full-time academic staff and a large number of sessional staff.

During the course of this project, the University was actively reviewing its pre-service teacher programs to include a greater emphasis on sustainability, in keeping with the increased presence of sustainability in the Australian Curriculum and the inclusion of a sustainability goal as part of the University's mission statement.

Involvement in Project

I joined the University in July 2011 fresh from a 20 year career as a high school Science Teacher and Outdoor Education instructor. A part of my teaching role at ACU is the provision of science education units for pre-service primary and secondary teachers and I am the course coordinator for the Graduate Diploma of Education (Secondary) and Master of Teaching (Secondary) programs. I am an early career researcher with an interest in educational psychology. Maturational changes in self-regulation and motivation during adolescence are my particular areas of interest.

My involvement in this project has been fairly pragmatic. As a new member of the academic world, I saw my involvement in this project as a way of making professional connections with others and to begin to build a research/publications profile. As this project progressed, I have become interested in Education for Sustainability (EfS) as a phenomenon in education, the prescription of EfS in the Australian Curriculum and the challenges of preparing pre-service teachers to incorporate EfS in their future classes.

Key characteristics that have underpinned research

Recent years have seen an increased emphasis on the topic of sustainability in education and sustainability has been identified as a cross-curriculum priority in the Australian Curriculum. As such, it is embedded in all learning areas. However, while studies have shown that teachers believe that education for sustainability (EfS) is important, there is concern over the level of understanding of sustainability concepts in the teacher population as a whole (Taylor, Kennedy, Jenkins, & Cunningham, 2006), with reports of primary teachers appearing to operate at a level of ecological illiteracy (Cutter-McKenzie & Smith, 2003). During the course of this project, the

University was actively reviewing its pre-service teacher programs to include a greater emphasis on sustainability, in keeping with the increased presence of sustainability in the Australian Curriculum and the inclusion of a sustainability goal as part of the university's mission statement.

As a result of these understandings, two goals for this project were identified:

38. Establish the current status of EfS in ACU's pre-service primary education courses
39. Develop a deeper understanding of pre-service teacher's knowledge and self-efficacy for the teaching of sustainability.

Seeking these goals led to the creation of two separate investigation paths. These will be explored below.

The status of EfS at ACU (Qld)

The presence and depth of Education for Sustainability in pre-service primary teaching courses at ACU were assessed through a 'desk audit' and mapping exercise. *Education for sustainability: The role of education in engaging and equipping people for change* (The Australian Research Institute in Education for Sustainability, 2009) was used to generate a list of key terms related to EfS. Eight terms were selected (*sustainability, environment, culture, future, economic, social justice, values, knowledge, change and society*) and the learning outcomes, content descriptions and assessment items embedded within 30 unit outlines from the Bachelor of Education (Primary) and Bachelor of Education (Early Years) programs were then searched for these terms. The results are shown in Study 4 Table 1.

Study 4 Table 1 Frequency distribution of key terms in 30 pre-service education units

	Unit outline areas		
	Learning outcomes	Content	Assessment
Sustainability	2	3	1
Environment	5	4	1
Culture	8	3	1
Social justice	3	3	0
Values	4	3	0
Reflection	2	1	7
Change	1	1	0
Society	4	2	0

The results of this audit suggest a relatively low frequency of occurrence of EfS related terms across the unit outlines that were assessed. It was found that the key terms were most frequently encountered within a small number of specific units with one unit, EDST107, returning the greatest number of EfS terms and highest frequency of terms across all 30 units. EDST107 is a first year science education unit that focuses on water and water catchments, land use and bush regeneration, plant identification, riparian zones, weeds, water quality tests, soil tests and also includes an 'Education for sustainability forum'. The learning activities for this unit are conducted at the Nudgee Water Holes which are adjacent to ACU's Brisbane campus (see Study 4 Figure 1 Study 4 Figure 1 Nudgee Water Holes).



Study 4 Figure 1 Nudgee Water Holes

Thus, it appears that the primary exposure to EfS for pre-service teachers at ACU is through the EDST107 unit. This unit appears to incorporate a range of topics and learning experiences that support EfS. The context, and perspective, of this unit is that of science. There is a very real danger that the effectiveness of this unit may support the perception amongst students and staff that sustainability is ‘a science thing’ or ‘is covered in science’. This perception is at odds with the placement of sustainability as a cross-curriculum priority in the Australian Curriculum. The apparent lack of EfS terms in other units studied in this audit suggests that an integrated, ‘whole-of-school’ approach to EfS that has a cross-curriculum focus has yet to be developed.

The fact that the audit was limited to a search for key terms within the published unit outlines for the pre-service primary teaching units was a limitation of this study. A wider audit, involving academic staff and pre-service teachers identifying the ways in which sustainability issues are incorporated or addressed during the teaching and learning cycles of the units may yield different results.

Pre-service Teacher Self-efficacy and knowledge of EfS

In order to develop a deeper understanding of pre-service teachers’ knowledge and self-efficacy for the teaching of sustainability, a sample of pre-service teachers (N = 296) was surveyed using an anonymous questionnaire based on Helen Boon’s (2011) ‘Education for sustainability: Supporting pre-service teachers’. The survey instrument included demographic questions, attitudinal questions, items assessing participants’ confidence about their knowledge and their actual knowledge of environmental sustainability issues. In the course of this study, Boon’s instrument was modified by the inclusion of additional demographic questions and the reduction in the number of questions related to the participants knowledge of environmental sustainability issues from 21 to 10. The reduction in the number of questions was considered necessary as Boon (2010) found that the length of the survey to be problematic and influenced the return rate of the instrument.

The participants were asked indicate their levels of self-efficacy for teaching EfS by responding to four questions:

40. I am confident that I can prepare accurate teaching modules about our environment,
41. I have skills and knowledge that would allow me to educate students about the environment,
42. I am confident and able to include education about our environment in my teaching, and
43. As a teacher I can play an important role in solving environmental problems through teaching.

The participants responded using a using a five point Likert scale (1 = Strongly Agree, 5 = Strongly Disagree). The sum of the four scores was subtracted from 20, the maximum numerical score, to form an aggregated Self-efficacy Score where low scores represent low self-efficacy and high scores represent high self-efficacy. The distribution of Self-efficacy Scores was approximately symmetrical (mean = 10.8, sd = 1.45), with half of the participants returning a Confidence Score of 11 or more out of 20. Typical scores were between 10 (Q1) and 12 (Q2). A one-way between-groups analysis of variance was conducted to explore the potential differences in Self-efficacy Scores between students at different stages of their four year pre-service program. No statistically significant differences in confidence were found.

The participants in this study were asked to indicate their perceived knowledge about seven environmental issues (greenhouse gases, nuclear waste, forest clearing, water shortages, climate change, pollution and the extinction of species. Participants were asked to respond using a four point scale

44. (1 = I have never heard of this issue and would not be able to explain it,
45. 2 = I have heard about this but I would not be able to explain what it is really about,
46. 3 = I know something about this and could explain the general issue,
47. 4 = I am familiar with this and I would be able to explain it well).

Participant scores were summed to form an aggregated score for Perceived Knowledge. The distribution of Perceived Knowledge scores was approximately symmetrical (mean = 20.85, sd = 3.33), with half of the participants returning a Perceived Knowledge Score of 21 or more out of 28. Typical scores were between 19 (Q1) and 23 (Q2). A one-way between-groups analysis of variance was conducted to explore the differences in the aggregated score for Perceived Knowledge between the different groups. No statistically significant differences were found.

The participants were also asked ten multiple choice questions about environmental issues. The number of correct answers was tallied to give a Knowledge Score. The distribution of Knowledge scores was approximately symmetrical (mean = 5.86, sd = 2.12), with half of the participants providing 6 or more correct answers (out of 10). Typical scores were between 5 (Q1) and 7 (Q2). A one-way between-groups analysis of variance was conducted to explore the differences in the aggregated score for Perceived Knowledge between the different groups. No statistically significant differences were found.

The relationship between Knowledge of environmental issues and Self-Efficacy for teaching them was explored by calculating the Pearson correlation coefficient for the Knowledge Score and the Self-Efficacy Score. No statistically significant correlation was found between Knowledge and Self-Efficacy. The relationship between the participant's Perceived Knowledge of environmental issues and their real Knowledge was investigated in a similar manner and again, no statistically significant correlation

was found.

While the typical scores for Self-Efficacy, Perceived Knowledge and real Knowledge of environmental issues in the sample group are relatively pleasing, the lack of correlation between Self-Efficacy and Knowledge scores and between Knowledge and Perceived Knowledge are of some concern. If the 'content' regarding sustainability is not well known, then it logically follows that a dearth in the pedagogical content knowledge (PCK) for sustainability also exists. To complicate matters, sustainability is often an emotive issue (it is hard to argue that encouraging sustainable practices is inherently bad or unimportant) that encourages a degree of 'urgency of action'. These factors have the potential to combine to produce a tokenistic approach to sustainability in education. Pre-service teachers see sustainability as important, are seemingly willing to engage with sustainability issues in their classes in the future, but their lack of knowledge and PCK means their efforts may be superficial.

This study was limited by the fact that the data was collected via a pen and paper questionnaire that involved a series of multiple choice/closed style questions. Providing pre-service teachers with an option to provide free responses or to participate in focus group interviews may yield a rich vein of data on Self-Efficacy for EfS and a means of exploring the development of PCK for sustainability.

Looking to the future

At the beginning of this project, my knowledge of EfS was constrained by my lack of experience and colored by my background training as a quantitative scientist. The nebulous nature of EfS, with its various understandings and perspectives, has been a source of frustration for me. In response, I have moved to a wider view of EfS, that of EfS as a phenomenon in education. This approach allows me to incorporate the various perspectives of EfS as part and parcel of the phenomenon, and to appreciate some of the challenges of preparing pre-service teachers to incorporate EfS in their future classes.

The findings of my small research project indicate that much more work needs to be done on incorporating EfS into our pre-service teacher programs. Overt discussions and demonstrations of how EfS fits within the different curriculum areas is required, along with activities designed to address both knowledge and pedagogical content knowledge are necessary.

Case Study 5 University of the Sunshine Coast

Embedding Sustainability in Teacher Education: Graduate Attribute Mapping

Principal Researcher:

Associate Professor Deborah Heck

Context/Background

The University of the Sunshine Coast (USC) is one of Australia's fastest growing universities. Its vision is to be 'regionally relevant and recognised, nationally and internationally, for excellence in teaching, research and engagement' (University of the Sunshine Coast, 2012c). This vision is achieved through four strategic priorities: 'enable access to the USC experience; deliver high quality teaching, learning and graduate outcomes: build research productivity and output significantly and develop USC for a sustainable future' (University of the Sunshine Coast, 2010).

Sustainability has been part of the vision of USC for some time and has been integrated into practice at the level of teaching, research, engagement and capital works (University of the Sunshine Coast, 2012b). This project will focus on the development of sustainability within the curriculum in the discipline of Education. The Education discipline is located within the Faculty of Health, Science, Education and Engineering within the School of Science, Education and Engineering. The discipline engages with approximately 1000 students enrolled in a range of education programs, including initial teacher education, graduate certificate, coursework and research Masters and PhDs.

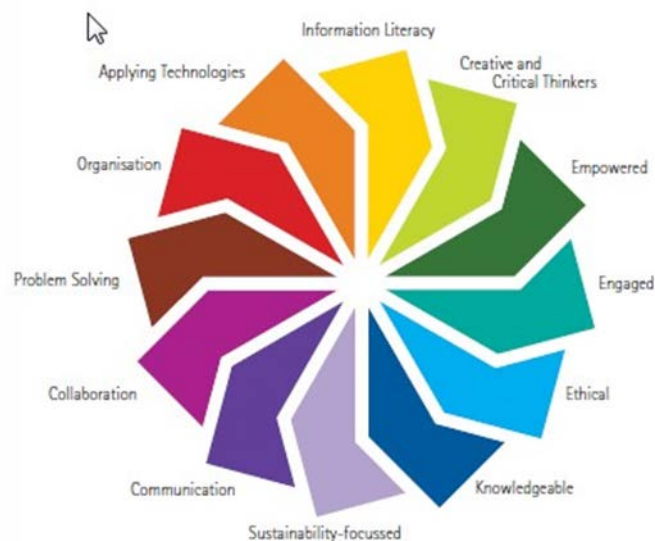
USC redeveloped its suite of graduate attributes, qualities and generic skills and adopted these as part of university policy in 2009 (University of the Sunshine Coast, 2012a). In this process the sixth graduate quality was identified as 'sustainability focused, responding to ecological, social and economic imperatives.' Study 5 Figure 1 provides a summary of the descriptors for the six graduate qualities identified at USC. In addition to these graduate qualities six generic skills were also identified as outcomes to be achieved by all graduates from USC. These generic skills include: communication, collaboration, problem solving, organisation, applying technologies and information literacy. Study 5 Figure 2 graphically illustrates the combined suite of graduate qualities and skills collectively known as graduate attributes.

Graduate Qualities

The University provides opportunities for student to be:

48. creative and critical thinkers, generating original ideas and concepts, and appreciating innovation and entrepreneurship
49. empowered, having both the capacity and confidence to pursue the attainment of full potential
50. engaged, contributing positively to diverse communities through service and leadership
51. ethical, acting with integrity in intellectual, professional and community pursuits
52. knowledgeable, building disciplinary and interdisciplinary knowledge through a scholarly approach incorporating global and regional perspectives
53. sustainability-focused, responding to ecological, social and economic imperatives

Study 5 Figure 1 USC graduate qualities



Study 5 Figure 2 Graphical representation of USC Graduate Attributes and Skills

Involvement in Project

My research interests and engagement with teaching and learning in the area of education for sustainability span the last 18 years. The fact that sustainability is identified as a University priority and that there is some evidence that it is valued as a graduate attribute for all programs of study, is an important level of commitment at the whole of University level. The challenge ahead in the role of Discipline Leader Education was to engage all of the staff with the notions of the suite of graduate qualities and skills for each program authentically so that links between content,

learning outcomes and assessment could be identified. This also needs to be done within the context of the reflection on changes to programs and courses required to ensure programs are compliant with University policy, Australian Qualifications Standards (AQF) (Australian Qualifications Framework Council, 2011) and moving towards compliance with the program standards for national accreditation for teacher education (Australian Institute for Teaching and School Leadership, 2011).

The key participants in this project were the program leaders across the range of initial teacher education programs. Some of these programs were involved in retrospectively mapping the graduate attributes against previously approved programs, while another used the newly developed graduate attributes as part of the process of constructing the program.

Retrospectively mapping graduate attributes for approved programs:

54. Sharn Donnison: Bachelor of Primary Education

55. Sharon Hogan: Graduate Diplomas: Early Childhood, Primary and Secondary

Using graduate attributes as part of the development process:

56. Anne Tietzel: Bachelor of Early Childhood Education

The aim of the project was to authentically engage all program leaders and course coordinators in the process of mapping courses within programs. This process was followed up with a secondary analysis focused on identifying the pattern of how the graduate quality, sustainability, mapped across one program from each group namely: the Bachelor of Early Childhood Education and the Bachelor of Primary Education.

Overview of project activities

Mapping graduate qualities and graduate skills across all programs within the University is a huge task. This work is being led by the Centre for Support and Advancement of Learning and Teaching (C-SALT) within the University of the Sunshine Coast. Each Faculty within the University had one staff member with allocated time to support academic staff in the implementation of mapping. In the Faculty of Science, Health, Education and Engineering this activity was undertaken initially by Kylie Readman, with the role transferring to Theresa Ashford when Kylie Readman was seconded to C-SALT.

The approach adopted within the Faculty of Science, Health, Education and Engineering was to undertake a natural mapping of existing courses and programs. New programs under development would be outlined with reference to the new graduate attributes. In the discipline of education, program leaders were the main drivers and discussed in their regular meetings the best ways to take this process forward. Therefore, the process of graduate attribute mapping has developed differently across the programs.

Stories of engagement with graduate attributes mapping

Bachelor of Early Childhood Education

This program was an early adopter of the graduate attributes and skills. The general mapping and design of this program was driven by the program leader. As part of the approval process, the program was required to articulate how the six graduate qualities and six generic skills would be developed program-wide. The Faculty Graduate Attributes leader Kylie Readman (and later Theresa Ashford), provided support directly to the program leader to achieve constructive alignment between program learning outcomes, course learning outcomes and assessment ([University of the Sunshine Coast, 2012a](#)). It was during this process that the new course outline format was developed, redeveloped in response to early adopter feedback. The new course outline format provided space to identify the graduate qualities and generic skills being developed within each individual course. The development of the program mapping allowed for shifts in assessment and course development in line with accreditation requirements. The achievement of the graduate qualities and skills across the program begins with introductory levels and moves to arriving at graduate attribute levels by the end of the program. The program leader developing this program identified strongly with notions of education for sustainability and had experience of this within early childhood practice. It is important to note that for this early adopter program there were limited if any support materials available for staff, aside from the policy document outlining the revised graduate qualities and generic skills.

The program was approved for first and second year in 2011, in order to accommodate students transferring from TAFE entering the second year. The first graduates will exit in 2013.

Grad Dip Early Childhood, Primary and Secondary

This existing program was mapped by a process that began with a workshop for course coordinators in late 2011. These coordinators were involved in teaching the programs in two groups: early childhood and primary, and then secondary courses.

The program leader and the Faculty Graduate Attributes Leader Theresa Ashford provided a workshop that introduced staff to the graduate qualities and skills, and provided the space for ongoing discussions. These were the first group discussions amongst staff, in which concepts of what 'sustainability-focused' really meant were discussed. The discussions centred on the position that sustainability was more than just the environment. Exploring the idea that sustainability linked economic social and ecological systems, and development of a shared view of this and other graduate qualities, was an important part of the conversation. During these discussions, staff had access to new versions of support material that were redeveloped and refined following the workshops and graduate qualities and skills mapping sessions. The Program Leader worked with the Faculty Graduate Attributes Leader to develop maps of each of these three programs.

Bachelor of Primary Education

During 2011 the program leader identified a range of program changes that were required, based on an analysis of accreditation requirements and the initial review of the program in accordance with the graduate qualities and skills. The program had been developed and aligned with the previous university graduate attributes. The key changes included:

57. Removal of the option to choose between COR111 Environment,

Technology and Sustainability or EDU107 Science and Sustainability in Primary Schools with the latter being the requirement for all students.

- 58. Reducing the number of professional experience days to 115 and reducing the final course from 24 units to 12 units.
- 59. The inclusion of an additional course EDU410 Aboriginal and Torres Strait Islander Perspectives in Learning and Teaching.

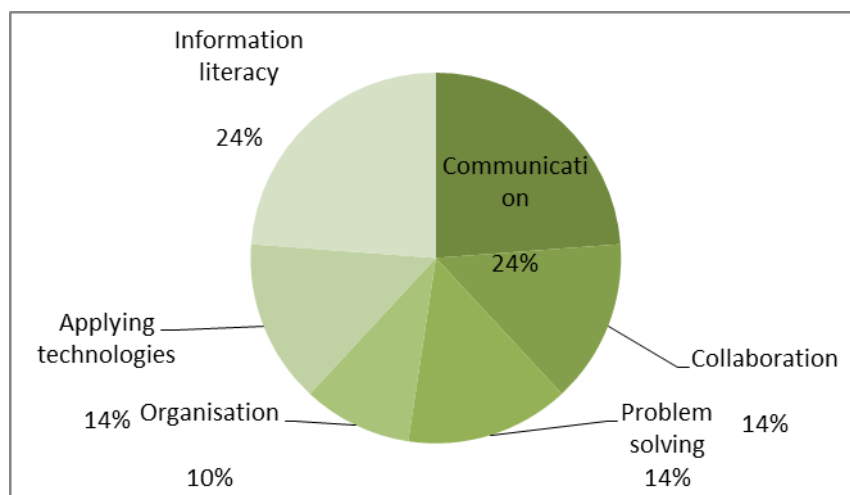
Following on from this course development in 2011, graduate attribute mapping occurred in consultation with all staff and with staff having access to the published materials on the University website in mid-2012. The Graduate Attributes Leader provided staff with the opportunity to engage with graduate qualities and generic skills at an off campus site. An important part of this process was for course coordinators to map their own courses with a focus on limiting the number of graduate qualities and skills identified in the main attributes addressed in each program. This was commonly identified as 2 to 3 qualities and another 2 to 3 generic skills. Course coordinators identified the level or progression of learning opportunities within their course as either introductory, developing or graduate.

The resulting map illustrates the development of the mapping process as some courses have been progressively mapped throughout this process and have developed over time. Their content, assessment and outcomes have been redeveloped to meet the needs of the program and the overall program outcomes.

Reflections on the mapping

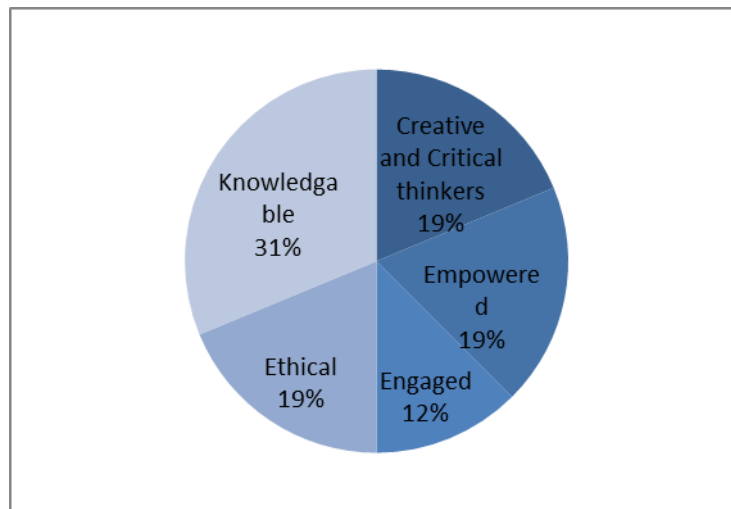
Bachelor of Early Childhood Education

The graduate quality sustainability-focused was mapped in nine of the 29 courses in the Bachelor of Early Childhood Education program. Study 5 Figure 3 illustrates that in this program sustainability-focused was linked to three groups of graduate qualities. The qualities most commonly associated at 24% were information literacy and communication. The next group of qualities linked 14% of the time included collaboration, problem solving and applying technologies. The final quality with the least connection at 10% was organisation.



Study 5 Figure 3 EDU303 generic skills linked to sustainability-focused courses

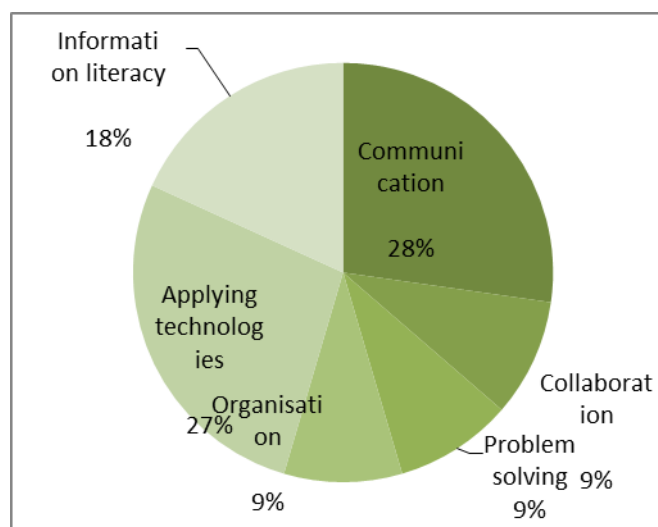
All of the generic skills were connected to courses associated with sustainability-focused as illustrated in Study 5 Figure 4. The most highly connected generic skills were knowledgeable (31%) followed by creative and critical thinker (19%), empowered (19%), ethical (19%) and then engaged (12%). The mapping process also identified the progression of learning for the graduate qualities and generic skills throughout the program from introductory, developing through to graduate level. Examples of these as they related to the graduate quality sustainability-focused are provided in Appendix A. Within this program an analysis of these levels as they relate to the graduate quality sustainability-focused indicates that half of the courses are offered at graduate level with 25% offered at introductory and developing levels.



Study 5 Figure 4 Graduate qualities linked to sustainability-focused courses

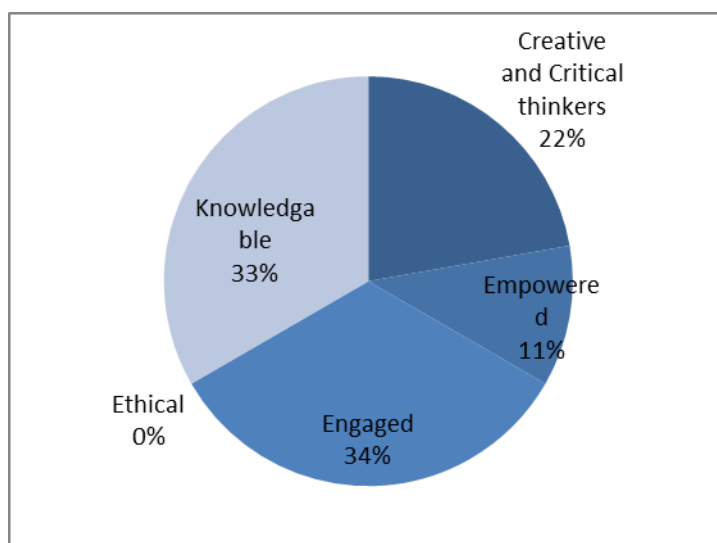
Bachelor of Primary Education

The graduate quality sustainability-focused was mapped in nine of the 28 courses in the Bachelor of Primary Education program. Study 5 Figure 5 illustrates that in this program sustainability-focused was linked to three groups of graduate qualities. The qualities most commonly associated were communication (28%) and information literacy (27%). The next level of connection was one graduate quality, information literacy at 18%. The final group of three qualities included collaboration (9%), problem solving (9%) and organisation (9%).



Study 5 Figure 5 EDU304 generic skills linked to sustainability-focused courses

All of the generic skills were connected to courses associated with sustainability-focused as illustrated in Study 5 Figure 6. The most highly connected generic skills was engaged (34%) followed closely by knowledgeable (33%) creative and critical thinker (22%), empowered (11%). This mapping identified no connection between the generic skill ethical and the graduate quality sustainability-focused. The mapping process also identified the progression of learning for the graduate qualities and generic skills throughout the program from introductory, developing through to graduate level. Examples of these as they related to the graduate quality sustainability-focused are provided in Appendix A. Within this program an analysis of these levels as they relate to the graduate quality sustainability-focused indicates that 60% of the courses are offered at graduate level with 20% offered at introductory and developing levels.



Study 5 Figure 6 ED304 Graduate qualities linked to sustainability-focused courses

Reflections

Knowledgeable was the graduate quality most often linked with courses across both programs that also identified as sustainability-focused. Both programs also had a similar level of commitment to the graduate quality creative and critical thinkers. However, this is where the similarities between the two programs ended. Differences between the two programs emerged in relation to the graduate quality engaged. In the Bachelor Education Primary the graduate quality engaged was the quality most often associated with sustainability-focused courses while in the Bachelor of Early Childhood Education the graduate quality engaged was the least associated with sustainability-focused courses. Another significant difference was the focus on ethical within the two programs. In the Bachelor of Early Childhood program sustainability-focused courses were linked with the ethical quality in 19% of cases. However, in the Bachelor of Education Primary none of the sustainability-focused courses were identified as connected with the graduate quality ethical.

In sustainability-focused courses communication was clearly identified as the most common generic skill associated with this graduate quality across both programs. Reflecting upon the pattern across both programs, three generic skills represented more than half of the generic skills associated with sustainability-focused courses. These included: communication, information literacy and applying technologies. The remaining three generic skills collaboration, problem solving and organisation were less frequently associated within sustainability-focused courses. Reflecting on the pattern of the progression of learning opportunities for the graduate quality sustainability-focused there were some distinct similarities between

the two programs. This analysis shows that the majority of the sustainability-focused opportunities within programs were at the graduate level 50 to 60% with some opportunity to explore introductory and developing levels between 20 to 25%. This suggests that the notion of sustainability is built across the programs and should be strongly integrated at the graduate level to consolidate the student learning.

The most important part of the process of developing graduate attribute mapping has been the sustained conversations between staff. It has been an opportunity to talk about and identify the main graduate qualities and generic skills being developed within courses. This has developed understanding about how individual courses contribute towards the development of program outcomes. Across both of these programs course outlines have been progressively developed and approved, with the final courses planned for submission in semester two 2012.

Issues and Challenges

In a small regional university in which the use of shared courses is a requirement, the delivery of courses at different levels of progression within programs has been identified as a real issue. The concern raised by academic staff relates to the level of progression of learning for generic skills and qualities at various stages of the program. For example: in one program of study a course is offered as first year first semester while in another program the same course is offered to second year students. It was important to consider that these courses should be mapped at introductory level. This provided scope for academics to consider the kind of assessment tasks to be adopted within these particular courses. Academic staff benefited from the conversation, with both program leaders to consider how this particular course contributed to the program learning outcomes. The challenge comes is when program leaders would prefer that some courses develop skills at higher levels due to their location within programs.

The next challenge for both the Bachelor of Primary Education and the Bachelor of Early Childhood Education will be the transition to national accreditation. The next logical step in the mapping process is to identify gaps, and to redevelop courses to address any issues identified. Given the high level of change within initial teacher education, the idea of redeveloping courses only in relation to graduate qualities and skills is not one that is well received by academic staff. The shift to national accreditation requirements conversations will need to continue, and ongoing discussions about graduate qualities and skills will be required to be part of that conversation. A further challenge will be ensuring that staff members continue to increase their understanding of what sustainability-focused means. This is an important part of course and program outcomes for all students in initial teacher education.

Case Study 6 The University of Queensland

Embedding Education for Sustainability into Teacher Education Programs in the School of Education : The University of Queensland Case Study

Principal Researcher:

Dr Louise Phillips

Context/Background

The University of Queensland

The University of Queensland places a strong and growing emphasis on the need for sustainable practices throughout its operations and the need to prepare its students for the challenges climate change presents for the future. The University of Queensland has an outstanding reputation as a research-intensive university and has demonstrated commitment to sustainability in curricula by becoming a declared participant of the Universitas 21 Statement on sustainability and signing the Talliores Declaration in 2009.

After discussing the ALTC embedding education for sustainability into teacher education project with Geoff Dennis, Deputy Director, Properties & Facilities Division (within which the UQ Sustainability office is located), I have been welcomed onto the UQ Teaching and Learning education for sustainability working party. This group has, in recent months, developed a proposal for embedding sustainability into UQ curricula for consideration by each Faculty's teaching and learning committee. The proposal promotes strategies like inclusion of education for sustainability principles in the UQ graduate attributes, a web portal of resources, school and discipline reviews, pre-orientation courses, sustainable teaching spaces and providing elective information. The general response from the Faculty of Social and Behavioural Sciences (in which the School of Education is housed) Teaching and Learning Committee was a preference for initiatives to address education for sustainability to be developed at a School level, so that there will be greater ownership and therefore greater momentum to enact education for sustainability.

UQ School of Education

The University of Queensland School of Education has been a provider of teacher education since 1945. The 2010 *Excellence in research in Australia* report ranked The University of Queensland as the only university to be conducting research at the highest level of 5, well above world standard, in education. The Head of School, Professor Peter Renshaw, is principal investigator along with Dr Ron Tooth in an ARC-funded project titled Pedagogy and place: Transforming teachers' and students' knowledge and values regarding environmental sustainability. Dr Ron Tooth is an Adjunct Associate Professor in the School of Education and the Principal of Pullenvale Environmental Education Centre. Pullenvale has an international reputation for its practice of storythread pedagogy: an innovative pedagogy in environmental education.

The School of Education's academic staffing consists of 28 full time academics, 9 research fellows, and 16 honorary academics. At present there are 1218 students enrolled in a suite of undergraduate programs which include:

60. Bachelor of Education (Primary)
61. Bachelor of Education (Middle Years of Schooling)
62. Bachelor of Arts/ Bachelor of Education (Secondary)

- 63. Bachelor of Arts/ Bachelor of Education (Middle Years of Schooling)
- 64. Bachelor of Business Management/ Bachelor of Education (Secondary)
- 65. Bachelor of Commerce/ Bachelor of Education (Secondary)
- 66. Bachelor of Creative Arts/ Bachelor of Education (Secondary)
- 67. Bachelor of Music/ Bachelor of Education (Secondary)
- 68. Bachelor of Science/ Bachelor of Education (Secondary)
- 69. Graduate Diploma in Education (Middle years of Schooling and Secondary).

Involvement in Project

I first became interested in and passionate about environmental education in my Diploma of Education study in the late 1980s and early 1990s. In 1992 I organized the World Environment Day Children's Festival that was held in Prince Alfred Park, Surry Hills, Sydney. Throughout my career as an early childhood educator and storyteller, I have integrated environmental education and sustainability concerns into my teaching and storytelling. The stories that I choose to tell invariably have a powerful message regarding care for the environment, social justice and sustainability. My pedagogical concerns of care for the environment, social justice and sustainability, led me to recognise the powerful work of Environmental Education Centres, and I worked casually for a few years at Bunyaville Environmental Education Centre.

More recently, in practitioner research of my practice of social justice storytelling with a Prep class, the children initiated social actions to support the recovery of a local critically endangered bird, and address the exploitation of child labour in Pakistan. Publications on this study led to membership of an international collective of researchers in early childhood education for sustainability. This year, when I began an academic appointment at The University of Queensland, I came to hear of the ALTC funded project *A state systems approach to embedding the learning and teaching of sustainability in teacher education*. Given my research interest in education for sustainability, I agreed to be The University of Queensland investigator for this project. I agree with Sterling (1990) and UNESCO (1993) that we urgently need to embrace education for sustainability, as the global issues facing us require immediate attention. This is especially true since a further twenty years has passed since their claims were made. Scientific evidence clearly demonstrates that life on earth cannot be sustained if humans continue to use resources at an alarmingly excessive rate (Brown, 2011).

Key characteristics that have underpinned research

In discussions, interviews and surveys with colleagues in the School of Education, education for sustainability was defined as an umbrella for many forms of education that already exist, along with new forms that remain to be created. Education for sustainability was defined from a systems thinking position in accordance with the UNESCO (2010c) definition of the four interdependent pillars of sustainability –

- 70. Natural/ biophysical systems - provide life support systems (air, water, food) for all life;
- 71. Economic systems - provide continuing means of livelihood (employment and money);
- 72. Social systems - provide ways for people to live together peacefully,

equitably and respectfully; and

73. Political systems - exercise democratic power to make decisions about ways social and economic systems use the natural (biophysical) environment.

A vision of sustainability that goes beyond ecological sustainability was adopted to recognise and include the intersecting factors of cultural, social, political and economic sustainability. A broader, all-encompassing definition was believed to be needed to affect all disciplines and to increase momentum for responsibility for action.

The seven key concepts of sustainable development as defined by the UK Sustainable Development Education Panel (1998) were used. These concepts are:

74. Interdependence – of society, economy, and the natural environment, from local to global scales.
75. Citizenship and stewardship – rights and responsibilities, participation and co-operation.
76. Needs and rights – of future generations.
77. Diversity – the importance of cultural, social, economic and biological variety.
78. Quality of life, equity and justice.
79. Sustainable change – development and carrying capacity.
80. Uncertainty and precaution in action.

In terms of education for sustainability skills and dispositions the following UNESCO statement provided an auditable list:

A successful UN Decade of ESD would create citizens and leaders who have skills in critical and creative thinking, conflict management, problem solving, problem assessment to actively take part in the life of society, are respectful of the Earth's resources and biodiversity, and are committed to promoting a peaceful and democratic society.

(UNESCO, n.d.)

For sustainability pedagogies, Sterling's (2008) suggested list of practices were audited, these included:

81. Systemic thinking,
82. Critical thinking,
83. Interdisciplinarity and transdisciplinarity,
84. Experiential learning and real-life issues,
85. Reconnecting to sense of place and real-world inquiry,
86. Empowerment of the learner,
87. Teacher as mentor, exemplar and facilitator,
88. Multiple teaching styles,
89. Developing dialogue,
90. Space for emergence,
91. Learning for action,
92. Reflection on learning (reflexivity),

- 93. Transformative learning,
- 94. Collaborative learning and co-inquiry,
- 95. Action competence, and
- 96. Campus as curriculum and use of campus as a learning resource.

Key Players and roles in project

- 97. Dr Louise Phillips – Principal Investigator of this case study and Course Coordinator of literacy education courses
- 98. Professor Peter Renshaw – Head of School
- 99. Associate Professor Shelley Dole – Coordinator of Bachelor of Education (Primary)
- 100. Dr Kerryn McLuskey - Coordinator of Bachelor of Education (Secondary)
- 101. Dr Ron Tooth - Adjunct Associate Professor and the Principal of Pullenvale Environmental Education Centre
- 102. Dr Tony Wright – Course Coordinator of science education courses
- 103. Associate Professor Liz MacKinlay - Course Coordinator of Indigenous Knowledge and education course
- 104. Karena Menzies - Course Coordinator of studies of society and environment courses

Research questions and expected outcomes

To explore how UQ School of Education might embed education for sustainability in pre-service teacher education programs at UQ four methods were employed. They were:

- 105. Convene a focus group discussion,
- 106. Audit course profiles of the Bachelor of Education (Primary) program in relation sustainability principles,
- 107. Identify how teacher educators embed education for sustainability into course content & assessment via an online survey, and
- 108. Interview two course coordinators of courses that explicitly embed education for sustainability principles.

The expected outcome of data analysis from these methods is to identify strengths and gaps of the current provision of the Bachelor of Education (Primary) program with regard to embedding education for sustainability. Using this profile, considerations for future directions will be deliberated within the School of Education and future plans mapped and enacted.

Findings

Focus group discussion

At the beginning of June a focus group was held to discuss this project in the UQ School of Education, and to explore possibilities of how to address education for sustainability. Participants included the Head of School, Professor Peter Renshaw, Associate Professor Shelley Dole, Coordinator of Bachelor of Education (Primary), Dr Kerryn McLuskey, Coordinator of Bachelor of Education (Secondary), and post-

doctoral research fellow Donna Couzens. The discussion began with an exploration of the definitions of sustainability and education for sustainability. The UNESCO (2010c) definition of the four interdependent pillars of sustainability was provided as a framework for exploration. Myths (e.g., “it’s an ideology”) and barriers (e.g., “the curriculum is already crowded”) were deliberated. From the discussion the following actions were proposed:

109. Embed education for sustainability across all courses,
110. Make links with UQ Global Change Institute and UQ Sustainability,
111. Add education for sustainability resources to School of Education weekly email newsletter, and
112. Develop a survey for all primary program course coordinators to assess how they apply education for sustainability into their courses on a weekly basis in Semester 2 2012 and for secondary program courses to assess their courses in Semester 1 2013.

Audit of Bachelor of Education (Primary) course profiles

Publicly available online course profiles for each of the Bachelor of Education (Primary) program core courses were audited for the inclusion of sustainability concepts as defined by UK Sustainable Development Education Panel (1998): interdependence; citizenship and stewardship; needs and rights; diversity; quality of life, equity and justice; sustainable change; and uncertainty and precaution in action. In addition, learning activities and assessment specifications were audited for sustainable pedagogies as defined by Sterling (2008): systemic thinking; critical thinking; interdisciplinarity and transdisciplinarity; experiential learning and real-life issues; reconnecting to sense of place and real-world inquiry; empowerment of the learner; teacher as mentor, exemplar and facilitator; multiple teaching styles; developing dialogue; space for emergence; learning for action; reflection on learning (reflexivity); transformative learning; collaborative learning and co-inquiry; action competence; and campus as curriculum and use of campus as a learning resource. When any of the above listed words (or synonyms) were located in a course profile, a ‘yes’ was noted. See Appendix A for results. EDUC1029 *Introduction to Education* and EDUC2090 *Indigenous Knowledge and Education* had embedded the most concepts and pedagogical practices with 12 of the suite of 23 concepts and pedagogical practices addressed. EDUC1706 *Introduction to Role of Science and Technology Education in Society*, EDUC1715 *Primary Professional Experience 1*, and EDUC3707 *Teaching Studies of Society and Environment* followed close behind with ten of the concepts and pedagogical practices included. All other courses included 3 to 9 of the concepts and pedagogical practices. These findings will be discussed and addressed further in program meetings.

Survey of lecture content and tutorial activities of Bachelor of Education (Primary) courses offered in Semester 2 2012

In semester 2, 2012 there were nine courses offered in the Bachelor of Education (Primary). The course coordinators were invited to complete surveys that asked the same set of questions about the content and pedagogies employed in lectures and tutorials on a weekly basis across the first seven weeks of the semester. See Appendix B for a sample of the survey. Teachers as Professionals, a final year project based course, was offered largely in the mid-semester break, so the course coordinator only completed the survey in week 1 as a summative review of nine weeks of course content. All courses were surveyed in the first three weeks. This reduced to four respondents out of eight courses in weeks 4 and 5, and only two respondents in weeks 6 and 7 (myself and the Course Coordinator of the primary program).

113. Of the 4 pillars of sustainability, social sustainability seems to be addressed the most frequently, specifically, in the context of citizenship and also relating studies to real-life situations. Ecological sustainability is addressed on a regular basis in specific subjects, particularly science-related modules.
114. Assessment of the inclusion of education for sustainability concepts identified that citizenship, quality of life, and uncertainty are addressed fairly regularly in several courses, whereas interdependence and sustainable change are the most infrequently concepts within the participating courses.
115. Survey results of sustainability skills and dispositions indicated that critical/creative thinking was most consistently included in courses on a week-to-week basis, with 25 inclusions out of 29 responses. This is followed by problem assessment and solving (20 inclusions out of 29 responses). The other three listed skills were consistently fewer in results (respect for Earth's resources and biodiversity 11 out of 29 responses; promotion of a peaceful and democratic society 10 out of 29; and conflict management 7 out of 29).
116. Audit of practices typically used in sustainability pedagogies found that:
 - a. Critical thinking is the pedagogical principle applied most frequently and consistently across the participating courses.
 - b. Empowerment of the learner and experiential learning are two other concepts addressed fairly consistently in several modules.
 - c. The campus was only used in one participating course in one week for one activity.

Interviews

Individual interviews were conducted with science education and indigenous knowledges course coordinators, because these were seen to more explicitly embed education for sustainability, along with sociology courses. However, an interview has not yet been secured with course coordinator of sociology courses. Key points articulated in these courses, that defined the School of Education's current position on embedding education for sustainability, included:

Sustainability is one of the very important social things that goes into education. I think that science contributes to it by providing reliable evidence about what you can do and what you can't do for sustainability.

In education, I see our goal as to help students get enough understanding of the underlying scientific ideas so that they can see how that they apply to issues like sustainability, and allow students to make good judgements about how they behave when they are thinking about sustainability.

There is only one science course in the four year Bachelor of Education (Primary).
 Science Education Course Coordinator

The work I do in indigenous education, it's about bringing students into a space that we call the cultural interface, which means that it is a place where indigenous and non-indigenous knowledges have always been in dialogue ...and acknowledge that indigenous people around the world have knowledges of environment and relating to one another and the world that they live, that are different to ours but not lesser

than ours, and in some ways a lot more sustainable than ours.

This is done by not telling but showing...so just yesterday I showed the students a turtle hunting video, which was interesting because we catch, we hunt, we find a turtle, we kill it, butcher it, cook it, you know, the whole kit and caboodle, but alongside that, we had a really big discussion around the ethics of care in relation to that turtle, and some of the things that we were doing that were about an indigenous way of caring for country and caring for the species of the turtle, and the spirit of the turtle.

Unless we have that capacity to care, things won't change, and that sustainability across the globe, for peace and harmony and humanity and the environment, it won't happen. So I guess that is what I see as the challenge in the school organization.

Indigenous Knowledges Course Coordinator

These two course coordinators also offered suggestions on how the School of Education might address embedding education for sustainability.

"The trouble is the amount of curriculum our education students see of science is tiny; one serious course that addresses a bit of science."

Science Education Course Coordinator

A more holistic approach to the courses that we teach...I guess trying to see how it is that this kind of way of thinking, this concept of the thinking heart, how can we interweave that into our programmes so that when students come to my class, some of that work has already been done.

I wonder if it's just about some PD for us here.

Everybody here engage that thinking heart, and really embed it, not just be tokenistic about it.

Indigenous Knowledges Course Coordinator

Most significant impacts and outcomes

UQ Chief Investigator on this project, Dr Louise Phillips, is now a member of the UQ Teaching and Learning education for sustainability working party. Attention to embedding sustainability into UQ attributes was suggested and was supported by Deputy Vice-Chancellor for Teaching & Learning. It is now included in the UQ-wide proposal.

Education for sustainability now has a presence in the School of Education. There have been discussions, surveys, interviews and inclusion of education for sustainability resources in the school's weekly updates, and sustainability-focused morning tea gatherings (in June and October). All of these practices have brought sustainability issues to the forefront of the School of Education's consciousness. From this new more visible position, greater scope for real action to address education for sustainability is possible.

Challenges

The greatest challenges to date have been attitudinal, with resistance being expressed similar to that which Sterling (2012) outlines in *The Future framework*. Included is the barrier of 'crowded curriculum', espoused through comments like

“this is yet another factor for educators to address’, and objections that it is an ideology and impinges on academic freedom. *The Future framework* provides useful responses to these barriers and objections, so this document has been circulated to members of the School of Education, Faculty of Social and Behavioural Sciences, and UQ Teaching and Learning education for sustainability working party.

Future plans

At this stage of the project, future plans largely comprise further consultation at both a School and University wide level.

117. The results of audit of the Bachelor of Education (Primary) program will be discussed at the next Program meeting, with future directions proposed.
118. The Bachelor of Education (Secondary) Program will be audited in Semester 1 2013.
119. A whole-of-school approach needs to be determined.
120. UQ Working Party On Embedding Sustainability Into UQ Curricula will continue to meet with faculty representatives and share resources to enable sustainability to be embedded across UQ curricula

The work of embedding education for sustainability will, by its very nature, never end. As Benjamin Barber (1984/2003) noted, this is essentially a political question: “What shall we do when something has to be done that affects us all, we wish to be reasonable, yet we disagree on means and ends and are without independent grounds for making a choice?” (p. 120-121). The work of education for sustainability is highly contentious because of these tensions.

Audit of Bachelor of Education (Primary) course profiles

Module	Interdependence (of society/economy/natural environment)	Citizenship/stewardship (rights & responsibilities . participation)	Diversity (cultural, social, economic, biological)	Quality of life (equity & justice)	Sustainable change (implications of finite resources)	Uncertainty & risk (flexibility & lifelong learning)	Critical thinking	Systemic thinking
EDUC1029		yes	yes	yes			yes	yes
EDUC1702	yes	yes	yes	yes			yes	yes
EDUC1703							yes	
EDUC1704		yes	yes				yes	
EDUC1706	yes	yes	yes	yes	yes		yes	yes
EDUC1707			yes				yes	yes
EDUC1708	yes	yes	yes	yes	yes		yes	
EDUC1715			yes					yes
EDUC2707		yes	yes		yes	yes	yes	
EDUC2712			yes					yes
EDUC2716	yes		yes					yes
EDUC2703							yes	
EDUC2706							yes	yes
EDUC2714								yes
EDUC2704				yes			yes	yes
EDUC3701		yes	yes	yes			yes	
EDUC3702				yes			yes	
EDUC2090	yes	yes	yes	yes	yes		yes	yes
EDUC3706	yes	yes					yes	

EDUC3707	yes	yes	yes	yes	yes		yes	
EDUC3714								yes
EDUC3703								yes
EDUC3705								
EDUC4702			yes				yes	yes
EDUC4703							yes	
EDUC4714								yes
TOTALS	7	10	14	9	5	1	18	15

Module	Interdisciplinarity/ transdisciplinarity	Experiential learning	Sense of place/ real-world inquiry	Multiplicity of teaching styles	Developing dialogue	Action learning	Reflection on learning	Transformati ve learning	Collaborative learning	TOTAL
EDUC1029	yes		yes	yes	yes	yes	yes		yes	12
EDUC1702	yes						yes	yes		9
EDUC1703	yes	yes		yes			yes			5
EDUC1704		yes		yes						5
EDUC1706		yes		yes			yes			10
EDUC1707				yes			yes			5
EDUC1708	yes		yes	yes						9
EDUC1715	yes	yes		yes	yes	yes	yes	yes	yes	10
EDUC2707				yes	yes			yes		8
EDUC2712	yes	yes	yes	yes	yes	yes	yes			9
EDUC2716										3
EDUC2703				yes	yes		yes			4
EDUC2706			yes	yes						4
EDUC2714	yes	yes		yes	yes	yes	yes			7
EDUC2704				yes	yes					5
EDUC3701					yes					5
EDUC3702		yes		yes	yes		yes			6
EDUC2090		yes	yes		yes		yes	yes		12
EDUC3706	yes	yes	yes	yes		yes	yes			9
EDUC3707		yes	yes	yes			yes			10
EDUC3714	yes	yes		yes	yes	yes	yes			7
EDUC3703	yes	yes		yes			yes		yes	6
EDUC3705		yes	yes		yes		yes		yes	5

EDUC4702		yes			yes		yes		yes	7
EDUC4703		yes		yes	yes	yes	yes	yes	yes	8
EDUC4714	yes	yes			yes	yes	yes			6
TOTALS	11	16	8	19	15	8	19	5	6	TOTAL

Questionnaire

Please provide course name and code to which responses to questions 1-6 apply to.

Q1. Sustainability education prepares people to cope with, manage and shape social, economic, political and ecological conditions characterised by change, uncertainty, risk and complexity. What have you included in your course in week 1 to address education for sustainability?

Q2. UNESCO states that -

A successful UN Decade of Education for Sustainable Development would create citizens and leaders who have skills in critical and creative thinking, conflict management, problem solving, problem assessment to actively take part in the life of society, are respectful of the Earth's resources and biodiversity, and are committed to promoting a peaceful and democratic society. How have you included these skills and dispositions in your course in Week 1?

Q3. Please tick which education for sustainability skills and/or dispositions you have addressed in Week 1 of your course.

- . critical and creative thinking
- . conflict management
- . problem assessment and solving
- . respect for Earth's resources and biodiversity
- . promotion of a peaceful and democratic society

Q4. There are considered to be seven key concepts of sustainable development, which concepts were addressed in Week 1 of your course?

1. Interdependence – of society, economy, and the natural environment, from local to global scales
2. Citizenship and stewardship – rights and responsibilities, participation and co-operation
3. Needs and rights – of present and future occupants of earth
4. Diversity – the importance of cultural, social, economic and biological variety
5. Quality of life - global equity and justice
6. Sustainable change – understanding implications of finite resources
7. Uncertainty and precaution in action - situations are constantly changing, a need for flexibility and lifelong learning

Q5. Education for sustainability requires active, participative and experiential learning methods that engage the learner and make a real difference to the learner's understanding, thinking and ability to act. Which of the following pedagogical practices were included in your course in Week 1?

- critical thinking
- systemic thinking
- interdisciplinarity and transdisciplinarity
- experiential learning and real-life issues
- reconnecting to sense of place and real-world inquiry
- empowerment of the learner
- teacher as mentor, exemplar and facilitator
- multiplicity of teaching styles
- developing dialogue

action learning
reflection on learning
transformative learning
collaborative learning and co-inquiry
use of campus as a learning resource
other

Q6. If you ticked other in Q5 please describe the other active, participative and experiential learning method/s that were used in your course in Week 1.

Case Study 7 University of Southern Queensland

Education for Sustainability in the Bachelor of Education (Primary)

Principal Researcher:

Dr Karen Spence

Context/Background

University of Southern Queensland (USQ)

The University of Southern Queensland (USQ) is a regional university that has three campuses, located at Toowoomba, Springfield and Fraser Coast. However, USQ is a leading provider of distance education and more than 75 per cent of students choose to study via distance education.

USQ has made environmental sustainability an imperative and the USQ Environment and Sustainability Committee is committed to making the University carbon neutral by 2020. In order to further this goal, USQ is an institutional member of the Australasian Campuses Towards Sustainability (ACTS) and has attained membership of the Association for the Advancement of Sustainability in Higher Education. The USQ Environmental Office, known as “The Lilypad”, has initiated a sustainability pledge to promote activities that reduce the University’s carbon footprint. The recently endorsed Carbon Reduction Strategy (2012 – 2014) has been implemented to encourage renewable energy alternatives, water conservation, recycling, waste minimisation and green transport initiatives



Study 7 Figure 1 The USQ Environmental Office known as “The Lilypad”

Faculty of Education

The Faculty of Education offers undergraduate and postgraduate studies in Early Childhood, Primary and Middle School, Special Education, Sport Health and Physical Education, Secondary, Vocational and Further Education and Training. Approximately 3800 students are enrolled in education programs which are staffed by 65 full time academics and supported by 30 professional staff.

In 2012, the Bachelor of Education (BEDU) is in the process of re-accreditation with the Queensland College of Teachers (QCT) and AITSL for national accreditation. In addition to these processes, the University is responding to a variety of internal and external influences that are impacting on the structure, content and delivery of courses that are offered by the Faculty of Education.

In the education programs that are offered at the University, professional experience is an embedded component of an academic course of study. Students in the BEDU are required to attend a total of 100 days of professional experience in order to meet the requirements of their program. Over 4 years, each professional experience course requires a supervised placement of 10, 15 or 25 days. The Professional Experience Office places approximately 1500 students each semester in variety of educational settings both locally, interstate and overseas. The University is interested in developing an enduring relationship with our partner organisations which include childcare centres, schools, TAFE and environmental education centres.

Involvement in Project

At this university, I am the Science Education Lecturer, Professional Experience Coordinator and Deputy Associate Dean Teaching and Learning. My interest in the project began with an awareness of the Australian Research Institute in Education for Sustainability (ARIES) project in 2008 (Ferreira, Ryan, Davis, Cavanagh & Thomas, 2009). At the time, the new BEDU program was being developed using a framework of 10 core courses and a range of shared courses, electives and specialization courses with 100 days of embedded professional experience. This development process provided an opportunity to embed sustainability in science education courses and to establish connections with other courses that include literacy, professional experience and technology.

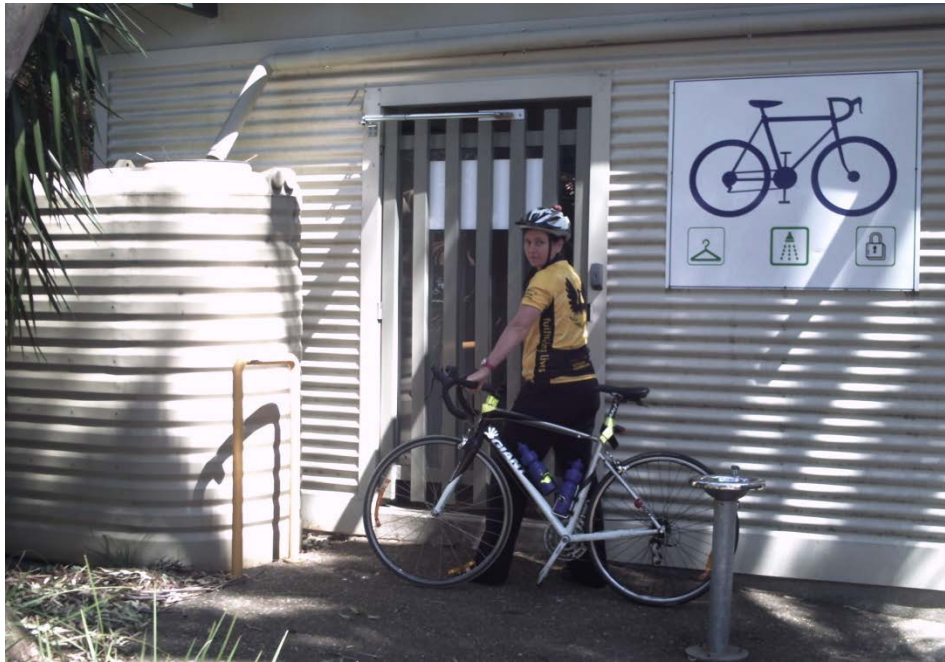
In 2012, the BEDU is in the process of re-accreditation and Project 1,2,3,4 is being used as a mapping exercise for the Professional Standards for Teachers, the Graduate Attributes, and the scope and sequence for content knowledge, assessment and professional experience. This horizontal and vertical mapping exercise is a useful tool to determine how sustainability has been embedded across the program and to identify opportunities for further inclusion.

I am the course examiner for Teaching Science for Understanding. This is usually a second year course in the BEDU and it is a compulsory course for early childhood and primary students. However, it does attract interest from secondary education students who are seeking a minor or major in science, as well as students that are considering building their science content knowledge before entering the Graduate Diploma. The course focuses on the science content knowledge required for the areas of physical science and Earth/space science which are relevant to the Australian Curriculum: Science.

In my role as professional experience coordinator, I am aware of the assessment that is required in The Middle Years, which contains a 10 day placement, and the 15 day placement that is embedded in Technology Curriculum and Pedagogy. Through my association with the examiners of these courses, we have explored how

sustainability can be embedded in courses that students are studying in second and fourth year.

I have a personal interest in education for sustainability because of my background in science and my commitment to sustainable living practices such as green transport. At university, I am a member of the Ride the Range cycling team and a participant in the Ride to Work group. I am a user of the “end of trip facilities” at the campus that have been established to provide ecofriendly storage for bicycles and complements use of the cycle path network in the city. Green technology has been incorporated into these facilities for the security system, photovoltaic power production, rain water harvesting and solar hot water.



Study 7 Figure 2 Rain water harvesting at the “end of trip facilities” at USQ Toowoomba

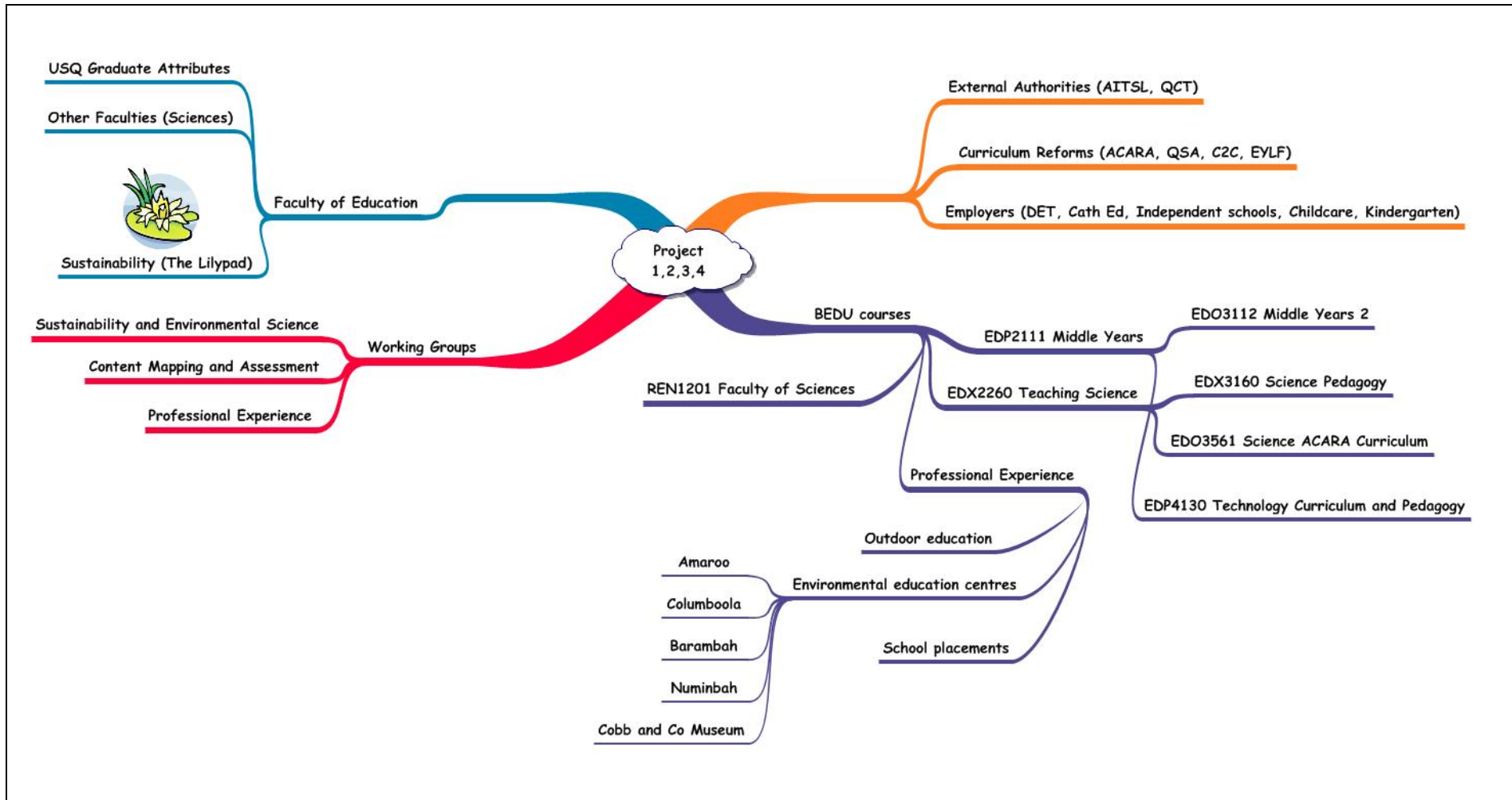
The most efficient form of transport for humans is cycling at speeds of 16 – 24 km/h. At this speed, a cyclist can travel a distance of 5 km using 500 kJ of energy. However, for the same amount of energy, a car can barely travel 100 metres.

(Rickard, 2012)

Key characteristics that have underpinned research

The key characteristic that has underpinned my work in this project is the embedded nature of education for sustainability in both the academic and practical components of linked courses. Currently at this University, sustainability is integrated into the assessment for The Middle Years, as a cross-curriculum priority for the Australian Curriculum: Science and through a cooperative group project for technology.

In the BEDU, there are two required science courses and one science elective that students may choose to complete in third year. There is the capacity for science education courses to establish a context for students to learn about sustainability in second year, in which students are studying both courses in the same semester. The Middle Years requires a 10 day professional experience placement and many local schools in the area have a connection with the Amaroo Environmental Education Centre through school excursions and site visits. With the appointment of a new principal at Amaroo, there has been a renewed interest in professional experience for pre-service teachers at the environmental education centre.



Study 7 Figure 3 The systems mapping exercise for education for sustainability at USQ

Key Players and roles in project

121. Dr Karen Spence: Principal investigator for this case study, course examiner for EDX2260 Teaching Science for Understanding, Professional Experience Coordinator and Deputy Associate Dean Teaching and Learning
122. Professor Peter Albion: course examiner for EDP4130 Technology Curriculum and Pedagogy
123. Mr Steve Smith: course examiner for EDP2111 The Middle Years
124. Mr Cameron Mackenzie: Principal of Amaroo Environmental Education Centre



The key document that has influenced the importance of sustainability at USQ is the Earth Charter (2012).

The four pillars of the Earth Charter are:

- I. Respect and Care for the Community of Life
- II. Ecological Integrity
- III. Social and Economic Justice
- IV. Democracy, Nonviolence, and Peace

Preamble

We stand at a critical moment in Earth's history, a time when humanity must choose its future. As the world becomes increasingly interdependent and fragile, the future at once holds great peril and great promise. To move forward we must recognize that in the midst of a magnificent diversity of cultures and life forms we are one human family and one Earth community with a common destiny. We must join together to bring forth a sustainable global society founded on respect for nature, universal human rights, economic justice, and a culture of peace. Towards this end, it is imperative that we, the peoples of Earth, declare our responsibility to one another, to the greater community of life, and to future generations.

(Earth Charter, 2012)

Stories that best capture the most significant impacts and outcomes that have come about as a result of this project

STORY 1 Integrating sustainability across courses in the BEDU

A focus group was conducted in the form of a pedagogical conversation to determine how sustainability was embedded across the BEDU program. This pedagogical conversation was part of a broader discussion about the theme for the Faculty of Education; which is “Global educators for contemporary learning communities”. The focus group identified a number of areas that place education for sustainability within this theme.

At the beginning of this project, I envisioned embedding education for sustainability through a stand-alone “sustainability course” which would, naturally enough, be delivered through science. Like my colleagues, I assumed that the discipline of science was the most appropriate course in which to embed sustainability. However, over the course of my involvement with this project and through discussions with other course examiners as part of the BEDU accreditation, we have realised that an authentic, embedded approach to education for sustainability is required across the entire program. We then set out to determine how sustainability is currently embedded across the BEDU.

Study 7 Table 1 : Course audit for education for sustainability across the BEDU

Course name	Sustainability Issues Taught or Assessed
The Middle Years	Optional student choice for assessment e.g. either history or sustainability
Teaching Science for Understanding	Assessed as part of the Australian Curriculum: Science from physical and Earth/space science
Health and Wellbeing	Integrated approach to environmental health and human health
Literacies Education	Integrated literacy, history, geography and science which includes sustainability
Adolescence: Issues and Challenges	Social, economic and political dimensions of sustainability
Literacies Across the Curriculum	Sustainability is integrated as a cross-curriculum priority with literacy
Technology Pedagogy and Curriculum	Group project to articulate informed decisions about technology in society, including an awareness of the values dimension e.g. coal seam gas exploration
Professional Placement and Portfolio	Internship placement in schools or non-school setting e.g. environmental education centre

The pedagogical conversation approach was selected in order to produce a deeper discussion across the breadth of the BEDU. Although a course audit was conducted for the Graduate Attribute for sustainability as part of the BEDU re-accreditation, this “tick and flick” format did not provide an authentic understanding of the nature of education for sustainability. Across the 83 courses that were surveyed in the BEDU, the Graduate Attribute for sustainable practices was an objective of 31 courses and assessed in 21 of these courses. It was argued that a course audit of this type was tokenistic and not adequately representative of sustainability as an embedded component across the program. This was found to be the case because at least 5 courses that contained sustainability as part of the assessment were not identified in the course audit.

Through this pedagogical conversation, it became apparent that sustainability is embedded across at least eight courses. These courses included representations from the primary, secondary and sport health physical education specialisations, as well as three shared courses and one core course. However, based on the attendance at this pedagogical

conversation, it is likely that other touch points for sustainability occur in early childhood, special education, business, environmental science and vocational education.

The Professional Placement and Portfolio course involves a 20 day unsupervised placement or internship. In Queensland, the internship is authorised by QCT and the pre-service teachers are permitted to take a 50% teaching load in an unpaid capacity. Although an intern is not an unpaid supply teacher, they can be left alone with students and they do not require direct supervision by their mentor while they are teaching. At this University, most interns seek placements in traditional classroom settings. However, in part due to this project, there has been an increased interest in internship placements at the Amaroo Environmental Education Centre which is located at the old Kleinton School. Currently two pre-service teachers are placed for their internship at Amaroo as a consequence of the network developed from this project and from the students' interest in sustainability.



Study 7 Figure 4 Sustainable transport initiatives at USQ

STORY 2 Preparing the Petcha Kucha and interview with the technology lecturer

In preparation for the OLT Workshop 2 at the Griffith University EcoCentre, I was required to participate in a Petcha Kucha presentation to showcase sustainability education at this University. In the process of researching sustainability at the campus, it quickly became evident that local environmental issues were of particular concern and this context rapidly came to dominate any discussions about sustainability. Thus, my Petcha Kucha presentation focused on specific examples of sustainable resource management issues that related to water, agriculture and mining in the Darling Downs area. In an interview with lecturer for technology, we discussed how sustainability is embedded in the assessment for this technology course, the implications for pre-service teachers in the final year of their program and their expectations for employment in rural communities.



Study 7 Figure 5 The levee bank at Goondiwindi protects the town from the Macintyre River

After 10 years of drought, level 5 water restrictions had dominated the approach to water management in South-East Queensland and fuelled the debate about recycled water in Toowoomba. However, in late 2010 this extreme water shortage was relieved by unprecedented rainfall which culminated on the event of 10th of January 2011 in which 160 mm of rain fell in the Toowoomba area over 36 hours. This caused flash flooding through Toowoomba's central business district and devastated communities in the Lockyer Valley. Cars were washed away and 4 people died when they were swept away within hours of the storm. A total of 35 people were killed (21 from Toowoomba and the Lockyer Valley), 300 roads were closed, 9 major highways were impassable and an estimated half of Queensland was flooded by the end of January 2011.

Flood mitigation has had significant impact of the sustainability of Queensland communities such as Chinchilla, Dalby, Theodore and Goondiwindi, and the traditional name for Toowoomba refers to its location as the "swamp" between East and West Creeks. The Japanese Garden, Ju Raku En, is situated in the grounds of the USQ campus. The name of the garden roughly translates to "long life and happiness (in a public garden)" which is essentially the goal of sustainability. This aspiration for "enough for all forever" is part of the sustainable management of the garden. In addition to being the largest traditionally designed garden in Australia, the lake in the Japanese Gardens is maintained by storm water that is collected from the University.



Study 7 Figure 6 The Japanese Gardens in the grounds of the USQ Toowoomba campus

Toowoomba is an important regional centre for a quarter of a million people and is the commercial and economic hub for the Darling Downs. This area is in a process of social, environmental and political change. The township of Felton is 25 km south-west of Toowoomba but the fertile, food-producing Felton Valley is currently threatened by a proposal from Ambre Energy for an open-cut coal mine and petrochemical plant. The conflict between the use of land for agriculture and for the energy sector has been brought to international attention by the displacement of the 120 year old town of Acland. Mr Glen Beutel is the only resident of the town that is now designated for the New Hope Acland Coal Mine. The debate about mining costs and benefits has raised community interest in the coal industry's push into populated and farming areas, in addition to raising concerns about the effect of coal on the environment and food security.

My Petcha Kucha presentation provided the stimulus material to initiate discussions about sustainability with the course examiner for Technology Pedagogy and Curriculum. The assessment for this course is based on a cooperative project which requires the students to take on the role of interested and opposing groups, in a hypothetical coal seam gas exploration scenario. Each pre-service teacher is required to research coal seam gas production from the viewpoint of farmers, community members, the indigenous community and the mining industry. The challenge for the groups is to devise a strategy to generate power which does not ruin the farmland, drain the water or pollute the air, while at the same time create skilled jobs without displacing the existing employment opportunities within the community. The purpose behind this assessment item is to challenge the students to build a model for sustainability that is based on the values dimension within a real-life context. This fourth year assessment task helps to prepare students for employment in rural communities by developing their sensitivity to a range of issues, and demonstrates the importance of empathy for different viewpoints.

STORY 3: Student perception about sustainability from the assessment in The Middle Years

The Middle Years and Teaching Science for Understanding are taken concurrently in semester one by second year BEDU (Primary) students. A natural synergy exists to embed sustainability with science education; and in the practical and theoretical aspects of the middle years' course and its accompanying 10 day professional experience. An opportunity to embed the cross-curriculum priority of sustainability within a teaching context is possible using the assessment for these courses. The students are required to develop a sequence of two lesson plans that use constructivist approaches to engage middle years' students in either a history lesson or in a lesson that focuses on sustainability. The fact that the students have the opportunity to choose the topic for their assessment was an interesting area to explore. My analysis of these assessment items was used to determine the students' interest in sustainability.

125. Analysis of the 192 assessment submissions for The Middle Years revealed that 35% (67/192) of the assignments focused on sustainability but nearly two thirds (125/192) of the students chose to focus on a history topic.

126. Possible reasons for the choice for selecting the topic for the lesson plans were explored and included:

- a. The students felt more comfortable with their chosen topic, and hence more likely to get a better mark.
- b. The students commented that their choice of topic was more adaptable for meeting the requirements of a constructivist lesson.
- c. The students indicated that their audience of middle years students would respond more positively to their choice of topic.
- d. The students selected their topic based on events that were occurring in the school at that point in time and the context for learning.

127. The assignments that focused on the topic of sustainability were surveyed in more detail. The choice of content knowledge across the topic of sustainability was found to be distributed between 20 specific areas of interest. These 20 areas were further categorised into five over-arching ideas e.g. resources, waste, practices, issues and places.

Study 7 Table 2 Analysis of the specific areas of interest that were identified in student assignment submissions on the topic of sustainability

Resources	Waste	Practices	Issues	Places
Energy (16) Water (10) Food (1) Oceans (1)	Recycling (6) Pollution (4)	Housing (3) Living (7) Schools (4) Sustainability (4) Futures (4) Farming (4)	Ecological footprint (2) Greenhouse effect (3) Carbon footprint (1) Climate change (2) Habitat destruction (1)	Murray-Darling basin (2) National Parks (1) Somerset Dam (1)

128. The five over-arching ideas were not mutually exclusive and an individual submission may have included more than one specific area of interest. The over-arching idea of sustainable practices was represented most often (26 mentions). This can be attributed to the general nature of sustainable living and how it could be applied to housing, schools, growing vegetables and the vision for sustainability in the future. Overall, the most commonly cited example of any

issue for sustainability was concerned with energy resources and there were 16 specific discussions about renewable and non-renewable resources, fossils fuels and alternative energy sources such as solar energy. In the over-arching idea of waste, the discussion usually contained reference to the 4Rs and the importance of individuals to re-think, reuse, reduce and recycle. The submissions that focused on global environmental issues contained references to the greenhouse effect, climate change, habitat destruction and an individual ecological or carbon footprint. When a submission was concerned with the sustainability of a place, the students tended to draw on their knowledge for a specific context such as the Murray - Darling River system or the Somerset Dam; or the importance of preserving wild places in national parks.

129. During the analysis of the assignment submissions, it was evident that the students' understanding of sustainability was limited to issues that were encompassed by only two of the four pillars of the Earth Charter e.g. Pillar I: respect and care for the community of life and Pillar II: ecological integrity. It was interesting to note that the students did not select economic, social or political systems in their discussions about sustainability. In general, all of the submissions were focused on natural and biophysical systems and they did not mention social and economic justice (Pillar III) or democracy, nonviolence, and peace (Pillar IV).



Study 7 Figure 7 Solar panels and green technology at the “end of trip facilities” for bicycle users

Most significant impacts and outcomes

Throughout this project, the Principal Investigator has observed an increased awareness about sustainability at this University and a number of new touch points for sustainability in the course material that is developed by the Faculty of Education.

Throughout 2012, there have been a number of organised events that have raised the profile of sustainability at this University. The following list of events has helped to establish a presence for sustainability across a variety of disciplines:

130. A team of experts from the Australian Centre for Sustainable Catchments successfully completed a trial of a web-based forum to educate rural Indian farmers about climate trends (08-02-2012)
131. Professor Dayantha S. Wijeyesekera was invited to speak on disaster management at USQ by presenting a lecture entitled "Tsunami Devastation in Sri Lanka 2004 – rehabilitation and integrated approach for disaster resistant construction and environmental concerns (10-02-2012).
132. The Sustainability Pledge was initiated by the Environmental Office known as "The Lilypad" as an endorsement for the Carbon Reduction Strategy (2012-2014) (05-03-2012).
133. Professor Tony Sorensen was invited to present a seminar for the Economic Development and Enterprise Collaboration about global threats and responses in regional Australia (13-03-2012).
134. The Digital Futures Institute hosted the global, 48-hour, Follow the Sun Online Conference as an accessible, flexible and borderless professional education opportunity (19-03-2012).
135. The foundation Environmental Studies course was launched, which is offered at one campus as part of the Bachelor of Science (Environment and Sustainability) degree (30-03-2012).
136. World Environment Day was celebrated to support staff and students to adopt a more sustainable lifestyle (04-06-2012).
137. Professor John Cole was recognised for his outstanding contribution to business sustainability in Queensland over 30 years at the 2012 Premier's Sustainability Awards (12-06-2012).
138. Harvard University academic Professor Michael Hiscox visited the Australian Centre for Sustainable Business and Development as a corporate sustainability expert. He presented his research focused on international trade, global supply chains and the demand for ethically labelled goods (23-07-2012).
139. The University hosted the Queensland FACETS (Food, Agriculture, Climate, Energy, Topsoils and Sustainability) forum. The speakers included Professor John Cole, Professor Steven Raine and Dr Ray Malpress, as well as university associate Fiona Waterhouse (23-08-2012).
140. The annual two-day sustainability conference was organised by Professor Marie Kavanagh for 1000 school students. The keynote speaker, NASA Astronaut Colonel Robert Kimbrough, presented an engaging seminar entitled "Sustainability - Lessons from Space" (24-08-2012).

Specifically, the most significant changes that were encountered for education for sustainability in the BEDU include:

141. Sustainability is studied in context and the connections that are formed are

local and personal.

142. Capacity building has occurred across a number of courses in the BEDU and there are shared synergies between science, The Middle Years and technology.
143. An understanding has emerged that education for sustainability is not solely the domain of science and that there is greater potential to integrate sustainability across a number of courses and different disciplines as a cross-curriculum priority, a QCT priority area and as a Graduate Attribute.
144. A renewed interest has arisen in the theoretical and practical aspects of sustainability through professional experience and internship placements at the Amaroo Environmental Education Centre and at other outdoor environmental centres.

Challenges

Sterling (2012) has observed a number of barriers to the successful implementation of sustainability in higher education, such as

145. Crowded curriculum,
146. Perceived irrelevance,
147. Limited staff awareness or expertise,
148. Limited institutional commitment,
149. Limited commitment from external stakeholders,
150. Lack of incentives,
151. Silo organisation,
152. Too demanding, and
153. Lack of resources.

To some extent, many of the hurdles that were identified would prevent sustainability from being embedded in the BEDU. However, the most important single barrier that was identified that could impede the successful implementation of education for sustainability is the rapid cycle of change. This University is in the process of refreshing its strategic plan and restructuring the academic division of the University. In addition, the BEDU is in the process of re-accreditation with QCT and national accreditation. There have been considerable shifts in the educational landscape in Queensland schools with the Year 7 move to high school, delivery of the Australian Curriculum for Mathematics, Science and English, implementation of Curriculum to Classroom (C2C) and external pressures from NAPLAN testing. Within a very short time frame, a combination of many of these external, and internal, influencing factors are shaping the content and delivery of course material in the BEDU. However, this rapid cycle of change is an opportunity to embed education for sustainability because sustainability is both a part of the “journey” as well as the destination.

Future Plans

Sustainability and embedding education for sustainability are both a destination and a journey. At this stage, the direction of the project will be determined by the re-structure of this University, the QCT re-accreditation process and the path towards national accreditation.

The future plans for embedding education for sustainability may include:

154. Two more pedagogical conversations in October 2012 with a wider range of course representation,
155. Membership of the USQ Environment Society,
156. Developmentally appropriate implementation of sustainability issues in science courses,
157. Course audit and mapping of the Graduate Diploma, and
158. Continued relationship with Amaroo Environmental Education Centre for professional experience and other projects, and extending this relationship to other centres such as Columboola.