Survey Study on Attitudes to Multi-Dimensional Sustainable Development with U.K. MSc Students

Gavin Melles

Faculty of Health, Arts and Design, Swinburne University of Technology, Hawthorn, Victoria 3122, Australia; gmelles@swin.edu.au; Tel.: +61-3-9214-6851

Abstract: As reflected in the sustainable development goals (SDGs), sustainable development is a multi-dimensional concept integrating political, ethical, economic, and other factors. Reports from the United Nations (UN) Decade of Education for Sustainable Development (UNDESD) suggest that universities are more engaged with sustainable development in higher education. Despite promising signals about student awareness of sustainable development, survey studies suggest student engagement and knowledge is limited. Previous studies have tended to focus on undergraduates and examine basic attitudes to triple bottom line issues. This study examined knowledge and attitudes of postgraduate U.K. students enrolled in one-year taught sustainability degrees on the multi-dimensional issues of sustainable development. This study piloted a 39-question 7-point Likert scale survey with a cohort of U.K.-taught postgraduate (MSc, MPhil) students (n = 121, Cronbach's Alpha 0.796, n = 39 questions). The study found this cohort able to recognize and respond to the multiple challenges of strong and weak sustainable development issues rather than exhibiting knowledge gaps previously reported. Results and qualitative comments from the survey suggest, however, that students resist the idea of strong interventions in social, political, and economic life.

Keywords: education for sustainable development; postgraduate students; United Kingdom; survey study

1. Introduction

The UN Decade of Education for Sustainable Development (2004–2015) aimed to promote greater impact of principles and practices in education globally. In higher education specifically, results indicate mixed outcomes in terms of the depth of engagement of universities, students, and faculty (Wals 2012, p. 86). Ashford (2004) has suggested that important concepts and values of Education for Sustainable Development (ESD), including ideological challenges to mainstream approaches, can be swallowed up by the restrictions of institutional curriculum constraints, which are "arguably undergoing a process of neo-liberalisation" (Sylvestre et al. 2013, p. 1358).

Thus, the acceptability of value-laden commitments to sustainability is a fraught issue in university contexts of academic neutrality, neoliberalisation and industry relationships (Mulder 2010). These pressures have contributed to the mainstreaming of conventional ecological modernisation arguments in ESD (e.g., Coffey and Marston 2013), Amador et al. (Amador et al. 2015) conclude that the slow institutionalization of ESD is due to the resistance of universities to addressing the ideological and political challenges that strong sustainable development commitments suggest. This and other obstacles suggest that we are still some distance from developing transformative ESD courses that challenge the mainstream (for example see Sipos et al. 2008).

Postgraduate taught courses integrating education in the challenges of sustainable development offer a distinct environment to enrol committed and engaged student cohorts to explore ecocentric and anthropocentric issues. In addition to any specific disciplinary focus, e.g., engineering, management,

natural sciences, such courses often integrate units addressing the broader social, environmental, and economic questions of sustainable development. Such a foundational unit into which students were enrolled was a selection criterion for the institutions and programmes selected in this study. Compared to undergraduates, this is a cohort with (albeit varying) knowledge of and attitudes to sustainability. Students bring beliefs and attitudes to such courses, which are subsequently enhanced and challenged (Grierson and Hyland 2011; Naeem and Peach 2011; Stubbs and Cocklin 2008).

1.1. Student Attitudes to Sustainability and Development

Previous studies have focused primarily on undergraduate university cohorts. Most identify weaknesses in student understanding of social versus environmental and economic issues. They also identify weak commitments of students and limited development in understanding across year levels. Poor connections with campus greening initiatives was also a weakness. Few studies have surveyed postgraduates and none have explicitly asked students to evaluate their principled commitments to strong and weak sustainable development ideas.

In the first global survey study (45 questions) of engineering students ($n = 3134$) across multiple institutions, Azapagic et al. (Azapagic et al. 2005) found that knowledge and recognition of environmental principles was at a level of "heard about but could not explain". The authors noted poor knowledge of environmental legislation, policy, and standards, and no difference in knowledge between year levels. They also found that "significant knowledge gaps exist with respect to the other two (social and economic) components of sustainable development" (Azapagic et al. 2005, p. 16). Kagawa (2007) surveyed Plymouth University students ($n = 1889$) finding limited in depth knowledge and strong association of the idea with environmental rather than economic or social concepts. The study also found a "light green" approach among students to sustainable changes, e.g., beliefs in recycling. Tuncer (2008) found all students, irrespective of whether they were in a sustainability-oriented course or not, were interested in committing to sustainable lifestyles, although no specifics were given on how they would do this. They also note that campus initiatives, e.g., recycling, have had limited uptake. Barth and Timm (2011) found a 'sophisticated' understanding among undergraduate students at Leuphana University where education is strongly learner-centred and experiential. In their Malaysia-based study ($n = 379$) Nejati and Nejati (2013) found that students associate a sustainable university with activities that are rarely practiced on campus. In an annual repeated study across first- and second-year U.K. students ($n = 3845$) a UK Higher Education Academy (HEA) report (Drayson et al. 2014) identified interest in students in learning about sustainable development, limited desire to participate directly in environmental actions or initiatives and some preparedness to sacrifice earning potential to work for an ethical company. These studies while useful focus on undergraduate student cohorts.

Few studies have focused specifically on postgraduate taught students. The small case–control study by Brody and Ryu (Brody and Ryu 2006) from the United States did find that following a postgraduate course in sustainable development that students reported reducing their ecological footprint significantly. Corney's study (Corney 2006) of postgraduate teacher education students ($n = 19$) indicated inter alia serious doubts about introducing more radical strong notions of sustainable development into school contexts. Zeegers and Clark (2014) employed student reflective journals ($n = 34$) from Master's students in Australia, finding that despite being exposed to the multi-dimensional challenges of sustainable development, most students remain with an envirocentric view. They also note that the complexity of the subject matter including with regard to the political, economic and ideological issues, makes it a challenge to teach. In sum, these studies suggest a general "dissonance" in student attitudes to sustainability and sustainable development with limited acknowledgement of the multidimensional nature of the processes; general student knowledge and attitudes seem favourable but uninformed about the specifics of sustainable development.

This study aimed to further evaluate this weak knowledge claim against a more detailed articulation of sustainable development issues by asking a multi-institutional U.K. postgraduate

cohort of students undertaking sustainability studies to evaluate their position with regard to multiple key aspects of sustainable development. These aspects included: historical responsibilities, principles of equity; beliefs about market-oriented versus other growth discourses; technological optimism; local versus global economics; and other questions (see Table 1 ladder of sustainable development below). No studies to date have based surveys on an articulated view of the multidimensional nature of strong, weak and mainstream approaches to sustainable development.

1.2. Strong and Weak Sustainable Development Paradigms

Mainstream sustainable development as typified by the Bruntland Report Our Common Future mixes strong, weak and populist discourses to strike a compromise (Adams 2009). Weaker approaches tend to adhere to versions of market environmentalism and "green wash", which see the invisible hand of market transactions as the way to secure progress (see Eckersley 1993). Thus, strong sustainability focuses on critical natural capital and (non)substitutability, where this "is responsible for important environmental functions and which cannot be substituted in the provision of these functions by manufactured capital" (Ekins et al. 2003, p. 169). Despite criticism of the ambiguities in the terms "sustainability" and "sustainable development" (e.g., Lele 1991), beyond environmental thresholds (mentioned), envisioning alternative futures issues in the latter brings many more factors into play, e.g., approaches to technology, politics and government, etc. These are captured in more recent articulations of sustainable development

1.3. Ladder of Sustainable Development

The political, economic, ethical and other concepts have been plotted as a continuum or "ladder" of sustainable development as developed by Baker (2013), across an anthropocentric and eco-centric continuum (see table). These are distinguished by their appeal to different normative principles, attitudes to nature, spatial focus (e.g., local vs. global), type of development (e.g., attitudes to consumption), approaches to governance, belief in technology, policy integration and tools, and civil society state relationships, i.e., far more than attitudes to critical natural capital. Survey instruments that build on the multi-dimensional consequences of strong (eco-centric) and weak (anthropocentric) positions are being explored by researchers (Kopnina 2014). This study employed Baker's (2013) ladder to systematically reflect these multiple dimensions and evaluate postgraduate student knowledge and attitudes to these.

Baker divides the continuum into four broad 'models' from a deep green ideal model to a pollution control market environmentalism. Initial development of the questionnaire included at least one survey question per cell plus three, which provided alternative perspectives on the topics. Subgroups of questions (Table 1 below) addressed eight areas of relevance. The content of specific survey questions asked individuals to choose a position across the continuum relative to specific topics, e.g., globalization, and thus content coverage was duplicated in areas that affected the Cronbach's Alpha for reliability and factor analysis. Future survey development would offer a reduced number of questions.

Table 1. Ladder of sustainable development (Baker 2013).

	The Ladder of Sustainable Development: The Global Focus									
Model of Sustainable Development	Normative Principles	Type of Development	Nature	Spatial Focus	Governance	Technology	Policy Integration	Policy Tools	Civil Society: State Relationship	Philosophy
Ideal Model	Principles take precedent over pragmatic considerations (participation; equity, gender equality, justice; common but differentiated responsibilities)	Right livelihood; meeting needs not wants; biophysical limits guide development	Nature has intrinsic value; no substitution allowed; strict limits on resource use, aided by population reductions	Bioregionalism; extensive local self-sufficiency	Decentralisation of political, legal, social and economic institutions	Labour-intensive appropriate, green technology; new approach to valuing work	Environmental policy integration; principled priority to environment	Internalisation of sustainable development norms through on-going socialisation, reducing need for tools	Bottom-up community structures and control; equitable participation	Ecocentric
Strong Sustainable Development	Principles enter into international law and into governance arrangements	Changes in patterns and levels of consumption; shift from growth to non-material aspects of development; necessary development in Third World	Maintenance of critical natural capital and biodiversity	Heightened local economic self-sufficiency, promoted in the context of global markets; green and fair trade	Partnership and shared responsibility across multi-levels of governance (international; national regional and local); use of good governance principles	Ecological modernisation of production; mixed labour- and capital-intensive technology	Integration of environmental considerations at sector level; green planning and design	Sustainable development indicators; wide range of policy tools; green accounting	Democratic participation; open dialogue to envisage alternative futures	
Weak Sustainable Development	Declaratory commitment to principles stronger than practice	Decoupling; reuse, recycling and repair of consumer goods; product life-cycle management	Substitution of natural capital with human capital; harvesting of biodiversity resources	Initial moves to local economic self-sufficiency; minor initiatives to alleviate the power of global markets	Some institutional reform and innovation; move to global regulation	End-of-pipe technical solutions; mixed labour- and capital-intensive technology	Addressing pollution at source; some policy co-ordination across sectors	Environmental indicators; market-led policy tools and voluntary agreements	Top-down initiatives; limited state-civil society dialogue; elite participation	
Pollution Control	Pragmatic not principled approach	Exponential, market-led growth	Resource exploitation; marketisation and further closure of the commons; nature has use-value	Globalisation; shift of production to less regulated locations	"Command and control" state-led regulation of pollution	Capital-intensive technology; progressive automation	"End of pipe" approach to pollution management	Conventional accounting	Dialogue between the state and economic interests	Anthropocentric

2. Material and Methods

This study focused specifically on postgraduate (MSc/MPhil) students in Environment and Sustainability taught programs where a sustainable development unit was taught explicitly along with other disciplinary foci.

2.1. Survey Design and Development

The ladder of sustainable development was used to develop a draft set of questions, which aimed to reflect all aspects of the framework (content validity) and based on pilot and participant responses appeared to have face validity (see Appendix A below). The questions were modified following feedback from two anonymous reviewers and the survey then submitted in pilot form to students at Swinburne University for further evaluation and comment. This feedback provided further inputs, which were incorporated into the final version of the survey. The questions address several dimensions of sustainable development and were polarized to provoke positioning on a seven point Likert scale. Some questions overlap in content focus and this is indicated below for composite scoring and statistics. According to the ladder description above, most but not all survey questions were either strongly polarized towards eco-centric or anthropocentric positions. In conducting reliability analysis, creating composite scores, and Exploratory Factor Analysis (EFA), some questions were transformed.

2.2. Institutions and Programs

Ten institutions responded to the invitation to participate (see Table 2 below), which included an onsite visit to a lecture where students and lecturers were present. Many respondents did not indicate which program or institution they came from. Students recruited to the survey were undertaking a unit (either compulsory or elective) addressing the human and material aspects of sustainable development.

Table 2. Recruited Organisations.

Institution	Example Program(s)	No
Bath University School of Management	MSc in Sustainability and Management	01
Brunel University	Sustainability, Entrepreneurship and Design MSc	06
Cambridge University School of Engineering	MPhil Engineering and Sustainable Development	14
Edinburgh University Edinburgh College of the Art	Advanced Sustainable Design (MSc)	03
Cardiff University School of Architecture	Theory and Practice of Sustainable Design (MSc) Sustainable Mega Buildings (MSc)	05
Glasgow University Adam Smith Business School	Environment and Sustainable Development MSc Sustainable Energy MSc	01
Lancaster University Environment Centre	MSc Energy and the Environment MSc Vulcanology	11
Strathclyde University School of Civil Engineering	Environmental and Sustainability Studies MSc Global Sustainable Cities MSc	20
UCL Faculty of the Built Environment (Bartlett)	MSc Environment and Sustainable Development	03
University of Edinburgh School of Geosciences	MSc in Environmental Sustainability MSc Sustainable Resource Management	15
University of London SOAS	MSc Sustainable Development MSc Poverty Reduction	15
Unstated		27
Total		121

3. Results and Analysis

Through recruitment at 10 U.K. institutions (Table 3) the study obtained a sample (n = 121) to conduct an exploratory translation of the multiple dimensions of the ladder. With an integrated consent form, the survey was advertised on various channels including face to face on campus. This recruitment strategy elicited a varied response rate, which suffered a loss in sections of the survey.

3.1. Missing Values, Factor and Reliability Analysis

Following Little's Missing Completely at Random (MCAR) test to test for random missing values the study used Expected Maximization (EM) to replace these. Without reverse transformation of variable outcomes reliability analysis achieved an Alpha score of 0.796 ($n = 39$). Subsequent removal of nine questions, which overlapped questions in content and focused on government and politics (Q21, 22, 25, 31, 32, 34, 36, 37, 39) significantly raised Cronbach's Alpha to 0.819 ($n = 30$). The reason for this requires future investigation. Exploratory Factor Analysis (EFA) was conducted on this subset of survey variables ($n = 30$), which produced the best Cronbach's Alpha reliability (Figure 1 Scree Plot below). This produced nine factors explaining 65% of variance, with the first two factors dividing between strong and weak positions, and collecting questions oriented to these two positions.
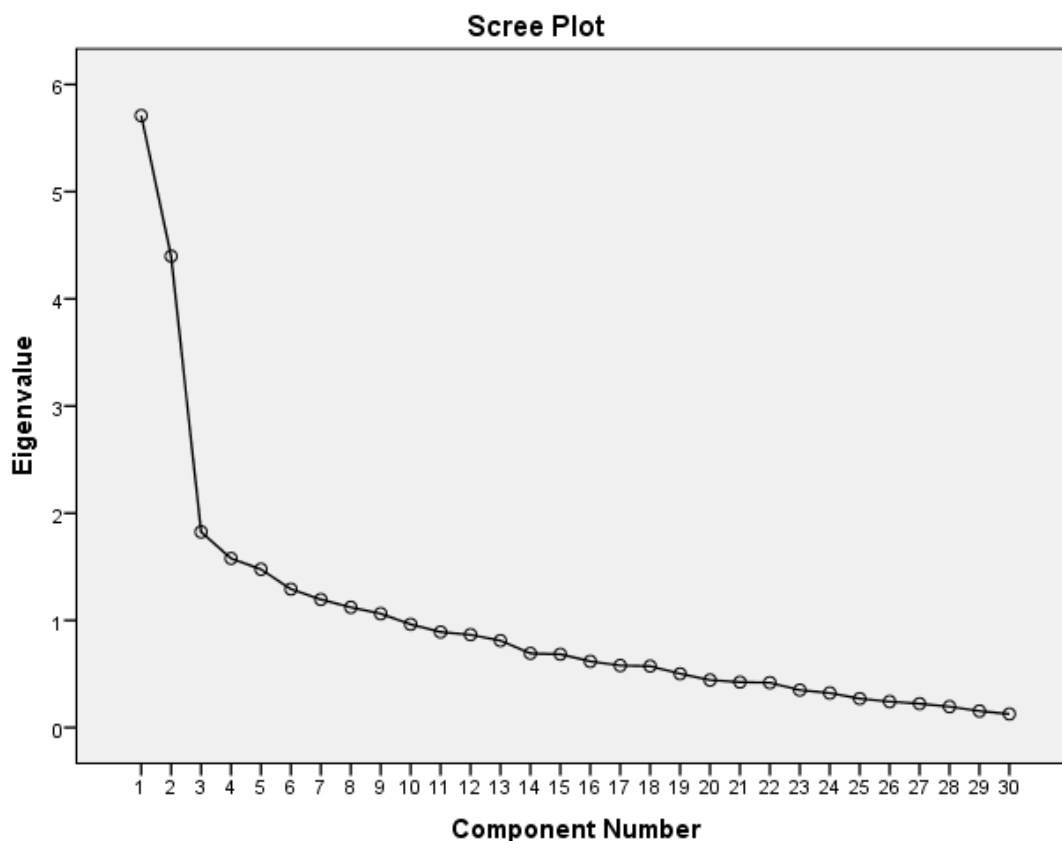
Figure 1. Scree plot for factor analysis.

Thus, the factor analysis seemed to corroborate the claim that sustainable development was multi-dimensional in the sense described above.

3.2. Consensus and Dissensus on Specific Issues

To illustrate the measure of variation and consensus on specific issues, range, mean and standard deviation of individual items ($n = 39$) was calculated (as shown in Table 3 below). There was a high degree of consensus (interpreted as means near or over 6) about principles, general strategies, e.g., legislation, and practices. In addition, the need to legislate, regulate, and employ relevant tools, e.g., Environmental Impact Assessment (EIA), was also relatively undisputed. Concepts which suggested a starker dichotomy, e.g., practical versus principles, importance of market-led growth and locally appropriate farming, generated more disagreement and varied responses as indicated by range, mean, and standard deviation. They are marked in the Table 3 below with an asterisk (*). Means between

3 and 4 typically with high standard deviation (SD) tended to show rejection of the proposition (whether positive or negative polarised) and generated discussion about nuances.

Table 3. Survey questions range, average, and standard deviation.

Survey Question Content Focus	Min	Max	Mean	SD
daily life principles	3	7	6.34	0.832
equal responsibility for solutions	1	7	6.21	1.064
historical responsibility	1	7	5.99	1.275
*practical versus principle	1	7	3.83	1.759
needs versus wants	3	7	6.00	0.962
biophysical limits matter	2	7	6.03	0.982
control class consumption	2	7	5.42	1.433
well-being versus income	3	7	5.98	1.017
legislate industry recycling	4	7	6.49	0.686
*market-led growth matters	1	7	3.41	1.758
natures intrinsic value	2	7	6.20	1.007
biodiversity for development	4	7	6.21	0.798
protect critical natural capital	2	7	6.39	0.841
nature as ecosystem services	1	7	4.85	1.742
*convert environment for development	1	7	3.54	1.482
local versus global economy	2	7	5.44	1.004
universal green trade	2	7	5.85	1.196
*globally competitive local firms	1	7	3.90	1.469
*offshoring ok for development	1	7	4.12	1.518
decentralized institutional authority	1	7	5.02	1.221
government levels coordinate	4	7	6.37	0.594
national regulation of pollution	4	7	6.27	0.657
*global agreements effective	1	7	4.12	1.421
*locally appropriate farming	1	7	3.55	1.598
balance technology and labour	2	7	5.03	1.242
another green revolution	1	7	4.45	1.643
*encourage genetic manipulation (GM) farming	1	7	4.00	1.713
*voluntary industry control	1	7	3.30	1.939
Environmental Management System (EMS) addressing source	1	7	6.06	1.103
ecologically sensitive planning	1	7	6.26	0.893
coordinate government sectors	4	7	6.32	0.710
wide range of policy tools	3	7	6.36	0.678
mainstream impact assessment	3	7	6.28	0.751
*mainstream SD understanding replace laws	1	7	3.72	1.576
voluntary tools and commitments enough	1	7	5.01	1.486
bottom up community governance	2	7	4.89	1.147
equitable participation for decisions	2	7	5.73	1.188
open dialogue matters	3	7	6.20	0.708
*elected representatives enough	1	7	3.54	1.626

3.3. Qualitative Comments

A qualitative component was added to the survey offering participants the opportunity to comment on their choices. Only one-third to one-quarter of respondents added qualitative caveats and a fuller analysis in future of these will be conducted. As noted above suggestions about radical political, e.g., bottom-up governance, economic, e.g., privileging local farming and economies, or environmental change interventions in the survey provoked disagreement. Contentious issues pitting different strong and weak concepts, e.g., market-led growth, practice versus principle, citizens and representation, global competitiveness, converting environment for development (capital substitution), encouraging GM farming, and voluntary industry control, etc., produced disagreement. There was scepticism about voluntary commitments in general, including global agreements (non-enforceable).

In what follows, I briefly illustrate some of the comments attached to specific questions to illustrate how such comments elaborated on, challenged or exemplified issues raised in questions.

Q4: Practical development issues, e.g., job creation, should take precedence over principles and practices, e.g., gender equality or affirmative action, especially for poor economies or sectors of society. Practical issues should be addressed with principles of fairness and justice in mind to avoid perpetuating an unequal world. There is no conflict. With greater gender equality and affirmative action it allows increased participation and innovation within economies that will create jobs [...] there is an untapped reserve. I could imagine situations where it is reasonable, but generally it is a very bad idea, because it does not promote sustainability. Education is probably the single most important stimulus for development across all sectors, and is a fundamental root of both economic growth and (arguably) gender equality. However, segregated attitudes to education will inhibit economic growth, so...

Q10: The key to sustainable development globally is market-led growth, e.g., supply meeting demand in a free market. Market-led gives rise to too many negative externalities and fails to address inequalities. It needs to be restrained by redistributive policies. The key to sustainable development is to reach social agreements made on the basis of rationality (science-based evidence), but been aware that our decisions are taken only on the base of what we know, and there are many uncertainties. Therefore, flexibility to changing policy and management paths is [. . .] In part bridging the technology gap for low carbon and other renewables, and the growth can only be sustainable when growth is decoupled from carbon pathways or carbon intensity growth paradigms.

Q15: The conversion of the environment, e.g., land or forests converted to farming or housing, is an acceptable trade-off or substitution for development. It can be, but it depends on how much land/forest is substituted, where (what kind of land/forest is lost), what is the quality/purpose of the development and who is it for. This needs to be regulated and strictly controlled. The recent government's decision to relax planning laws is uniformed and a fundamental mistake. Brownfield development needs to be moved up the government's agenda (again).

4. Discussion and Conclusions

Sustainable development is a multi-dimensional concept with broad ideological, ethical, political and economic consequences (Adams 2009). Explicitly addressing this complexity should form part of sustainable development in higher education (HESD) pedagogy. Frameworks such as Baker's (2013) make this explicit and this framework was employed to motivate questions in the study. This study could be compared to other recent examples of such tests (Zeegers and Clark 2014). This study trialled a survey with a cohort of U.K. postgraduate taught students (n = 121), including a significant international student enrolment, to demonstrate the feasibility of such evaluation and initial results from its deployment, including EFA evaluation of multi-dimensionality. While the survey had limitations in development and deployment it indicated the feasibility of such evaluation and trends from this cohort. Results also suggest that fewer questions could provide adequate content coverage and improve response rates and completion.

Prior survey studies of students have indicated limited knowledge of the broad multi-dimensional challenges of sustainable development (e.g., Drayson et al. 2014). This study addressing a postgraduate cohort found students willing and able to take a position on a wide range of dimensions. Student respondents from a wide range of countries and backgrounds took an overall pragmatic attitude to moral versus practical issues and showed a general resistance to strong interventions. There was broad consensus on the importance of principles, while anthropocentric development demands often won out over the environment.

In sum there seemed to be limited support for strong positions on sustainable development. Given the small cohort (n = 121) and the limited discipline and institution representation (n = 10) it is not possible to generalize to the broader sector. However, based on the existing results

and analysis there are indications that students respond positively to ecological and mainstream arguments about government intervention, civil participation, equity, and so forth while questioning either market environmentalism, strong state interventions, and deep green ideologies. A repeat survey in other countries with a shortened version of test questions ($n = 30$) would be potentially enlightening. Correlation of the survey with curriculum content and lecturer views would also be an interesting development.

Funding: This research received no external funding.

Conflicts of Interest: The author declares no conflict of interest.

Appendix A. Survey Questions and Themes

Appendix A.1. Normative Principles

Q1: In all areas of daily life, e.g., work, school, etc. principles of (gender) equality, justice and equal participation, e.g., equal opportunity, should be observed and legally binding.

Q4: Practical development issues, e.g., job creation, should take precedence over principles and practices, e.g., gender equality or affirmative action, especially for poor economies or sectors of society.

Q7: Patterns and levels of consumption between rich and poor sectors of society should be controlled, e.g., excessive manager salaries, higher income taxes, for more equitable outcomes in society, e.g., not only the rich have big houses, caviar and holiday.

Q8: Non-material aspects of development and well-being, e.g., health, social connection, happiness are more important than increasing income.

Q5: People's (basic) needs, e.g., water, shelter, not wants, e.g., new car, should guide global and national development policies and practices.

Q6: The biophysical limits of the environment, e.g., forest growth rates, fishing stock replenishment, coral reef temperature sensitivity, should dictate development and growth policy and practice.

Appendix A.2. Historical Responsibilities

Q2: Both rich and developing nations are responsible for protecting the environment and taking steps to reduce carbon emissions and promote renewable energies.

Q3: Highly developed nations, e.g., the United States, the United Kingdom, Australia, have greater (historical) responsibility for the current global imbalance of wealth than developing and poorer countries.

Appendix A.3. Nature's Value and Development

Q11: Nature and the environment, e.g., lakes, landscapes, humpback whales, has its own intrinsic value that should not be sacrificed to human needs or wants.

Q12: Maintaining biodiversity, e.g., a rich balanced spread of fauna and flora species, has to be central to development.

Q13: There is a critical natural capital, e.g., global forest cover, whale populations, ozone layer, that must be protected and cannot be replaced or substituted, e.g., sun hats and sun cream for missing ozone layer, more housing construction for less forest cover.

Q14: Nature's reserves, e.g., water stocks, fish stocks, carbon stocks, are a resource pool, i.e., ecosystem services, for human development and growth.

Q15: The conversion of the environment, e.g., land or forests converted to farming or housing, is an acceptable trade-off or substitution for development.

Appendix A.4. Local and Global Focus

Q16: Local and regional self-sufficiency and economic development in villages and towns, e.g., employment, jobs and business, should be preferred to global competitivity.

Q18: Local firms and economies should be globally competitive and driven by global market demands for goods and services.

Q19: Offshoring manufacturing or service workforces from rich to less developed countries, e.g., factory production, outsourcing, and globalizing production is acceptable for development needs.

Appendix A.5. Market and Industry Controls

Q17: Green and fair trade practices, e.g., fair trade coffee, clothing, should be a universal standard and norm for retail, production and consumption.

Q28: The relevant industry and firms, e.g., pharmaceutical companies, energy companies should be able to voluntarily manage and control their environmental obligations and pollution controls, e.g., water pollution.

Q29: Environmental policy and management measures for firms and industries should address the source of pollution, e.g., use of chemicals, not the final output, e.g., polluted rivers.

Q10: The key to sustainable development globally is market-led growth, e.g., supply meeting demand in a free market.

Appendix A.6. Policy and Legislation

Q22: National or state bodies (not just community, market tools, e.g., carbon taxes, or voluntary actions) should regulate environmental management and pollution controls and development policies, e.g., national laws and penalties.

Q23: Global measures for development and climate change agreements, e.g., Kyoto Protocols, Millennium Development goals, have been effective

Q32: There should be a wide range of policy tools, e.g., environment protection laws, building and construction laws, to enable sustainable development

Q31: Government should jointly coordinate different policy areas, e.g., urban planning, water supply management, employment, according to overarching sustainable development principles, e.g., small footprint, balance of local and state or national concerns.

Q30: Ecologically sensitive planning and design in towns and cities, e.g., green spaces, low-density housing, small footprint construction, should be the norm.

Appendix A.7. Government-Society Relations

Q20: Political, e.g., government, economic, e.g., banks, and other institutions, e.g., schools, should have significant decentralised autonomy for making legal, economic and social decisions for their communities.

Q21: National, state and district levels of governance need to have better coordinated and more balanced partnerships for decision making about development.

Q36: Bottom up local government and community structures and decisions provide the best guidance for national and state government regarding sustainable development.

Q37: Local and national government should ensure equitable participation for decision making about growth and development across gender, ethnicity, including through quotas e.g., female, ethnic quotas and policies.

Q38: Open dialogue with government through multiple channels, e.g., social media, forums, etc., about current and future growth and development is important for good civil society–state relations and outcomes.

Q39: Elected representatives can negotiate with representatives of economic and other interests, e.g., business leaders, without significant civic participation.

Appendix A.8. Technology and Rural Development

Q24: Farming and agriculture should return to more locally appropriate, labour-intensive forms of agriculture, e.g., planting and milking by hand, rather than just technically more efficient mechanisms, e.g., high yield seeds, tractors.

Q25: A balance of labour-intensive and technology-driven farming and agriculture, e.g., tractors, according to local conditions, e.g., employment rates, local economy needs, is the best global solution to development.

Q26: Another Green Revolution, e.g., significant increases in crop production, through technological innovation is needed to meet rising global food production needs.

Q27: Experiments with genetically enhanced and pest resistant plants should be encouraged to meet future food production needs.

References

Adams, William Mark. 2009. *Green Development: Environment and Sustainability in a Developing World*, 3rd ed. Abingdon: Routledge Taylor & Francis Group.

Amador, Filomena, Ana Paula Martinho, Paula Bacelar-Nicolau, Sandra Caeiro, and Carla Padrel Oliveira. 2015. Education for Sustainable Development in Higher Education: Evaluating Coherence between Theory and Praxis. *Assessment and Evaluation in Higher Education* 40: 867–82. [CrossRef]

Ashford, Nicholas A. 2004. Major Challenges to Engineering Education for Sustainable Development. *International Journal of Sustainability in Higher Education* 5: 239–50. [CrossRef]

Azapagic, Adisa, Slobodan Perdan, and David Shallcross. 2005. How Much Do Engineering Students Know about Sustainable Development? The Findings of an International Survey and Possible Implications for the Engineering Curriculum. *European Journal of Engineering Education* 30: 1–19. [CrossRef]

Baker, Susan. 2013. *Sustainable Development*. London: Routledge Taylor & Francis.

Barth, Matthias, and Jana Timm. 2011. Higher Education for Sustainable Development: Students' Perspectives on an Innovative Approach to Educational Change. *Journal of Social Sciences* 7: 13–23. [CrossRef]

Brody, Samuel D., and Hyung-Cheal Ryu. 2006. Measuring the Educational Impacts of a Graduate Course on Sustainable Development. *Environmental Education Research* 12: 179–99. [CrossRef]

Coffey, Brian, and Greg Marston. 2013. How Neoliberalism and Ecological Modernization Shaped Environmental Policy in Australia. *Journal of Environmental Policy and Planning* 15: 179–99. [CrossRef]

Corney, Graham. 2006. Education for Sustainable Development: An Empirical Study of the Tensions and Challenges Faced by Geography Student Teachers. *International Research in Geographical and Environmental Education* 15: 224–40. [CrossRef]

Drayson, Rachel, Elizabeth Bone, Jamie Agombar, and Simon Kemp. 2014. *Student Attitudes towards and Skills for Sustainable Development*. York: Higher Education Academy.

Eckersley, Robyn. 1993. Free Market Environmentalism: Friend or Foe? *Environmental Politics* 2: 1–19. [CrossRef]

Ekins, Paul, Sandrine Simon, Lisa Deutsch, Carl Folke, and Rudolf De Groot. 2003. A Framework for the Practical Application of the Concepts of Critical Natural Capital and Strong Sustainability. *Ecological Economics* 44: 165–85. [CrossRef]

Grierson, David, and Chris Hyland. 2011. Learning for Change: Cross-Disciplinary Postgraduate Programmes in Sustainability. *The International Journal of Environmental, Cultural, Economic and Social Sustainability* 7: 37–50. [CrossRef]

Kagawa, Fumiyo. 2007. Dissonance in Students' Perceptions of Sustainable Development and Sustainability: Implications for Curriculum Change. *International Journal of Sustainability in Higher Education* 8: 317–38. [CrossRef]

Kopnina, Helen. 2014. Revisiting Education for Sustainable Development (ESD): Examining Anthropocentric Bias through the Transition of Environmental Education to ESD. *Sustainable Development* 22: 73–83. [CrossRef]

Lele, Sarachchandra M. 1991. Sustainable Development: A Critical Review. *World Development* 19: 607–21. [CrossRef]

Mulder, Karel F. 2010. Don't Preach. Practice! Value Laden Statements in Academic Sustainability Education. *International Journal of Sustainability in Higher Education* 11: 74–85. [CrossRef]

Naeem, Malik A., and Neil W. Peach. 2011. Promotion of Sustainability in Postgraduate Education in the Asia Pacific Region. *International Journal of Sustainability in Higher Education* 12: 280–90. [CrossRef]

Nejati, Mostafa, and Mehran Nejati. 2013. Assessment of Sustainable University Factors from the Perspective of University Students. *Journal of Cleaner Production* 48: 101–7. [CrossRef]

Sipos, Yona, Bryce Battisti, and Kurt Grimm. 2008. Achieving Transformative Sustainability Learning: Engaging Head, Hands and Heart. *International Journal of Sustainability in Higher Education* 9: 68–86. [CrossRef]

Stubbs, Wendy, and Chris Cocklin. 2008. Teaching Sustainability to Business Students: Shifting Mindsets. *International Journal of Sustainability in Higher Education* 9: 206–21. [CrossRef]

Sylvestre, Paul, Rebecca McNeil, and Tarah Wright. 2013. From Talloires to Turin: A Critical Discourse Analysis of Declarations for Sustainability in Higher Education. *Sustainability* 5: 1356–71. [CrossRef]

Tuncer, Gaye. 2008. University Students' Perception on Sustainable Development: A Case Study from Turkey. *International Research in Geographical and Environmental Education* 17: 212–26. [CrossRef]

Wals, Arjen E. J. 2012. Shaping the Education of Tomorrow: 2012 Full-Length Report on the UN Decade of Education for Sustainable Development. Paris. Available online: http://www.desd.org/UNESCOreport.pdf (accessed on 23 February 2019).

Zeegers, Yvonne, and Ian Francis Clark. 2014. Students' Perceptions of Education for Sustainable Development. *International Journal of Sustainability in Higher Education* 15: 242–53. [CrossRef]