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Overcoming institutional barriers to interdisciplinary education for sustainability

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This paper demonstrates how prioritising collaboration can lead to the successful design and implementation of a new compulsory sustainability program for first year students at an Australian regional university. We propose that a pragmatic approach to working within the barriers to interdisciplinarity identified in the literature can lead educators to innovation in teaching and learning for sustainability, even if the ideal of a sustainable university has not been achieved. However, this is premised on the development and support for collaborative teaching practices within Australian universities which we believe is a key component of the success of this initiative.

We outline the theoretical underpinnings of interdisciplinary learning as an essential element of Education for Sustainability in Higher Education. We then critically examine how the literature has reported the implementation of interdisciplinary sustainability programs and discuss why such programs are not common at Australian universities, despite the many recommendations and frameworks developed for their implementation. The implementation of our program will then be described and the implications of this for the development of interdisciplinary EfS programs at other universities in Australia.

Keywords: sustainability, higher education, interdisciplinary

Introduction – Higher Education for Sustainability Theory and Practice

To integrate the concept of sustainability across higher education curriculums and ensure all university students engage in the sustainability discourse is a challenging task for educators. Education for Sustainability (EfS) in Higher Education seeks to enable the development of a range of outcomes across domains of knowledge, competencies and attributes (Barth, Godemann, Rieckmann, & Stoltenberg, 2007; Dale & Newman, 2005; Sipos, Battisti, & Grimm, 2008; Svanström, Lozano-García, & Rowe, 2008; Thomas & Day, 2014; Warburton, 2003; Wiek, Withycombe, & Redman, 2011). An EfS curriculum in higher education should enable people to "cope with, manage and shape social, economic and ecological conditions characterised by change, uncertainty, risk and complexity" (Sterling, 2013, p. 9). Thus an EfS curriculum needs to do more than just present a body of knowledge; it needs to enable new ways of thinking and learning (Jucker, 2002; Warburton, 2003), and promote an understanding of how values and beliefs can shape a sustainable society (Fien, 1997).

Interdisciplinary learning has been identified as a key pedagogy to facilitate EfS and has been advocated through a number of Higher Education EfS frameworks, both in Australia (Department of the Environment Water Heritage and the Arts, 2009; Phelan et al., 2015; Tilbury & Cooke, 2005) and internationally (Hidalgo & Fuentes, 2013; Sterling, 2013; UNESCO, 2014). Interdisciplinary learning has been advanced as a key pedagogy to develop sustainability knowledge (Barth & Timm, 2011; Coops et al., 2015), sustainability thinking competencies such as creative thinking, critical thinking, collaboration and cooperation (Barth et al., 2007; Dlouha & Burandt, 2015; Howlett, Ferreira, & Blomfield, 2016; Remington-Doucette, Connell, Armstrong, & Musgrove, 2013; Sipos et al., 2008), problem solving competencies such as systems thinking (Barth & Timm, 2011; Dale & Newman, 2005; Davison et al., 2014), to develop sustainability attributes such as notions of justice and equity (Remington-Doucette et al., 2013), and develop ecologically sustainable behaviours (Brody & Ryu, 2006) that may not be developed within discipline specific courses.

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Although interdisciplinary learning is not always interpreted the same way by educators (Pharo et al., 2012), it can be thought of as being along a continuum that starts with discipline specific learning, through to cross- or multidisciplinary learning (e.g. access to units/programs across different departments), and finally to intentionally integrating various fields of knowledge and ways of learning into a single course (Franks et al., 2007). At the interdisciplinary end of this continuum learning can "step outside the limiting frames and methods of phenomenon-specific disciplines" (Davis & Phelps, 2005, p. 2). The term transdisciplinary has been used in a similar way to interdisciplinary (Remington-Doucette et al., 2013), but can be differentiated whereby the former seeks to emphasise the development of new ways of learning (Franks et al., 2007; Steiner & Posch, 2006).

The State of Interdisciplinary Learning in Higher Education

Despite its widespread advancement as a key pedagogy, programs and courses that use interdisciplinary learning are not common in Australian universities. O'Byrne, Dripps, and Nicholas (2015) have identified this as a gap between how EfS is described in the literature and how it is being implemented in higher education. The common picture here and internationally is of EfS more likely implemented within a single discipline rather than through interdisciplinary programs (Coops et al., 2015; Rusinko, 2010), and that interdisciplinary learning is not a common pedagogy (Christie, Miller, Cooke, & White, 2013; Sustainable Campus Group, 2013).

The Australian situation mirrors that of universities worldwide. While there are exceptions, such as the Luneburg model at Leuphana University (Barth & Timm, 2011), a recent worldwide survey found the lowest level of implementation was integrating sustainability throughout all programmes, courses, and faculties; instead sustainability was generally implemented within discipline specific programs (Lozano et al., 2015).

The challenges to implementing EfS in universities have been discussed for some time (Corcoran & Wals, 2004) and a number of barriers to the implementation of EfS and interdisciplinary learning in universities have been identified (Gale, Davison, Wood, Williams, & Towle, 2015; Moore, 2005; Verhulst & Lambrechts, 2015). Thomas, Hegarty, and Holdsworth (2012) succinctly describe these barriers as a set of interrelated issues that include organizational change, institutional strategies, academic development, curriculum development, learning and teaching practice, pedagogy, the campus, graduate attributes, and professional associations.

There has been some discussion of the barriers to interdisciplinary learning from authors who have implemented such programs. Pharo, Davison, McGregor, and Warr (2014) analysed the implementation of interdisciplinary sustainability programs across four Australian universities and concluded that the main barriers are those that prevent disciplinary teachers collaborating, including the disciplinary structures of universities and administrative procedures, and the traditional view of university teaching as an individual practice.

Frameworks for overcoming barriers to interdisciplinary learning at universities can be found in the literature. Some authors have proposed that simply understanding these barriers and then responding within the context of an individual institution will enable EfS programs to develop (Leihy & Salazar, 2011; Thomas et al., 2012). A number of authors have proposed long-term structural plans dependent upon policy development to integrate EfS (Pearson, Honeywood, & O'Toole, 2005; Sterling, 2013; Verhulst & Lambrechts, 2015), or systems analysis to identify contextual opportunities for change (Lidgren, Rodhe, & Huisingh, 2006). Others have taken a behavioural management perspective to develop frameworks which promote individual actors as agents of change from within different levels of the university hierarchy (Brinkhurst, Rose, Maurice, & Ackerman, 2011; Lozano, 2006). All of these approaches develop a positive view that barriers to EfS can and will be overcome.

However, it has also been argued that these frameworks and strategies may not work due to an inherent conflict between 'top-down' and 'bottom-up approaches' within the confines of the hierarchical structure of universities (Brinkhurst et al., 2011; Noonan & Thomas, 2004). Or that these barriers cannot be overcome due to an inherent contradiction between the ideals of EfS and the dominant political and economic paradigms of universities and their managers (Cebrian, Grace, & Humphris, 2015; Fien, 1993, p. 7).

Implementing an Interdisciplinary Sustainability Program

This section discusses the implementation of a new compulsory sustainability unit for all first year students at a regional Australian institution – Charles Darwin University (CDU). We reflect on the barriers we encountered and how these relate to those outlined in the literature. We group these barriers into institutional (governance, management, policies), structural (disciplines, administration, academic development), and learning and teaching (teaching practices, pedagogy, professional development).

Firstly, institutional barriers such as governance, management, strategies and policies have impacted on the implementation of interdisciplinary EfS programs at CDU. Like most Australian universities CDU has some sustainability policies in place; its Sustainability Strategy covers operations, research and organisation, and includes learning and teaching performance indicators for sustainability with the goal to "produce graduates who have the values, understanding, skills and knowledge to contribute effectively to a sustainable world" (Charles Darwin University, 2013). However there is currently no senior management position with specific carriage for its implementation, thus few if any of its actions have been implemented. CDU also has a Graduate Attributes statement which includes that all students will be “able to apply equity values, and has a sense of social responsibility, sustainability and sensitivity to other peoples, cultures and the environment” (Charles Darwin University, 2012).

It was within this context, of a growing but not yet realised commitment to sustainability, that CDU recently implemented sustainability education into its ‘Common Units’ program for first year students (see Figure 1) through introducing a new interdisciplinary unit called ‘Academic Literacies Through Exploring Sustainability’ (CUC100). The inclusion of sustainability in this program was seen by some key position holders (the Deputy Vice Chancellor Learning and Teaching, both Faculty Pro Vice Chancellors and the Director of the Research Institute for Environment and Livelihoods) as a way to start addressing its aim that all CDU graduates should have an understanding of sustainability. This aim was also endorsed by the head of the Common Units program who has a strong personal interest in EfS.

Thus, the implementation of Graduate Attributes and a Sustainability Strategy were key policy documents that gave impetus to the program. As research shows policies and/or strategies for sustainability are already present in most Australian universities (Christie et al., 2013; Thomas & Day, 2014) however, the key challenge for universities is turning policy into practice. In our case it was the effective collaboration of a small number of key individuals within the university’s management that led to the successful implementation of the unit.

Secondly, like many universities, CDU experiences a number of structural barriers to interdisciplinary learning including discipline specific schools and faculties which independently set courses and subjects. Although sustainability plays a core role within two of the University’s three research institutes (the Research Institute for Environment and Livelihoods and the Northern Institute), as well as two of its five research centres (the Centre for Renewable Energy and the Research Centre for Health and Well-being), the integration of sustainability into the curriculum had been limited to a few discipline specific units within the environmental sciences and engineering schools. Even at institutions where interdisciplinarity has played a major part in their foundation and development, interdisciplinary sustainability programs have remained focused within environmental schools rather than across disciplines (Franks et al., 2007; Howlett et al., 2016).

Franks et al. (2007) reflected on interdisciplinarity at one Australian university and found that its emphasis has decreased over time due to an increase in specialist degrees satisfying professional accreditation that may incorporate some aspect of multidisciplinarity, but are not favourable to interdisciplinarity (e.g. education, teaching, nursing and engineering). CDU also has an emphasis on professionally accredited courses, with nursing and teaching the two most enrolled degrees.

The Common Unit program is a compulsory course for all first year students to provide a transition into university study and develop academic literacy skills and foundational knowledge which students can apply to their disciplinary studies. The new interdisciplinary sustainability unit (CUC100) aims to provide academic skills augmented by the topic of sustainability, which students are required to critically examine from environmental, social and economic perspectives. In this way it aims to remain relevant, in content and skill development, to individual disciplines. At the same time it provides an interdisciplinary learning experience for the students no matter which degree program they are enrolled in.

This new interdisciplinary sustainability unit is undertaken by over 80% of first year students from across all faculties (the concurrent unit CUC106 involves students designing a solution to a development brief through a competition run by the NGO Engineers Without Borders – and has a 'cross-disciplinary' sustainability focus within a design/engineering discipline). All students undertake a second unit, Cultural Intelligence and Capability, which has an inherent consideration of cultural sustainability.

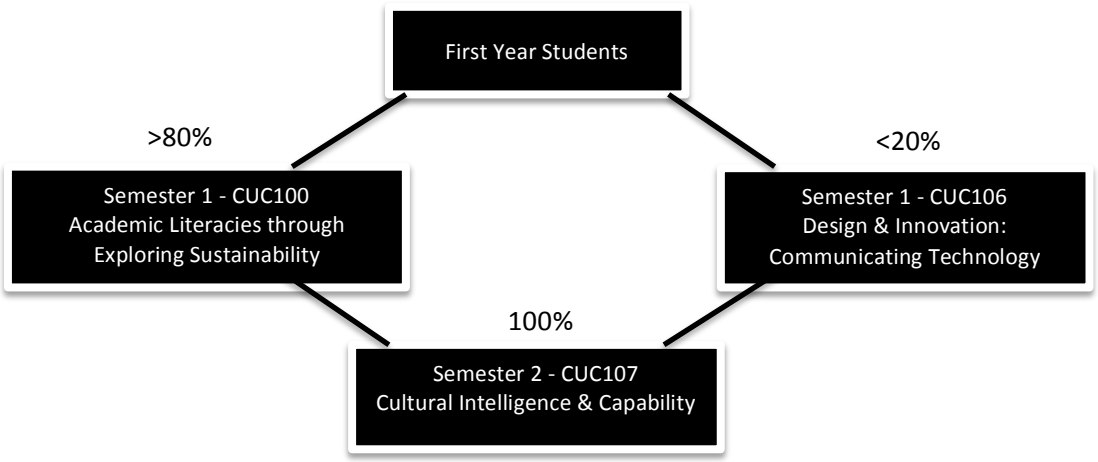

Figure 1. First year participation rates in the Common Unit program.

CUC100 is delivered to a diverse group of local and international students (>16% low SES, >5% ATSI, >6% international, > 15% NESB) studying on multiple campuses as well as over 65% of students studying at a distance around Australia through online materials. Over one thousand students undertake the unit each semester and the program is administered on behalf of all faculties by a specialist school: the School of Academic Language & Learning (SALL).

A range of EfS frameworks were used from the literature (Hollweg et al., 2011; Sipos et al., 2008; Sterling, 2013; Tilbury & Cooke, 2005; Wiek et al., 2011) and integrated into a critical literacy structure for the unit around 3 themes: 'Define', 'Explore' and 'Apply'. Through these themes, the unit intends to develop a wide range of sustainability knowledge, competencies and attributes as well as key academic literacies with which to apply this knowledge.

Students undertake reflective assignments which scaffold towards a discursive essay in which they examine and argue a position on a real-world sustainability issue, as well as how these interdisciplinary perspectives could enable sustainable outcomes. The on-campus students undertake three hour weekly workshops, in mixed disciplinary groups, facilitated by two lecturers who co-teach. External students undertake equivalent tasks and discussions through an online learning system.

Coops et al. (2015) has found that a lack of centralised support and a sustainable funding model within a discipline focused institute prevented the on-going availability of their interdisciplinary program, and the barriers put in place by discipline specific schools and their competition for student funds has also been identified as major issue in Australian universities (Pharo & Bridle, 2012). In the case of the CDU Common Units program student funds are distributed by central administration according to the proportional teaching delivered in the units by different disciplinary schools. The School of Academic Language and Learning, as administrators of the unit, receive a set proportion for four full-time teaching-focused academic staff. Where teaching staff are casual, they are paid directly from a specific casual budget line for Common Units. Thus, with this centralised model of funding distribution and the provision of a managing school the program has been able to by-pass many of the structural and financial barriers to interdisciplinary teaching.

Lastly, in regards to learning and teaching barriers to interdisciplinary learning at a university, Aktas, Whelan, Stoffer, Todd, and Kern (2015) found differing expectations amongst lecturers was a major hurdle that needed to be overcome for their interdisciplinary program, as well as coordinating development and implementation amongst a cross-faculty teaching team. Coops et al. (2015) in their evaluation of an entry level interdisciplinary sustainability course found communication and

expectations amongst the teaching team were two of the most important factors for successful implementation. These papers highlight a key aspect of implementing interdisciplinary sustainability programs that many frameworks overlook, which is how teaching practices affect how successfully they are implemented.

In the development of our new interdisciplinary sustainability unit these learning and teaching barriers were successfully overcome by effective collaborative practices. The unit was developed by an interdisciplinary team from across the university, representing expertise in sustainability, academic literacies and sociology, under the management of the Common Unit Program's academic leader. A systematic development process over twelve months enabled the team to develop a common understanding and approach to the course content and teaching methodology, as well as developing explicit methods for communication, planning and reflection. The unit is delivered internally through co-taught workshops by an interdisciplinary teaching team of approximately eight, comprising lecturers from multiple schools and faculties. Co-teaching pairs are teamed up with different disciplinary knowledge to provide students with the required breadth of expertise. External students work through interactive online learning materials and classes supported by a single tutor. Importantly, these teams are carefully supported and managed by staff within the school employed specifically for the program.

The essential components of this management include the participation of all teaching staff in weekly curriculum planning meetings and reflection and review sessions. All staff undertake a pre-semester workshop to develop a common understanding of the teaching aims and pedagogy, as well as discussing communication, feedback and personality differences which may impact co-teaching. Apart from the weekly curriculum meetings, a formal assessment moderation process is undertaken for each assessment by the whole teaching team. Feedback and evaluation include in-class and end of class reflections between co-teachers, by the whole teaching team facilitated through an online discussion board, formal end of semester reviews which incorporate qualitative feedback from university surveys, and quantitative data such as completion rates and unit satisfaction surveys that may be needed as 'evidence' of success as defined within the paradigm of university managers.

Sipos et al. (2008) advocate combining "iterative processes of reflection, innovation and implementation" (p.81) to enable common understandings and approaches within an interdisciplinary teaching team. Such a collaborative and continuous approach to development amongst a teaching team was also recommended by Dlouha and Burandt (2015) in their evaluation of an interdisciplinary program. Thus an important role of the coordinating school is to collate and manage the ongoing feedback on course content and delivery combined with formal and informal evaluation systems for improving and developing the course, so that the teaching team learns together in a process where evaluation is rigorous and iterative over semesters.

Implications - the pragmatics of negotiating an ideal

Is the absence of interdisciplinary EfS programs at universities in Australia because the barriers to EfS cannot be overcome? Our experience has shown that EfS frameworks for sustainability pedagogy and interdisciplinary learning were successfully used to develop an interdisciplinary sustainability unit. Further, the 'ideal' of a sustainable university and all of the reported barriers to EfS had not been overcome before the implementation of our program, thus it is not necessary to think of these as barriers that need to be overcome, rather we suggest it is how you work within the context of those barriers.

The development of this unit can be regarded as a pragmatic approach to implementing interdisciplinary sustainability learning at a university. This type of "incremental pragmatism" (Sherren, 2009) may be regarded as "second-best solutions" by some (Cotton, Bailey, Warren, & Bissell, 2009), but we would argue that as long as the ideals of EfS are central to any new program then this is better than no interdisciplinary learning at all. Development of the unit did not start with any systemic analysis of the 'barriers' that needed to be overcome, but rather with a practical evaluation of what could work within the existing policy, institutional and curriculum structures.

Thus, the successful development and implementation of the unit was achieved through a combination of collaboration amongst some key individuals within the university's structure, a sustainable management and funding model within the discipline specific structures of the institute,

and the carefully conceived and managed interdisciplinary collaboration (including co-teaching) that has occurred amongst the lecturers who teach the unit.

An interdisciplinary program would ideally be implemented and taught by an interdisciplinary team, yet teaching teams, co-teaching, collegiality, and team development do not happen without support, and are not the dominant teaching practices within universities. We suggest an emphasis on the 'education' part of EfS and supporting such teaching practices in universities may facilitate its implementation. However, academics working in isolation, and the lecture as the primary delivery mode of a program, are still the dominant teaching practices even when sustainability is taught (Christie et al., 2013). Although professional teaching associations play an active role in EfS teaching theory and practice, professional development in teaching sustainability is not a common occurrence within Australian universities (Holdsworth, Wyborn, Bekessy, & Thomas, 2008). Pharo et al. (2014) and Davison et al. (2014) have reported on a "communities of practice" model that facilitated the leadership of teams of academics across four Australian universities to develop interdisciplinary teaching and overcome disciplinary fragmentation and competition. However our experience has shown that some level of coordination and control is necessary to ensure responsibility and consistency amongst an interdisciplinary teaching team. Future research and evaluation of successful interdisciplinary sustainability programs may provide the necessary strategies for further developing such programs.

Ultimately, adhering tightly to the ideals of EfS does not preclude the introduction of innovative interdisciplinary learning, even within the current institutional barriers. A pragmatic, teaching-focused approach to the individual context of an institution may be what is needed to enable universities to more widely implement interdisciplinary sustainability programs.

Conclusion

The impetus for this discussion paper arose from reflecting upon our experiences in light of this conference's themes of connecting, innovating, and collaborating to spark solutions. This led us to examine how we enabled the development of an interdisciplinary sustainability program within an institution that was not known for its sustainability programs or initiatives. What we have found is that a reliance on collaboration and innovation, and working within rather than against the context of our institutional barriers has enabled us to ignite such a spark with the curriculum of the university that we hope will see sustainability embedded as a core value in every student's undergraduate learning experience.

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