# Balancing the Disciplines: A Multidisciplinary Perspective on Sustainability Curriculum Content

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**Abstract** This paper explores appropriate disciplinary content for generalist sustainability degrees, based on two recent surveys. A questionnaire was used to extract from a multidisciplinary, largely academic audience – all of whom share an interest in sustainability – their views as to the disciplinary knowledge that a university-based sustainability education should include. This was undertaken because the current focus in sustainability education literature on generic skills and pedagogical method provides little insight to assist curriculum developers with disciplinary content. While the sample was limited, respondents came from a diverse group of disciplines and thus supply a broad perspective to curriculum design. Recommended teaching methods were also captured, for both undergraduate and graduate levels, as well as the academic backgrounds of the participants for the purposes of investigating bias. The findings were compared with curricula from existing Australian coursework programs and showed that a slight rebalancing towards the human sphere is necessary.

## Introduction

As the United Nations Decade of Education for Sustainable Development begins this year, many universities are tackling the issue of educating for sustainability. Ten of Australia's universities have thus far signed the Talloires Declaration (ULSF, 1990), which commits them to implement sustainable practices throughout their institutions. Operations "greening" and research are covered by these commitments, though they are not addressed in this paper, as is curriculum development to create both specialists in sustainability and sustainability literacy in all graduates.

The literature on sustainability curriculum is rich with suggestions of how such education should be delivered, but contains little about disciplinary content. Tilbury lists the elements of sustainability curriculum as "systems thinking ... creativity, flexibility and critical reflection ... team work ... and working across disciplines" (2004, p. 103). Orr adds the importance of integrating the "disparate parts of personality: intellect, hands, heart" (1992, p. 137, cited in Noonan & Thomas, 2004, p. 68), and Lautensach (2004, p. 5) a "pedagogy of liberation". Given that sustainability is itself a learning process, a thirst for lifelong learning is also considered an element of education for sustainability (Blewitt, 2004), and the experience should be holistic and

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integrative, considering the major dimensions of time, space and ethics (Bosselmann, 2001). A transformation of higher education is clearly needed, but the role of disciplines goes largely unmentioned.

The need for sustainability literacy in all university graduates is the dominant concern in the literature, as well as in government policies and curriculum development activities in Australia (Environment Australia, 1999; Noonan & Thomas, 2004). Some proponents anticipate a future when sustainability will be so well integrated in universities that specialists will no longer be required (Fien, 2004). Pedagogical suggestions like those above are somewhat helpful for the task of fostering sustainability literacy in graduates from other fields, as the disciplinary content and context are already defined. Nonetheless, progress has been slow on integrating sustainability across the higher education curriculum in Australia, and most sustainability content is still delivered to those specialising in the area (Sherren, in press).

It is even more challenging, however, educating such sustainability *specialists* in the modern Australian university. The student market is tepid, as shown by the flatlining enrolments in traditional Environmental and Geography degrees, which usually attract those interested in broad sustainability issues (Sherren & Robin, in press). Even if students are attracted to the programs, disciplinary traditions and organisational arrangements can impede the delivery of appropriated curriculum. (Bosselmann, 2001; Noonan & Thomas, 2004). Australia holds many of these challenges in common with other western nations: increased commercialism, utilitarianism, managerialism, and "customer focus" in universities (Filho & Wright, 2002).

One further barrier to producing sustainability specialists is discussed in this paper. Academics and course administrators, rarely specialists in curriculum studies or education (or sustainable development for that matter), are currently attempting to develop degree programs to provide sustainability education without guidance on content. The education for sustainability literature is dominated by discussions of pedagogical methods and generic skills, but explicit discussions of discipline mix – although implicit in the oft-cited need for interdisciplinarity – are almost completely absent. Appropriate teaching methods *are* essential for sustainability education, but that detail often comes later in the design process. High level planning teams should be inclusive of the disciplines to be involved in course delivery. Who should be invited to participate in such re-engineering? What is core knowledge for sustainability?

This paper uses recent survey activities to clarify appropriate disciplinary mix for tertiary sustainability education. It should be stated that no "perfect" degree either exists or is desirable; each institution will build on its own strengths. What this paper provides is rather a starting point for dialogue, a skeleton upon which to apply the suitable pedagogical detail. A minor exploration is also undertaken into the biases inherent in curriculum design, further emphasising the need that curriculum designers have for leadership, precedent and exemplars on this topic.

## Methodology

Two separate surveys were undertaken and compared in order to explore the issue of disciplinary mix in university sustainability education. These are described below.

### *Internet Audit*

Over 20 days during December 2004 and January 2005, the author undertook an internet survey of all environmental and sustainability coursework activities at Australia's 41 public and private universities (for detail, see Sherren, in press). Most relevant for this paper, the author captured the core content of 77 coursework degree programs, and used the Research Field, Courses and Disciplines (RFCD) classification

system (ARC, 1998) to identify the study area of each one. Only one RFCD was captured per core subject, which often resulted in using a higher-level class in order to capture the content in cases where more than one sub-discipline was clearly covered. This data was generalised to form an aggregate picture of the core content of environment and sustainability degrees at both undergraduate and postgraduate levels, as well as the flexibility of such programs (Sherren, in press). These aggregates are used for comparative purposes in later sections of this paper, though it should be understood that optional content is not captured in this aggregate, such as specialisations or strands, nor were pedagogical methods or generic skills consistently available online. Such detail may be the subject of future research.

*Survey Instrument*

A survey instrument designed to elicit an "ideal" mix of disciplines for generalist sustainability education was distributed to attendees at the First International Conference on Ecological, Cultural, Economic and Social Sustainability, held in Hawaii at the end of February, 2005. The disciplinary and geographical mix of attendees was considered to be perfect for acquiring as broad a perspective as possible. The instrument was distributed in conference satchels and a collection box placed at the conference desk to receive them.

Survey respondents numbered only 26 (22 of whom filled it out in full), from a distribution of approximately 150 attendees of unknown national and disciplinary mix. As a result, the representativeness of the sample is unknown. Most respondents were from the United States (15), worked in universities (20), and had either Doctorate (10) or Masters (10) qualifications. Survey results were recorded in a Microsoft Access database. Again, the RFCD classification was used to categorise the nominated disciplines. The disciplinary expertise of the respondents was diverse, covering all but 6 of the 21 RFCD divisions (the highest level of the RFCD hierarchy which comprises, from the top down, division, discipline and subject). None were specialists in education, although they likely did teach within their respective institutions.

## Analysis and Discussion

The two surveys described above can bring insight to two issues around sustainability curriculum development in universities that help at the strategic stage of planning: what might be an appropriate discipline mix, and the level of flexibility in subject choice. Pedagogical methods and ways to avoid bias in curriculum development processes will also be briefly addressed, but will not have a comparative component as this level of detail was not captured by the internet survey.

*Degree Flexibility and Discipline Mix*

The disciplinary component of the survey was completed by 25 respondents. They nominated between 10 and 25 disciplines each (average 19.8); from 6 to 14 as core (average 10.3) and from 0 to 17 for elective study (average 9.5). Only 35 different RFCD codes were suggested for core subjects (as compared with 66 in the survey of 77 existing Australian courses) indicating that respondents were largely led by the supplied list. Only occasionally were new fields added or the supplied ones refined. An aggregate undergraduate course design was produced from the responses, and is shown by stacked areas in Figure 1, itemised by core and elective[1]. For comparison, Australian aggregate program cores are shown by broken lines, by level of program. This preliminary view shows not only that existing undergraduate and graduate programs differ considerably in discipline focus, but that the aggregate, "idealised" curriculum differs considerably from both of these.

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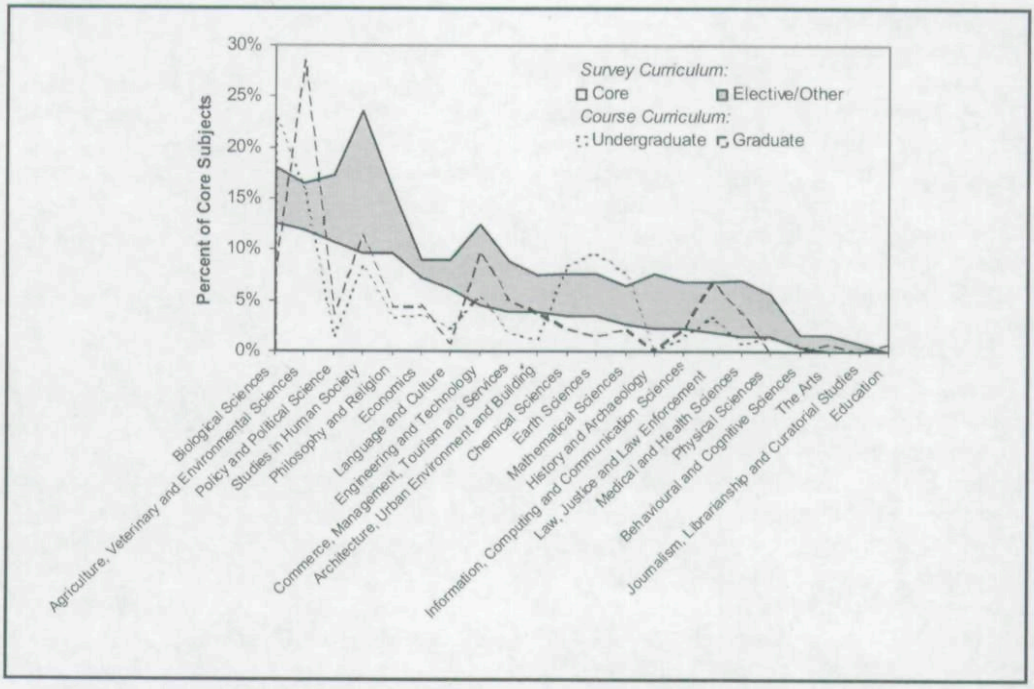


FIGURE 1: Aggregate Survey Curriculum as Compared with Aggregates Generated from Australian Environmental and Sustainability Programs (51 undergraduate and 26 graduate)

As mentioned above, respondents identified an average of 19.8 disciplines, out of which 10.3 were considered "core". Assuming only one subject per discipline (which is questionable), this calculates to a 52% proportion of core, which is the same as the average found for relevant Australian undergraduate courses (Sherren, in press). Assuming a three-year, 24 subject course (as is typical in Australia), 52% translates to 12.5 core subjects and allows the content of the two "aggregate" undergraduate courses to be compared using numbers of subjects per discipline (figure 2). Note that this figure is ordered by the degree of difference between the two curricula, so the division names are in different positions than in Figures 1 and 3.

Figure 2 suggests that some changes may be required in order to educate for sustainability in undergraduate programs. In its "see-saw" appearance, and the similarity of the shape of the lines, it could be interpreted that the balance of existing courses simply needs to be adjusted. Sciences like Biology, Chemistry, Earth Science and Mathematics/ Statistics – appearing on the right-hand side of Figure 2 – are emphasised in Australian program cores, as well as applied fields such as Environmental Science. The traditional Humanities (Language and Culture, Philosophy and Religion, History and Archaeology) and more pragmatic disciplines such as Policy and Political Science, Economics, Management, and the Built Environment – appearing on the left-hand side – are clearly underrepresented. Consider the two different eight-subject "foundation years" that could be derived from these two surveys (Table 1). The foundation year based on existing curriculum appears to emphasise the idea that the solution to sustainability lies in technology and science, rather than societal and individual behavioural change. The persistent Australian focus on science and innovation as a solution to future problems may be a reflection of language used in national debate.

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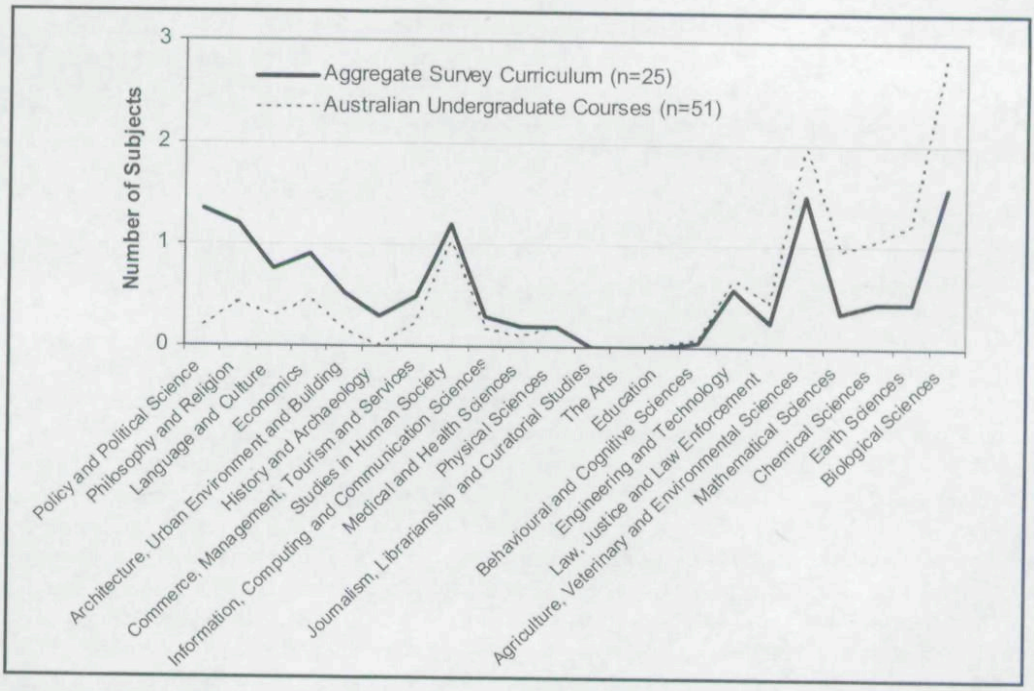


FIGURE 2: Number of Core Subjects in Each Division in Aggregates Based on Survey and Actual Australian Undergraduate Courses

Government at all levels uses the term Ecologically Sustainable Development (ESD) to refer to the issue, thus giving primacy to science over society.

The most pressing deficiency in existing programs is Policy and Political Science, which has an important role in creating active citizens and change agents (Sherren, in press). Philosophy and Religion, the next most unrepresented, tackles big questions around how humans should live, and as a discipline contributes to a critical consideration of identity, values and the "other". Language and Culture both supply necessary contextual knowledge for complex decision-making, such as literature, which provides immersive experiences of other lives and minds. These disciplines all clearly contribute to education for sustainability, but are often overlooked in curriculum design.

TABLE 1: Comparative Undergraduate Eight-Subject Foundation Years, Derived from the Top Ranked Core Disciplines from Each Survey

| Existing Programs | #Subjects | Survey-Based Programs | #Subjects |
|---|---|---|---|
| Biological Science | 3 | Biological Science | 1.5 |
| Applied Environmental Science | 2 | Applied Environmental Science | 1.5 |
| Earth Science | 1 | Policy and Political Science | 1 |
| Chemical Science | 1 | Studies in Human Society | 1 |
| Studies in Human Society | 1 | Philosophy and Religion | 1 |
| | | Economics | 1 |
| | | Language and Culture | 1 |

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The most popular elective subject area (Figure 3) was Studies in Human Society, again confirming the traditional mindset that science, technology and methodologies must be learned while human issues are "optional" and can be easily picked up (Sherren, in press). If this is so, why does quantitative modelling so often fail (or decline to try) when asked to model human behaviour?

*Pedagogical Methods*

Respondents were also asked in the survey what sort of methods should be used in teaching sustainability to undergraduate students, and here the lack of pedagogical background in the respondents became evident. Some of the methods nominated were in fact skills (statistics, for example), and so these were only included where they were "generic" (e.g. Leadership). Student experiences such as community-based outreach, field-based case studies, hands-on and "discovery-based" learning methods were considered most suitable by the 22 who completed this section in full (Figure 4). Problem-based research, including the presentation of seminars, was considered valuable for both individuals and teams, as well as dedicating considerable time to discussion and debate. The idea of "service learning" was mentioned a number of times, meaning a type of learning where students engage in relevant public service (such as research into a policy change that affects a group of landowners), and reflect upon the experience in the classroom. Some indicated that international or intercultural experiences were required, and one suggested that conflict resolution skills would be of value. The number of respondents that nominated lectures as desirable may be surprising, but this category also includes mentions of theoretical knowledge development for which no additional details were given.

Interdisciplinarity or integration was mentioned in two different contexts and so was accounted separately for each: as a teaching philosophy (Holism) and to indicate the teaching of many disciplines. The ideas are more powerful in combination, whereby disciplines are integrated throughout a degree program, rather than simply assembled

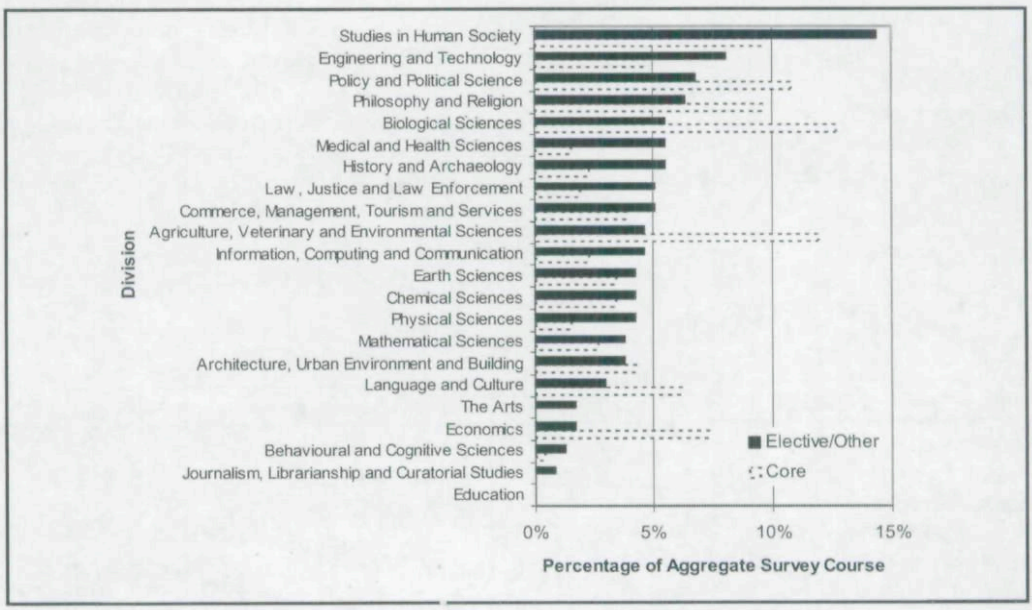


FIGURE 3: Popularity of Disciplines for Elective Study, Compared with Core

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and forcing students to make the intellectual leap of integrating them. It follows that modelling such interdisciplinarity via team teaching would be valuable.

There was no clear indication of whether graduate teaching methods should differ from undergraduate (10 of 22 believed it should), and – if so – how. Some of this appeared to be the result of unfamiliarity with the (common Australian) phenomenon of graduate coursework degrees, as many assumed that the courses would be dominated by thesis work. The type of teaching to be done in graduate programs would also necessarily differ based on the undergraduate training assumed of incoming students. A slight preference was evident for more applied and solutions-oriented programs for graduates, but no pattern or agreement existed about the pedagogical methods, degree of disciplinarity, independence (e.g. team work) or program flexibility.

### *Avoiding Bias in Curriculum Design*

It is not uncommon for administrative, organisational and disciplinary demands to influence tertiary curriculum design processes as much as pedagogical and professional needs. In order for this study to balance such pressures, any bias introduced by the survey design and response profile must first be isolated.

Genuine disciplinary bias was only evident in the curriculum design at the coarsest level of RFCD aggregation, and – as such – is not considered a pressing issue (Table 2). Although only 6% of subject area nominations were within the broadest area of expertise of the respondent, they were twice as likely to nominate their own division as core than elective and 96.6% of respondents' coarse qualification areas were chosen in their suggested curricula. Despite the fact that at each level of the RFCD classification there are only 15% as many classes as was in the previous, the subject and discipline-level bias levels are similar. This indicates that most of the nominated subjects were also in different disciplines, and these choices are shown at the division level to cover a wide range (84%) of possible areas.

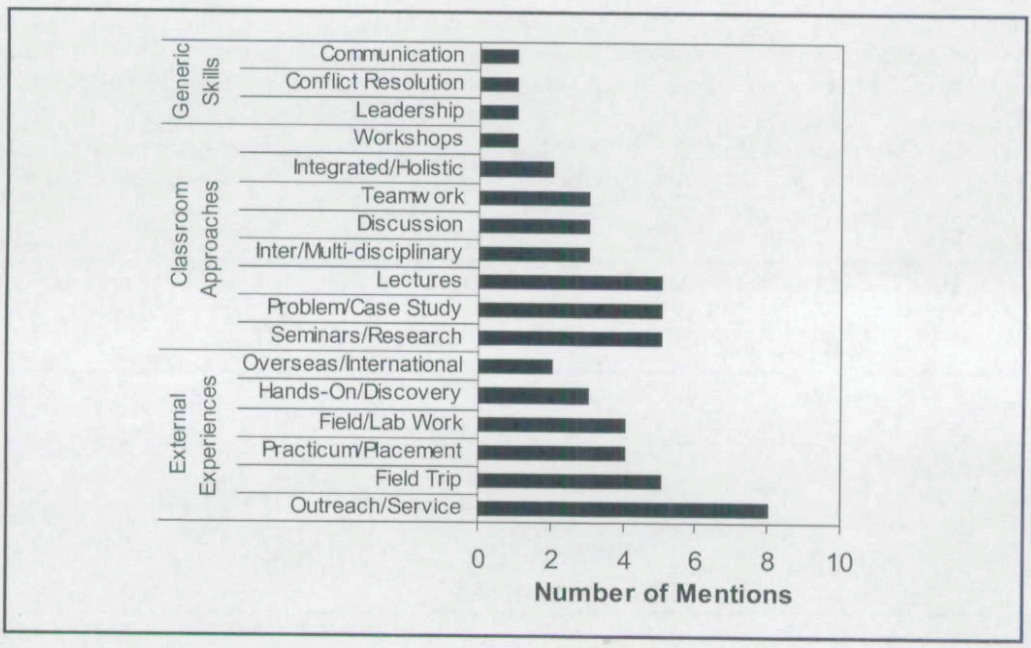


FIGURE 4: Popularity of Pedagogical Methods from Survey

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Bias may also be evident by what is excluded as a result of the respondent profile. It was previously stated that the respondent expertise did not cover the entire range of RFCD divisions, and additionally some respondents did not volunteer their qualifications. Gaps existed in Architecture, Physics, Medical Science, Behavioural and Cognitive Science, Law, Education and History and Archaeology. The highest ranking of these "gap" disciplines in nominated core curriculum was the first, at 10th most prevalent; the remainders were even less prominent. Future surveys will endeavour to close these gaps.

Bias is also introduced by the survey design itself. By far the highest counts were for subject areas listed on the survey. The power of suggestion was very much evident, and it must be recognised that the choice – and perhaps the phrasing – of these fields may impact the final results.

It should also be mentioned that the author presented material on this topic on the first day of the conference at which the survey was conducted (Sherren, in press). This may have modified the established opinions of those responding to the survey, but this is not considered to be a negative impact.

Additional bias arises from the subjectivity of the researcher's classification of categories provided, as well as those refined and suggested by respondents. Not all researchers would have returned the same results, but because the same individual undertook both studies discussed here, the results should be comparable.

With the consideration of the sources of bias addressed above, one is left with one very positive impact of the survey instrument design. The fact that the survey was undertaken outside of a real curriculum development process allowed participants to envision an ideal curriculum away from confounding pressures. Such processes are rarely able to be undertaken in such a "blue-sky" environment due to disciplinary allegiances, interpersonal issues, and the pragmatics of ensuring subjects, schools and courses can maintain viability of enrolments. The avoidance of this bias must be recognised, and it is partly for the elimination of vested interests that these outcomes are so valuable. It is also the reason why additional research is required in this area, most immediately through extending these survey activities and attempting to fill all of the "gap" perspectives. Those undertaking to design curriculum for sustainability

TABLE 2: Discipline Bias at Each Level of the RFCD Classification System. Square brackets indicate that multiple subjects are chosen within the class, and contain a subject count

| **RFCD Classification Level:** | **Subject** | **Discipline** | **Division** |
|---|---|---|---|
| Proportion of RFCDs nominated | 49 of 1062 (4.6%) | 37 of 163 (4.9%) | 21 of 25 (84%) |
| # Qualifications Chosen as (of 29): | | | |
| Core | 5 | 7 | 23 [24] |
| Elective | 2 | 3 | 11 [14] |
| Either | 7 | 8 | 21 |
| Both | 0 | 1 | 7 |
| Neither | 22 | 20 | 1 |
| Proportion of Qualifications Chosen: | 24.1% | 31.0% | 96.6% |
| Proportion of Biased Choices (of 467): | 1.5% | 1.9% | 6.0% |

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are looking to the literature to mediate these interests, but currently find little of sufficient detail to inform their decisions.

## Conclusions and Recommendations for Further Work

The preliminary results from survey activities undertaken by the author indicate that the most pressing deficiency of Australian coursework sustainability programs is Policy and Political Science. Generally, the balance of content should be shifted towards the Humanities and Social Sciences and slightly away from its current Science focus. Recommended teaching methods include external experiences; of nature, of society, of the workplace, of other cultures and disciplines, and of their fellow students and neighbouring disciplines through teamwork. There was mixed opinion about whether graduate degrees should differ in this respect. The percentage of a course that should be considered core echoed the Australian norm. Finally, bias in curriculum design was only evident at broad disciplinary classes; at more detailed scales, respondents almost appeared to disfavour their own fields of expertise.

Knowing for certain what disciplines and teaching methods might best be adopted to educate for sustainability is still far from the end of the issue. In such real-world sustainability curriculum discussions as the author has witnessed, there is confusion around some of the jargon used in existing literature. The distinction between education *about* and *for* sustainability is unclear. Additionally, though "green" and "environmental" are often used interchangeably with sustainable in the literature, this very limited view of sustainability may be causing curriculum to be dominated by that one pillar. The literature should endeavour to communicate more clearly to the practitioner audience. Additional work should also attempt to better capture and assess pedagogical methods and generic skills in existing programs, as well as determining which institutional structures and incentives will provide a more hospitable environment for the undertaking.

Some of remaining questions involve how to integrate recommended core disciplines with optional majors or streams. Narrow majors undertaken in combination with a broad core (such as that suggested here) may create disciplinary experts with a sustainability ethic and a critical, integrative mindset. Custom-designed sustainability majors may be broader, likely addressing sustainability as it is understood and implemented within a larger set of disciplines (e.g. Humanities), thus creating a sustainability generalist. Graduates from such programs will be suited to different roles. The first may provide the ubiquitous literacy in sustainability which is so desired, the latter, skilled, generalist "integrators". It has also been suggested that rather than ensuring that sustainability content is embedded in all subject matter, or imposing a specific set of core knowledge, perhaps all that is required to educate for sustainability is a liberal education which develops critical thinking skills and broad contextual knowledge (Foster, 2001; Sherren, in press). Whichever model is chosen, the spectre of indoctrination must be avoided (Jickling, 2001).

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*Keywords*: Education for Sustainability; Higher Education; Australia; University Curriculum; Environmental Education, Interdisciplinarity.

## Endnotes

1. Although linear graphs such as those found in Figure 1 and 2 are unconventional unless the x-axis comprises categories with an inherent order or relationship, the methodology is here applied for clarity. Some disciplines use such graphs to help in visually comparing patterns across a number of variables. Used to denote disciplinary content, it conveys a disciplinary "signature" for various kinds of degree programs and allows easier comparison than bars or columns.

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## Additional Resources

Due to space restrictions, the following additional resources can be supplied by the author upon request: a complete list of degree programs used to generate the aggregate Australian core; a copy of the survey instrumer t and information letter; and, the raw curriculum data collected during the survey.

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