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Is there a sustainability canon?

An exploration and aggregation of expert opinions

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Abstract This paper identifies one possible set of appropriate disciplinary content for undergraduate programs in sustainability, based on a survey instrument employed at two international sustainability events in 2005. Undertaken to supplement the focus in the sustainability education literature on generic skills and pedagogical method via case-based or broadly conceptual work, it seeks to assist curriculum developers with planning disciplinary content. Findings indicate that a sustainability canon of sorts exists. A surprising amount of agreement existed from the two different specialist groups about core concepts, notably in ecology and—less unanimously—policy, economics and ethics. Studies about society were preferred as elective content. A 10-subject core was nominated, suggesting the need for broad foundational underpinnings.

Keywords Core curriculum · Higher education · Sustainable development · Universities · Undergraduate · Environmental education · Disciplinary foundations

1 Why seek a canon?

Sustainable development requires activities which are ''ecologically sound, socially just, economically viable and humane'' and able to ''continue to be so for future generations'' (ULSF 1999, p. 1). As a topic of problem-based study in universities, sustainability should unify attempts to explore and solve challenging problems that were previously isolated within broad disciplinary sectors. Sustainability curriculum development is further encouraged by initiatives such as the Talloires Declaration on Education for Sustainable Development (ULSF 1990) and the United Nations Decade of Education for Sustainable Development (2005–2014). Sustainability-themed programs and majors are now being developed, just as environmental studies and science departments and degrees boomed in the 1970s and 1980s (Klein 1990). Guidance provided in the education for sustainability (EFS) literature is not communicating effectively with the practitioner audience responsible for designing the aggregate student experience in such programs. The result is a chaos of disciplinary foci (Focht 2003) and naming conventions (Sherren in review).

The literature on sustainability curriculum is dominated by educationalists, and thus is rich with suggestions of *how* such education should be delivered (Sterling 2001) to produce generic skills such as holistic and critical thinking (UNESCO 2004). It contains little discussion of relevant disciplinary content beyond ecological literacy (Orr 1992), and an implicit support for interdisciplinarity in order to balance and integrate the social, environmental and economic elements of the concept. This may be a backlash against early discussions on the topic which privileged the 'what' over the 'how', but the question of ''*what* will be integrated?'' is still often ignored. This literature also leaves a large gap between broad conceptual work and individual case vignettes (Fien 2002), both of which provide little actionable advice to practitioners. Sustainability is already an ill-defined and diffuse area of study (Leal Filho 2000; Robinson 2004; Whitley 1984). Without formal accreditation standards or expert guidance it has become embodied in universities by unrestrictive, cafeteria-style programs rather than those that proceed logically in building the capacity to respond to such issues (Sherren 2006). Easily perceived as 'anything goes', such programs

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exacerbate impressions about sustainability as the 'soft' option for study, rather than the biggest challenge of our continuing existence. Such low esteem attracts mediocre students in return, which often fuels further weakening in rigour.

While the content and method of such degrees both require ongoing discussion, course planning committees in traditional universities first turn to the discipline areas; the pedagogy to be employed is usually up to the responsible academic. In such planning environments, competition for resources (read: student numbers) is highly fraught and identifying subjects which all students should study can quickly create 'winners' and 'losers' around the table. Compromise in such settings involves opting for all or nothing, rather than enter into a time-consuming and divisive discussion of relevance. A consensus of expert views about relevant content can defuse and inform such discussions, but has been largely absent to date. Such guidance also lends support to academic members of planning committees whose primary training is likely not to be education, nor sustainability as a whole, but some contributing discipline. It can also combat the tendency of curriculum to evolve from those sitting around the planning table.

This paper uses recent survey activities to begin to delineate an appropriate disciplinary mix for tertiary sustainability education. Two strong caveats are required before continuing. Firstly, this set of surveys comprises a response rate and sample size that is small by any standards. Those that did respond, however, share an interest and expertise in this issue and their aggregate response is illustrative and informative without attempting to be definitive. Secondly, no 'perfect' degree either exists or is desirable; each institution will and should build on its own strengths. What this paper provides is a starting point for dialogue, a skeleton upon which to apply the suitable detail, and problem-based focus.

2 Methods

A questionnaire (available from the author) was opportunistically delivered at two international sustainability conferences in 2005 to explore the issue of disciplinary mix in university sustainability education. The part of the survey discussed here asked respondents to ''[I]magine [they were] designing a new undergraduate degree in sustainability aimed at producing students with an interdisciplinary, generalist understanding of the issue'' and mark a list of disciplines with a C (for core) or E (for elective) ''according to [their] opinion on its role in such a course''. Respondents could refine the discipline categories provided, or add new ones. The Australia Research Council's (ARC) hierarchical RFCD (research field, course and discipline) classification was used to categorise the nominated disciplines. It is comprised of 25 divisions subdivided into 163 disciplines and 1,062 subjects. Responses were translated to two matrices, one for core curriculum and one for elective, with each respondent's survey viewed as a row or tuple comprising a string of numbers representing how many of each RFCD they nominated. These rows are then easily compared with each other, and can be averaged to develop an aggregate or 'ideal' sustainability curriculum. As there was no space on the questionnaire for the number of subjects per discipline to be volunteered, one subject per nominated discipline area was assumed.

2.1 Survey cohorts

The survey was first distributed to attendees of the First International Conference on Ecological, Cultural, Economic and Social Sustainability, held in Hawaii at the end of February, 2005.[1] Hawaii survey respondents numbered only 26, from a distribution of approximately 150 attendees of unknown national and disciplinary mix. As a result, the representativeness of the sample is unknown. However, the disciplinary expertise of this cohort of respondents was certainly diverse, covering all but six of the RFCD divisions (the highest level of the RFCD hierarchy). The wide disciplinary and geographical origins of attendees provided valuable depth to the definition of sustainability. None were specialists in education, although many did teach within their respective institutions.

In late October of 2005, the questionnaire was distributed to attendees at the Halifax Consultation on Sustainability in Higher Education, funded by the Social Science Research Council of Canada. The EFS experts at this invited workshop were participating in another research exercise, involving the use of a Delphi process to develop a comprehensive research plan and strategy for the 'field' (Wright 2007). The thirteen Halifax participants that responded (out of 34 attendees) had a larger proportion of doctorates, a narrower range of primary disciplines (largely education or environment), had earned their higher degree 8 years earlier than the Hawaii cohort (1987 as compared with 1995) and were—unsurprisingly—more likely to volunteer contact details in order to be kept apprised of research findings resulting from the work. The difference in higher degree achievement may be accounted for by the fact that Halifax was largely attended by those who had achieved a high level of achievement in their field. The

[1] A detailed discussion of this survey, including the analysis of questions on pedagogy and graduate-level study, and a comparison with existing Australian program cores, can be found in Sherren (2005).

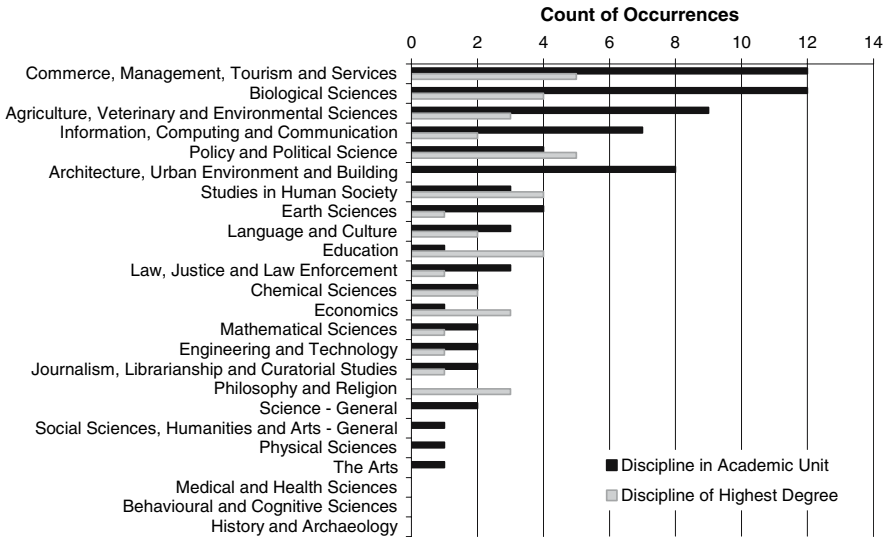

Fig. 1 RFCD discipline coverage of Hawaii and Halifax survey respondents. Black bars denote the discipline is within the respondent's academic unit (if they work in a university); grey bars indicate that the respondent's highest degree is in that field. Multiple counts are possible for an individual in each category

Hawaiian meeting was open, and included a large number of early career researchers.

Together, the 39 respondents were from the so-called West (33)[2], worked in universities (30), and had either Doctorate (21) or Masters (12) qualifications. Those higher qualifications were acquired over a 40-year period, from 1965 to 2005, but the average was 1992, indicating a peak of interest in sustainability. The breadth of the collective sample is shown in Fig. 1, identifying the RFCD divisions in which the full set of respondents had higher degrees, or that were included in the academic budget area in which they work. The area of higher degree is more evenly dispersed than those representing departmental affiliations; those working in departments relevant to sustainability come from all over the disciplinary spectrum.

2.2 Sources of bias

Bias was investigated by comparing the disciplines in which a respondent was trained or worked with those he or she nominated, to see if they appeared partial to their own fields of expertise. Disciplinary bias was only evident in the Hawaii curricula at the coarsest level of RFCD aggregation, comprised of 25 divisions, and—as such—was not confounding. (The Halifax cohort also demonstrated minimal bias, but its narrower range of expertise made this unlikely to start with.) Only 6% of subject area nominations were within the broadest area of expertise of Hawaii respondents, but 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 division-level bias numbers are similar (1.5% and 1.9% respectively). Most of the nominated subjects were thus also in different disciplines, and these choices are shown at the highest division level to cover a wide range (84%) of possible areas.

Bias may also be evident by what is excluded as a result of the respondent profile. It was already stated that the respondent expertise did not cover the entire range of RFCD divisions, and some respondents did not volunteer their qualifications. Gaps in the Hawaii cohort existed in Architecture and Urban Environment, Physics, Medical and Health Sciences*, Behavioural and Cognitive Science*, Law, Education and History and Archaeology*. Including the Halifax cohort, only three fields have no representation (those with asterixes above) in either the field of highest degree or academic department home (recall Fig. 1) of the respondent. The highest ranking of these 'gap' disciplines in nominated core curriculum was the first listed, at 10th most prevalent; the remainders were even less prominent.

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 and order—of these fields may impact the final results. For example, not presenting the entire range of RFCD codes, despite the opportunity provided to add to the list, may have disadvantaged fields such as Behavioural Sciences.

It should also be mentioned that the author presented material on this topic on the first day of the first conference

[2] The geographic dispersion of respondents, when volunteered, was largely western, including the United States (16), Canada (6), Australia (5), the United Kingdom (4) and the Netherlands (2). Two respondents were from Africa, and several did not specify, doubtless due to a concern that they would be too easily identified as a result.

at which the survey was conducted. This may have modified the established opinions of those responding to the survey, but this is not considered to have unduly skewed findings. 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 are 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 pragmatic concerns. Genuine processes are rarely able to be undertaken in such a 'blue-sky' environment due to disciplinary allegiances, interpersonal issues, and the burden of ensuring subjects, schools and courses can maintain viability of enrolments. The avoidance of this bias must be recognised, as it is partly for the elimination of vested interests that these findings are valuable.

3 Degree content and structure

The methods described above bring insight to two issues around sustainability curriculum development in universities that assist at the strategic stage of planning: what might be an appropriate discipline mix, and the level of flexibility in subject choice. First, the aggregated results are given in full, including a sample curriculum which received broad agreement, before the difference between the two cohorts is briefly discussed.

3.1 Program structure

The disciplinary component of the survey was completed by 39 respondents, who chose between three and 14 subject areas for core content, with a median and mode of 10, the same number that the survey suggested would be an appropriate number to include. Electives were chosen over a wider range, with as many as 17 included in one program and three with none at all, but the mode was 13. There was no relationship between the number nominated for core and that for elective. It was not perceived as a zero-sum equation by respondents, where—for example—a low number of core subjects left room for a large number of electives, nor was there any trend that those that nominated many core subjects did the same for electives. The two cohorts did not differ in this respect.

The response average suggests a desirable curriculum size of 19.4 subjects, exactly half core and half elective. In a 3-year program, such a sequence would leave room for a handful of non-specified electives. In a 4-year program, fully half the degree space would remain available for double majors or capstone graduation programs.

3.2 Disciplinary content

Only 53 different RFCD codes of various scales were suggested by the 39 respondents (39 for core, 43 for elective), and only occasionally were new fields added or the supplied ones refined although there was space for both actions on the questionnaire itself. Aggregated, the popularity of the various RFCD divisions for core and elective use can be seen in Fig. 2.

The ideal curriculum is compiled at an aggregated division level in Fig. 2, but the raw (as captured) level of subject

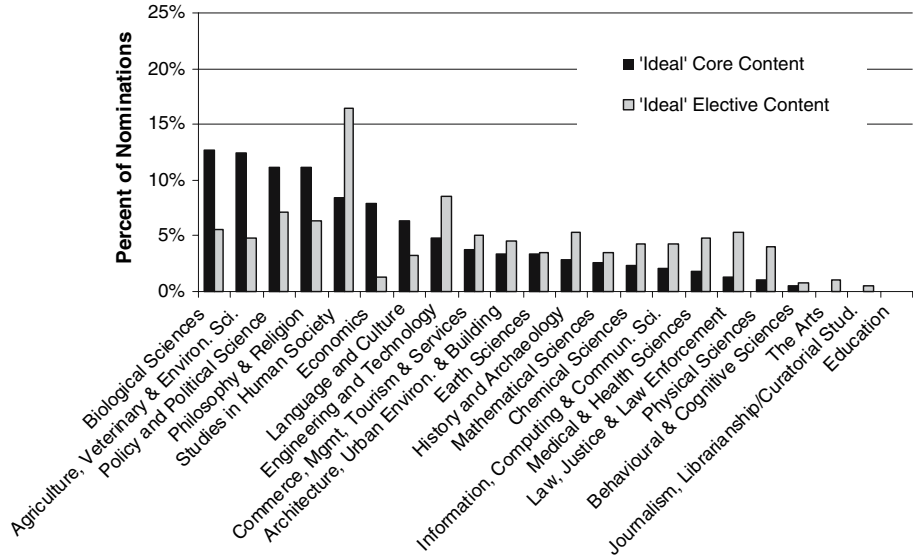

Fig. 2 The popularity of various RFCD divisions in curricula nominated by respondents, listed in order of their nomination as core

or discipline code is also informative. Statistics using the raw data (mapping back to the questionnaires for language) show that the topics that were agreed by respondents to be important for core study do not overlap with those agreed to be valuable for elective study (Table 1). The lower portions of both lists (not shown), which lack consensus, do overlap. The respondents agreed more about core content than electives, despite the anecdotal difficulty in real curriculum development processes of nominating those subjects which all students will do. All of the core areas listed in Table 1 were present in at least half of the designed programs, Ecology and Economics notably by over three-quarters. Electives were more widely dispersed, with only two—Human Geography and Anthropology—appearing in over half of nominations. The 16 areas identified in Table 1 provide guidance to program designers, both in deciding who to invite to the planning process, and what range of disciplinary ken they should be attempting to impart to undergraduate students. The lists contain no obvious theoretical gaps when viewed in relation to some of the more common conceptions of sustainability: the three-legged stool of society, environment and economy, the four pillars (adding culture) or the concentric 'target' (economy nested in society nested in environment).

That the most popular RFCD division nominated for elective study was Studies in Human Society (Fig. 2) suggests an attitude that science must be learned while human issues are 'optional' and can be easily picked up. Methods or pure sciences made little appearance in this 'generalist' sustainability curriculum, but mapping was a popular elective area (shown here as Geomatic Engineering). Engineering and Technology was a distant second in electives (receiving 8.5% of nominations, compared with 16.5% for Studies in Human Society) and half of its 'votes' were due to Geographic Information Systems (GIS). The other half related to the development of new technological solutions to sustainability problems. Design is certainly an important element of sustainability (Birkeland 2002), whether of new social systems, technological tools or new uses for our old byproducts. A generalist in sustainability may not be expected to develop new technologies without a more quantitative background, but knowledge about the process of innovation may contribute as much to social entrepreneurship as technology research and development.

Table 1 Subjects in which a high degree of agreement existed, by role, in order of priority

Core subjects	Elective subjects
Ecology (82%)	Human Geography (56%)
Economics (77%)	Anthropology (54%)
Applied Ethics (72%)	History (49%)
Environmental Sciences (67%)	Public Health and Epidemiology (46%)
Cultural Studies (59%)	Sociology (46%)
Policy and Political Science (56%)	Law (46%)
Resource Management (51%)	Philosophy (46%)
International Relations or Development Studies (51%)	Business, Management or Accounting (44%)

Percentages of agreement are given in brackets

3.3 Comparing two cohorts

The patterns are quite similar between the two cohorts, considering their demographic differences, but several variations in the undergraduate sustainability programs they designed are surprising. Firstly, Halifax respondents—those who were all researchers in higher education for sustainability—nominated proportionally fewer core subjects and more electives than the multidisciplinary Hawaii cohort, resulting in a slightly larger overall program (Table 2). This slightly increased flexibility may be an expression of the more conceptual nature of the Halifax respondents' field of interest. Neither formal nor informal discussions during the workshop concerned the role of individual disciplines in EFS, focussing instead on higher level pedagogical theory and educational philosophy: it is not what you teach, but how. Hawaiian attendees were specialist in a range of sustainability approaches, theories or technologies, and by attendance at such a broadly-defined sustainability conference could be assumed to have respect for the contribution that a range of disciplines make to the area.

Figure 3a compares the aggregate core programs, and the solid lines representing the two cohorts mirror each other closely, with two percent or less of difference between them in all but three divisions. The Halifax cohort markedly emphasised the importance of Philosophy (4.7%), and de-emphasised Studies in Human Society and Chemistry by 3.7% and 3.5% respectively, in comparison with the Hawaii cohort. Also notable is the unanimity with which the Biological Sciences are felt to be key content for sustainability graduates. Although Halifax respondents

Table 2 Differences in nominated program size between the Halifax and Hawaii respondent populations

Cohort	Average core	Average elective	Average total
Hawaii (2/3 of responses, $n = 26$)	10	9.1	19.1
Halifax (1/3 of responses, $n = 13$)	9.2	10.8	20
Both ($n = 39$)	9.7	9.7	19.4

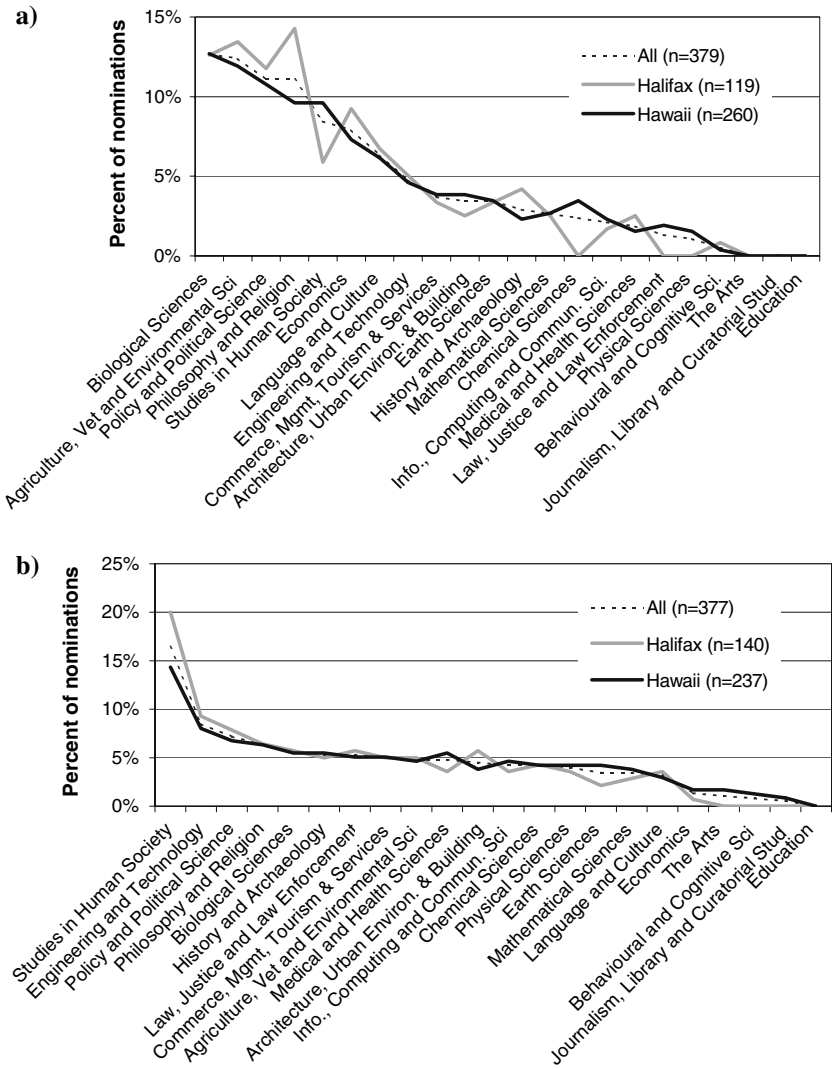

Fig. 3 The Halifax and Hawaii core (**a**) and elective (**b**) programs in comparison, ordered by the popularity of the field in the aggregate produced[3]. Note that the order the RFCDs are presented varies between the two

identified Studies in Human Society less frequently than the Hawaii cohort for core study, they promoted it as an elective subject 5.6% more than Hawaii respondents (Fig. 3b). Both cohorts felt it was the most important elective area by far (recall Fig. 2). All other differences in elective choice between the two cohorts were within 2% of each other, although admittedly, in some cases that margin of difference is larger than the popularity of the divisions in the final aggregate.

4 Conclusion

This paper presents one expert-derived sustainability canon that could be informative during the development of new undergraduate curricula purporting to educate in the full breadth of the topic. This canon includes in its core Ecology, Economics, Applied Ethics, Environmental Science, Cultural Studies, Policy and Political Science, Resource Management and International Relations or Development Studies. Topics educating in the third key pillar of sustainability, society, are largely relegated to elective status by experts, just as they are in existing Australian curricula (Sherren 2006). These include Human Geography, Anthropology, History, Public Health and Sociology. Half (9.7) of the subject nominations were for core subjects, and a majority of respondents agreed on the subject areas for the core, suggesting a broad foundation year to underpin any such program.

The value of this work lies in the fact that it gleaned the mechanics of appropriate program design from 39 sustainability experts in an environment where they were not subject to resource pressures related to subject load and discipline viability. In fact, bias in curriculum design was

[3] Line graphs are used here in lieu of bar charts, although line graphs usually indicate a natural order or relationship between categories (such as time), for ease of comparison when a number of variables are involved.

only evident at broad disciplinary classes; at more detailed scales, respondents almost appeared to disfavour their own fields of expertise. The results are useful for those in fraught planning situations, but are not intended to be a template as much as a touchstone. The aggregate program is as unproven in its value as any such nascent curriculum is before it is tested in the classroom.

Additionally, knowing what disciplines might best be recruited to educate for sustainability is still far from the end of the issue. Questions remain about how best to integrate recommended core disciplines with optional majors or streams. Undertaking narrow majors in combination with a broad core (such as that suggested here) may engender 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 sustainability generalists. Appropriate pedagogy is also in question, although many scholars and practitioners are engaged in answering these questions, often through action research in their own classrooms (Tilbury 2004). Finally, the context of the tertiary sector in question has to be considered in implementing curricula (Huisman 1997). The Australian sector, for example, lacks a liberal education tradition and rarely employs common foundation years in its programming, unlike the USA. However EFS is implemented, the spectre of indoctrination must be avoided (Jickling 2001).

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