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Seeking learning outcomes appropriate for ‘education for sustainable development’ and for higher education

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This article shares and extends research-based developments at the University of Otago, New Zealand, that seek to explore how students’ worldviews change as they experience higher education with us. We emphasise that sustainability attributes may be described in terms of knowledge, skills and competencies but that these are underpinned by affective attributes such as values, attitudes and dispositions; so that ‘education for sustainable development’ is substantially a quest for affective change. We describe approaches to categorise affective outcomes and conclude that ‘education for sustainable development’ objectives comprise higher order affective outcomes (leading to behavioural change) that are challenging for higher education to address. Our own work emphasises the need for student anonymity as these higher order outcomes are assessed, evaluated, monitored, researched or otherwise measured using research instruments that focus on worldview. A longitudinal mixed-effects repeat-measures statistical model is described that enables higher education institutions to answer the question of whether or not ‘education for sustainable development’ objectives are being achieved. Discussion links affect to critical reasoning and addresses the possibility of documenting and assessing the development of lower and mid-order affective outcomes. We conclude that ‘education for sustainable development’ objectives need to be clearly articulated if higher education is to be able to assess, or evaluate, their achievement.

Keywords: learning outcomes; evaluation; affective domain; anonymity; Revised New Ecological Paradigm Scale

Introduction

This article makes and supports, in essence, three simple arguments. The first is that while sustainability attributes learned in our higher education institutions may be described in terms of knowledge, skills and competencies, these are underpinned by affective attributes such as values, attitudes and dispositions; so that ‘education for

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sustainable development' is substantially a quest for affective change. The learning outcomes that we aspire to are essentially affective in nature.

The second is not our own argument, but that established by the Carnegie Foundation for the Advancement of Teaching. It suggests that we cannot improve something that we cannot measure (Carnegie 2014); in the sense that we need to know that our improvements are working in the right direction and have the evidence to support this. Higher education practitioners might have diverse views on what measurement in this context means, but most who explore the field of enquiry that we describe as 'education for sustainable development' or 'education for sustainability' will no doubt agree that we are trying to improve something pertaining to higher education. If we are to take this task seriously, we really must have some yardstick by which to measure it and by which to monitor the extent to which we are succeeding.

The third argument is more complex but essentially suggests that it is possible to use research instruments to reach conclusions about learning in the affective domain. The instrument chosen does need to address the limitations imposed by the nature of affect; in particular, accepting the vital importance of maintaining the anonymity of learners within the evaluative, or measurement, process associated with affective learning. And no instrument is likely to be perfect in this challenging domain. Until a perfect research instrument arises, we would do well to use an imperfect instrument and in the process learn more about how research instruments in general can help us to answer our substantive questions.

Accordingly, this article describes research that makes extensive use of the Revised New Ecological Paradigm Scale (Dunlap 2008), but is not, in more than a technical sense, about the Revised New Ecological Paradigm Scale. Rather the article is about how the Revised New Ecological Paradigm Scale can help us to ask the right questions and how to develop educational processes that might help us answer them. The authors of this article do not use this opportunity to advise individual higher education academics or their institutions what they should or should not be teaching, assessing or evaluating, but we do suggest that these matters are fields of enquiry in their own right, about which individuals and their institutions might be interested.

'Education for sustainable development' is a quest for affective outcomes

On affect

Affect is an odd and difficult word. It occurs as a noun and as a verb; although with respect to sustainability, we are most interested in its noun form. The Oxford English Dictionary (<http://www.oxforddictionaries.com/definition/english/affect>) defines this form as restricted almost entirely to psychology and meaning '*emotion or desire, especially as influencing behaviour*'. Educators particularly come across the term 'affect' through the work of Bloom, Krathwohl and colleagues, as these educational researchers attempted to categorise learning in the 1950s and 1960s, so as to better understand what learning should mean to teachers (Bloom et al. 1956; Krathwohl, Bloom, and Masia 1964). These researchers identified the affective domain of learning to include values, attitudes and behaviours. Most university learning can be categorised as cognitive (to include in a hierarchy; knowledge, understanding, application, analysis, creation and evaluation) (Bloom et al. 1956), but much of that which cannot, and which substantially influences behaviour through emotion or desire, was categorised in the affective domain of learning (to include in a hierarchy; listening, responding, valuing, organising and characterising).

Collectively, we may choose to include these two domains of learning within the single statement ‘what students know, what skills they have to put this knowledge to use, and what they choose to do with the knowledge and skills at their disposal’.

Higher education is not obliged to interpret its ‘education for sustainable development’ learning aspirations as affect. Other terms may be used. Aristotle, for example, interpreted at least some affective development as the ‘intellectual virtue’ of phronesis (Hargreaves 2012). The discipline of psychology has developed the term ‘conation’ to address an individual’s motivation to take any particular action. But within the discipline of education, and within the construct of ‘education for sustainability’, the concept of affect should not be ignored.

On ‘education for sustainable development’ learning outcomes

‘Education for sustainable development’ appears to have adopted affect at a significant level (Shephard 2010; Buissink-Smith, Mann, and Shephard 2011). Agenda 21 includes aspirations to change people’s attitudes and dispositions, and to achieve values and attitudes, skills and behaviour consistent with sustainable development (United Nations Conference on the Environment and Development 1992). Those institutions that have signed the Talloires declaration promise to create an ‘*institutional culture of sustainability*’ and to ‘*educate for environmentally-responsible citizenship*’ (University Leaders for a Sustainable Future 1994). The European Commission suggests that higher education institutions are the ‘*focal points for shaping critical thinkers, problem solvers and doers*’ (2013).

Those who wrote these words clearly had the perspective that graduates who simply know about or who have the skills necessary to put this sustainability knowledge to use will not provide a sufficient ‘education for sustainable development’ outcome. For these people, presumably proponents of ‘education for sustainable development’, graduates need to have the values and attitudes, emotions or desire, necessary to influence their behaviour so that they become environmentally responsible ‘doers’ appropriate for the mission of ‘education for sustainable development’. These are not simply affective outcomes; they are higher order affective outcomes at the top of the affective hierarchy.

Even where ‘education for sustainable development’ outcomes are described as competencies, as they often are, their underlying affective nature is generally acknowledged. Key sustainability-related competencies, for example, those described by Barth et al. (2007), are ‘characterised as dispositions’ and ‘are reflected in successful actions’ (417). Fischer and Barth (2014) identify that ‘competencies deal with complex demands that necessitate the interplay of cognitive, emotional and motivational dispositions’ (194) and ‘each [key competency] consists of cognitive and non-cognitive dispositions’ (196) with respect to sustainable consumption. Although ‘education for sustainable development’ is clearly a quest for affective outcomes, as described by Shephard (2008), there can be nothing inherently wrong with addressing ‘education for sustainable development’ outcomes at a higher level by, for example, focusing on the competencies that result from the required affective baseline of values and attitudes in combination with a set of cognitive skills that enable particular behaviours to occur. But ignoring the affective baseline of these behaviours may be problematic as learning and teaching in the affective domain brings with it particular educational issues and challenges (Bloom, Hastings, and Madaus 1971).

On 'education for sustainable development' outcomes and learning and teaching in the affective domain

Bloom, Hastings, and Madaus (1971) examined learning outcomes in the cognitive and affective domain and identified: rationales for the development of affective learning outcomes; reasoned arguments for why the affective domain had been at that time marginalised in education; and why it was essential for educators to re-engage with the affective domain. These authors described how questionnaires can be developed to enable judgements to be made by teachers, evaluators or researchers, on how well students are learning throughout the affective hierarchy; all the way to 'characterise', including students' 'total philosophy or worldview' (229). They also emphasised how affective outcomes are best evaluated in group settings with anonymous students. As described by Bloom, Hastings, and Madaus (1971, 235), 'if a student feels his affective behaviour is subject to either criticism or grading, there is a possibility that he will "fake" the desired behaviour'.

Bloom, Hastings, and Madaus (1971), in addressing the applicability of an evaluation questionnaire, emphasised that one criterion for item selection in the questionnaire, 'was that the behaviour or situation described deal only with things which the student might be expected to report honestly' (231). Ignoring the affective nature of the baseline values and attitudes necessary for sustainability-related behaviour may create problems for university teachers interested in the consequences of their teaching on the subsequent behaviour of their students, particularly as anticipated by measured competencies.

We cannot improve something that we cannot measure

If the mission of 'education for sustainable development' is to make progress in higher education; if the important educational outcomes are affective in nature; if these outcomes are best addressed in group settings with anonymous students, then we shall need to develop or make use of an instrument or process that allows us to measure the extent to which groups of anonymous students achieve the outcomes in question. But the concept of measurement does not necessarily come easily to educators. A range of terms, including assessment and evaluation, are widely but diversely used to describe the process used to determine the extent to which students achieve intended learning objectives or outcomes.

At the University of Otago, New Zealand, we use the term assessment to suggest the means whereby grades are applied to the assignments or examinations of individual, identifiable students. We use the term evaluation to suggest the means whereby judgements are made about the quality of the educational provision in our institution. Feedback from students is an important contribution to this form of evaluation and is always anonymous. The terms assessment and evaluation are used in different ways in other places. For our present purposes, in particular to explore how 'education for sustainable development' learning outcomes are developed in higher education, we may usefully incorporate these nuances of measurement, assessment and evaluation within the single term 'research'. Researchers are generally comfortable with the anonymity of their research subjects. Those interested in the generic processes of how higher education may engage with the intended outcomes from 'education for sustainable development' will not be particularly interested in what

individual students achieve; rather they will be interested in what their institution, and their own teaching, achieves. Anonymity is a key feature of everything that follows in this article.

Using the Revised New Ecological Paradigm Scale to ask questions about ‘education for sustainable development’ outcomes

The New Environmental Paradigm scale was initially developed in 1978 (Dunlap and Van Liere 1978) to explore the distribution of an alternative to what was seen then as the dominant social paradigm of anthropocentrism. The scale was modified in 2000 as the Revised New Ecological Paradigm Scale (Dunlap et al. 2000). The Revised New Ecological Paradigm Scale has been used extensively for researching the views that people have about the natural environment (styled as ‘ecological worldview’ by Dunlap et al. 2000), and for monitoring how these change (Teisl et al. 2011; Harraway et al. 2012; Jowett et al. 2014; Shephard et al. forthcoming).

The Revised New Ecological Paradigm Scale comprises 15 statements that relate to limits to growth, the position of humans in the environment, the fragility of nature and the imminence of eco-crisis (including, as examples: ‘we are approaching the limit of the number of people the earth can support’; ‘plants and animals have as much right as humans to exist’; and ‘humans will eventually learn enough about how nature works to be able to control it’). Respondents are asked to record their agreement with these items on five-point Likert-like scales. The validity of the construction of the Revised New Ecological Paradigm Scale and its ability to accurately represent environmental attitudes, concern or worldview has been repeatedly tested (Dunlap 2008; Hawcroft and Milfont 2010). Its ability to predict pro-environmental behaviour is less certain, at least in part because of the difficulties involved in accurately monitoring behaviour (rather than self-reported behaviour). Dunlap (2008) recommends that the Revised New Ecological Paradigm Scale be used alongside other variables to predict environmental behaviours.

Exploring the use of the Revised New Ecological Paradigm Scale

Our own research using the Revised New Ecological Paradigm Scale was initiated in approximately 2009 with the primary aim of exploring how our university students’ ecological worldviews could be described and monitored within constraints common to higher education. The processes we had in mind needed to be scalable to an institutional level and be not dependent on the enthusiasm of a few students who might be particularly interested in our research into sustainability education. Our research was built on early research with polytechnic students (Shephard et al. 2009). With the participation of several highly motivated university teaching colleagues in several academic departments, we discovered that the Revised New Ecological Paradigm Scale could be delivered to all students who attend a lecture, that nearly all of those students invited to complete the Revised New Ecological Paradigm Scale in these circumstances chose to do so, that the process took as little as 10 min and that university teachers were often able to integrate this process into broadly based discussions relating to most subject areas discussed at universities. Within statistics, for example, the Revised New Ecological Paradigm Scale could be introduced as an example of a particular form of survey instrument. Within zoology, it supported conversations about animal and plant conservation. Within human

nutrition, it was used in discussions about food sources and distribution and food ethics. Our challenge for institutionalisation, therefore, became one of attracting university teachers to the project, rather than their students (Harraway et al. 2012).

Factors and tendencies

Although several presumed aspects or facets of environmental or ecological worldview were incorporated into the original new environmental paradigm scale and the newer Revised New Ecological Paradigm Scale, factor analysis of data from many different uses of these instruments has produced variable indications of the number of statistical factors which the Revised New Ecological Paradigm Scale describes (Dunlap 2008). Some studies identify a single factor, while in our research, we generally found four factors. Our exploratory factor analysis and subsequent confirmatory factor analysis are described in detail by Harraway et al. (2012). Accordingly, the results of a Revised New Ecological Paradigm Scale survey may be described as an overall ecological worldview, or as descriptions of each contributory factor. The four factors that our research generally yielded were described as tendencies, referencing particular combinations of items that collectively imply behavioural intentions (Fishbein (1980) emphasised that people do not generally need to make decisions about ‘things’; but tend to consider how they will behave in relation to these things). The four tendencies that we described were related to recycling, to conservation, to supporting animal and plant rights and to being cautious about the future (Shephard et al. 2009; Harraway et al. 2012). We have continued to discuss our results in relation to a single scale factor and to these four tendencies.

Our detailed analysis of data also explored the nature of factor loadings of each scale item within the factor analyses. In our research, and, indeed, in that of others, (see, for example, Lopez and Cuervo-Arango 2008), Item 6 (The Earth has plenty of natural resources if we just learn how to develop them) tends to have much lower factor loadings than other items, bringing some doubt about the overall structure of the scale. We used multidimensional scaling to identify that Item 6 is an outlier, but not sufficiently so in a statistical sense to doubt the overall coherence of responses contributing to the scale (Harraway et al. 2012).

On qualitative and quantitative ‘measurement’

This research was built upon early work that compared students’ responses to the Revised New Ecological Paradigm Scale with their responses to a range of qualitative instruments (Shephard et al. 2011). Intuitively, we might suspect that measuring the sustainability attributes of our students would be best achieved by monitoring their actual and individual behaviour towards sustainability. More pragmatically, we might be forced to abandon this measure and rely more substantially on self-reported behaviour, perhaps by interviewing each and every student. Researchers in several disciplines focus on developing a more complete understanding of the relationship between knowledge about sustainability and behaviour towards sustainability. Psychologists, for example, emphasise behavioural intentions (Bamberg and Möser 2007) or personal responsibility (Kaiser and Shimoda 1999) to enable researchers to address constructs other than actual behaviour, and use research approaches that involve both qualitative and quantitative research instruments.

Shephard et al. (2011) compared students' responses to the Revised New Ecological Paradigm Scale with their responses to two other instruments (one encouraging reflective and personal appraisal in an open-ended written response to a partially develop scenario; another involving personal meaning mapping (Storksdieck, Ellenbogen, and Heimlich 2005) where respondents record words, phrases or images that come to mind when prompted by trigger word or phrases). This research suggested that the diversity of research instruments used probably measure essentially the same individual characteristics, or that those different characteristics co-locate within the student population. In particular, the research offered substantial support for the continued use of the Revised New Ecological Paradigm Scale in student populations.

The Revised New Ecological Paradigm Scale does differentiate between groups of students

Early research with polytechnic students demonstrated that different groups of students tended to respond to Revised New Ecological Paradigm Scale statements in different ways (Shephard et al. 2009). This finding was re-emphasised in our early research with university students. Students who complete the scale within the first semester of their higher education experience have mean scores predicted to some degree by their chosen discipline. Year after year, newly arrived zoology students have higher (more pro-environmental) scores than do our surveying and human nutrition students (Harraway et al. 2012; Shephard et al. 2012). As these findings relate to students with limited higher education experience, it is likely that this differentiation is determined by experiences prior to coming to university, and perhaps even the same experiences that caused the students to make particular career choices.

There are some potential practical applications of this finding. From an educational perspective, different sustainability attributes possessed by different groups of students may alternatively be interpreted as differing educational needs possessed by different groups of students (Shephard et al. 2009). Mann et al. (2013) used statistical cluster analysis to demonstrate that individuals within cohorts of students could reasonably be clustered into subgroups with identified sustainability attributes that could be relevant to the design of learner support programmes.

On change

Institutions that claim to educate for sustainability or for sustainable development will be interested in whether or not their students change as they experience education at the institution. Once some baseline sustainability or sustainable development self-reported attributes have been recorded by individual students, it is to the institution's advantage to be able to return to the same students, say a year later, to discover how they have changed, but at the same time, maintaining the anonymity of these same students.

In our research, we have developed a process for tracking students without identifying them, by the use of a code. The process was described in full by Harraway et al. (2012) and Shephard et al. (2014). Students calculate a code based on numbers (added in a particular way from their date of birth) and letters (drawn from their first and last names). These codes can be recalculated by the same student using the same

formula on subsequent occasions, but it would be difficult for an institution to do so without laborious calculation or the generation of a computer programme. In our institution, generally, university teachers who grade examinations and assignments do not have access to date-of-birth data, although departmental administrators do. There is every reason to anticipate that students regard this code system as an effective way to protect their anonymity, but nevertheless, we regard it as an ongoing challenge to develop better processes to protect our student's anonymity. There have been some occasions when it has not been possible to match codes, either because the student has miscalculated or because the student has deliberately generated an incorrect code. If the latter, this provides a safeguard for the research to ensure that only those students who are comfortable with their anonymity are incorporated within the change models.

Statistical models of change

Institutions that wish to explore how their particular students change as they experience higher education do need to address the detail of their approach. In most circumstances, they will be dealing with voluntary, self-selecting research subjects, representing incomplete, non-representative cohorts. If change is measured using repeat-measures processes, the analysis will have to cope with non-independent samples (as the same students will be represented at different times), missing values (as students do not always come to their lectures to be surveyed, and students fail or move to different courses) and uneven time intervals (as delivering a survey like the Revised New Ecological Paradigm Scale often needs to be done to fit in with variable lecture programmes). In addition, in our experience, new students arrive within a cohort and can be matched in later years, but not to earlier years. Naturally, institutions would not relate the changes that might occur to a cause and effect relationship between their education and the students' development, as higher education experiences are much more than formal educational experiences. Nevertheless, institutions that do educate for sustainability are, at least, hoping for change.

Two substantially different approaches have arisen to address these needs:

- Teisl et al. (2011) and Jowett et al. (2014) have developed logistic and multinomial regression models, respectively, where essentially at any given time, students in one cohort can be compared with students in another cohort. If the only substantive difference between the cohorts is that one has spent longer studying within the institution than the other, then differences (say in Revised New Ecological Paradigm Scale scores) that exist between them may be related to the students' experiences in this time. Of course, many other differences generally do exist, perhaps in particular because the students who fail to move between cohorts are not necessarily representative of those that do move, academically or otherwise. This process allows institutions, departments and individual university teachers to address change, for example, using the Revised New Ecological Paradigm Scale with first-year and second-year students at the same time.
- A more sophisticated approach, from a statistical perspective, is to use repeat-measures longitudinal statistical models to follow individual, but anonymous, students through their academic programmes. Shephard et al. (forthcoming) developed a range of a linear mixed-effects statistical model to compare their

efficacy, and used the resulting best-fitting statistical model to explore how the ecological worldview of two cohorts of students in three academic programmes (zoology, human nutrition and surveying) changed during four consecutive years, with multiple survey inputs by each student. They implemented the longitudinal analysis using a linear mixed-effects model. These authors comprehensively address alternative possible interpretations of this data, but conclude that if institutions wish to explore how the sustainability attributes of their students change as they experience higher education, this approach (addressing students' affective characteristics and emphasising their anonymity) and using the Revised New Ecological Paradigm Scale (or other instruments that develop numerical summary data) is worthwhile. The authors invited researchers from around the world to join them in further developing the approach, the statistical model and the research instrument.

Discussion

It appears that higher education institutions who wish to do so can monitor the sustainability characteristics of their students at the level of ecological worldview. The Revised New Ecological Paradigm Scale may provide a suitable instrument for this but it may also be that better instruments will be developed in the future. The monitoring process can take a snapshot of students' perspectives or address change in these over an extended time period. There will be doubts about: the validity of Revised New Ecological Paradigm Scale in these circumstances; links between worldview and sustainable behaviour; the nature of affect and its role within sustainability education and assessment; the value of anonymity in these processes; the role of higher education in particular as applied to students whose principal discipline is something other than sustainability; links between the experiences of students within the institution and their experiences outside the institution; the complexity of statistical enquiry involved; the additional workload that will accrue to universities who choose to explore student learning in this way; and likely about many other facets of this complex field of enquiry. But, notwithstanding these doubts, the enterprise of monitoring students' ecological worldview does seem to be plausible, and may indeed prove to be worthwhile for those institutions willing to attempt it.

Three important educational questions arise from this analysis. The first relates to the necessity for the educational objectives of 'education for sustainable development' to be clearly stated and in a form that lends itself to measurement. What should 'education for sustainable development' attempt to teach? Intended outcomes that may sound reasonable to those not responsible for higher education may prove to be ill-conceived as outcomes for measurement by higher education teachers and educational researchers. The Talloires declaration to 'educate for environmentally-responsible citizenship' is an example of an educational objective that sounds eminently reasonable to a non-education specialist, but remarkably challenging as an educational outcome to be taught and assessed or researched as such.

We cannot teach students to be environmentally responsible without addressing their affective nature (Kratwohl, Bloom, and Masia 1964). Teaching in the affective domain is possible but challenging. Setting standards of responsibility against which our teaching can be measured is particularly so. If, as seems likely, environmentally responsible citizens also have pro-ecological worldviews, it is tempting to establish an educational normative standard that relates to some particular level of ecological

worldview. But how high a Revised New Ecological Paradigm Scale score should educators aim for? Perhaps only those institutions that agree to ‘educate for environmentally responsible citizenship’, or their leaders, can fully appreciate the complexity that is involved in this educational process. Fundamental to this question is the extent to which these institutions actually embrace normalising doctrines. Is it possible that they interpret aspirational objectives such as ‘environmentally-responsible citizenship’ in terms of critical engagement rather than identity?

The second question relates to *how* this educational process could be undertaken. Shephard (2008) has suggested that Krathwohl, Bloom and Masia’s affective hierarchy provides a framework within which educators can address their affective aspirations for their students. Some educators express concerns about teaching and seeking higher order affective outcomes such as ‘characterise’ as indicated by behaviours and behavioural indicators such as ‘worldview’ (Bloom, Hastings, and Madaus 1971; Shephard and Furnari 2013). But these same teachers may be comfortable encouraging their students to listen, to respond and to develop their own value systems (Shephard 2008; Shephard et al. *forthcoming*). Shephard argues that the affective and cognitive domains intersect at the level of values exploration; building substantially on the work of Scriven (1966) in identifying that affective attributes underpin the development of cognitive outcomes. For example, Facione (1990) suggests that being open-minded, fair-minded, honest and willing to reconsider are necessary for critical thinking. These are all affective characteristics that appear to intersect with and underpin the development of critical reasoning skills. With respect to the question of how to teach, this analysis emphasises our need to help our students to explore their value judgements, perhaps by teaching and documenting critical reasoning skills (Ash and Clayton 2009).

The third question simply emphasises our need to understand the extent to which our students are developing during our educational programmes. Educationally, we should feel the need to know whether our educational processes are indeed having the desired effect. Whether we call this assessment, evaluation, monitoring, research or measurement seems less important than doing something that will tell us if our education is on the right track.

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