

Sustainability in Higher Education: Psychological Research for Effective Pedagogy

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ABSTRACT

Psychological theory and research can make key contributions to sustainability scholarship and practice, as is demonstrated here in the field of higher education pedagogy. College students undergo profound changes in epistemological assumptions and in identity during their undergraduate years. Data on the Measure of Intellectual Development for students participating in learner-centred pedagogies at Western Washington University in Bellingham, Washington, showed a trend toward more complex thinking by these students (N=153). Qualitative data on student identity development associated with transdisciplinary, project-based campus sustainability courses were collected at Canada's University of Prince Edward Island and at Western Washington University in Bellingham. Findings revealed the identity of "learner" blending with that of "change agent"; a greater sense of identity in relation to the campus community and the different perspectives of its stakeholders, the sustainability movement; and a sense of empowerment backed up by practical skills. Sustainability poses new challenges for intellectual-moral development and identity development. Psychological theory gives insights into how pedagogies should be designed to challenge students just beyond their level of intellectual, moral, and identity development, in order to expose them to intellectual-moral growth and identity alternatives conducive to the complexities of sustainability advocacy and practice.

RÉSUMÉ

Les théories psychologiques ainsi que la recherche peuvent apporter d'importantes contributions clés à la recherche et à la pratique de la durabilité, comme cette étude le démontre dans le domaine de la pédagogie dans l'éducation supérieure. Les étudiants collégiaux subissent de profonds changements en terme de réflexion épistémologique et d'identité lors de leurs années d'études au premier cycle. Nous présentons d'abord des données se rapportant à la Mesure du Développement Intellectuel (Measure of Intellectual Development) pour des étudiants de Western Washington University à Bellingham dans l'état de Washington aux Etats-Unis qui ont participé à des pédagogies centrées sur l'apprenant ; les résultats démontrent une tendance à une pensée plus complexe chez ces étudiants (N=154). Ensuite, nous analysons des données qualitatives sur le développement de l'identité des étudiants de l'Université de l'Île-du-Prince-Édouard au Canada et des étudiants de Western Washington University aux États-Unis qui ont assisté à des cours sur la durabilité sous forme de projets transdisciplinaires appliqués au campus universitaire ; les résultats révèlent la superposition de l'identité de « l'apprenant » et de celle d' « agent de changement », mais aussi un sentiment identitaire plus fort envers la vie de campus et les différentes perspectives de ses partenaires, le mouvement de la durabilité, et enfin un sentiment de confiance consolidé par un savoir-faire pratique. Les théories psychologiques éclairent la manière dont les nouvelles pédagogies devraient être conçues afin de stimuler les étudiants juste au-delà de leur niveau de développement intellectuel, moral et identitaire, pour les exposer à des alternatives identitaires, et soutenir leur engagement envers des identités d'un genre nouveau en matière de durabilité.

INTRODUCTION

The theory and practice of sustainability education at the post-secondary level has increased greatly in the last few years (see, e.g., Adomssent, Godemann, & Michelsen, 2008). Curricular theories and pedagogical innovations in particular have flourished (Beringer, 2007; Beringer, Adomssent, & Scott, 2008). In many cases, however, the scholarly literature analyzes such conceptions without reference to well-established understandings of students' college-age development. This article adds needed psychological and empirical dimensions to this discussion by introducing theories of intellectual-ethical and identity development in the college years, and by illustrating these with findings from curricular and campus greening projects. The theories and findings presented in this article demonstrate the potential of conservation psychology – psychological findings applied to sustainability and conservation efforts (Clayton & Myers, 2009; Saunders, 2003) – for sustainability in higher education (Beringer, 2006a). Theory and practice are reciprocally reinforcing here: knowledge of student development can and should inform higher education for sustainability. Thus informed, innovative sustainability pedagogies can and should help blaze new developmental pathways for college students, and inform theory thereof.

To illustrate the power of including developmental psychology in pedagogical conceptions for post-secondary sustainability education, this article weaves together

three strands of inquiry: (1) the nature of sustainability challenges and their implications for education; (2) college-age psychological development, emphasizing how students change in their thinking about knowledge and value claims and about their own identities; and (3) pedagogies that build on these psychological parameters for the goals of sustainability education and thereby for students' development. Sustainability challenges call for development in competencies and identity that typically occur in college, and higher education can build on these personal transformations to devise effective and efficient pedagogical interventions. A person needs intellectual, motivational, volitive, affective, social, and practical-technical competencies, integrated via an identity as a sustainability change agent in a societal context of uncertainty and divergent social perspectives in order to contribute effectively to the societal transformations needed to create sustainable futures (see also Barth, Godemann, Rieckmann, & Stoltenberg, 2007; De Haan, 2006). In this article, we focus on theories of cognitive and valuational development and psycho-social identity that are useful in conceptualizing these needs, and we suggest the implications for pedagogy through illustrative quantitative and qualitative data on the effects of two types of innovative instructional approaches. More research like this is needed, and we make no claim to comprehensiveness; rather, our intent is to draw the attention of the sustainability-in-higher-education community to the important "below the surface" psychology of college-age growth.

SUSTAINABILITY CHALLENGES AND EDUCATION FOR SUSTAINABILITY

The divergent and contested nature of "sustainability" (see also Kemp & Martens, 2007), and education for it, require some clarification to understand the importance of psychological variables in college development. Sustainability challenges – such as global climate change, biodiversity loss, poverty, and patterned social inequalities, to name just a few – are real-life problems with fuzzy boundaries, complexly interconnected components, unspecified parameters, missing information, conflicting societal values, and no single solution. In other words, they are what have been called ill-structured problems (Bardwell, Monroe, & Tudor, 1994; Simon, 1973). Grappling with such problems calls for multidimensional competencies which education can play an indispensable role in fostering. More adequate cognitive problem-construction skills are those that do not ignore diverse and conflicting claims about values, facts, and the bases of knowledge but nonetheless recognize and contest unreasonable claims. The scale of sustainability challenges poses substantial pitfalls; individuals need motivational competence to feel it is worth persevering. Socially, sustainability entails disequilibrium because "underlying the shallow consensus that appears to be triggered by the introduction of sustainability, there are still norms, values and interests that are in conflict" (Wals & Jickling, 2002, p. 224) and that are embodied in institutions that influence most individuals' lives, beliefs, commitments, and identities. A core aim of education is to give students experience and guidance in multi-perspective social settings. Cognitive, motivational, and social competencies are practical – sustainability work is largely mental, emotional, social, and institutional. Finally, students must be able to deploy practical-technical skills in context to be competent to act.

Sustainability and education for it also call for identities congruent with the social context implied. The challenge is not one of simply inculcating a different, proper set

of ecologically-informed values. Instead, identity must be self-determining and provide internal motivation, while also conveying the social maturity to act collaboratively with others who have different value systems and constructions of reality. Contrasting “utilitarian” with “emancipatory” visions of education for sustainability, Wals and Jickling (2002) suggested that the latter imagines “a very transparent society, with action competent citizens, who actively and critically participate in problem-solving and decision making, and value and respect alternative ways of thinking, valuing and doing” (p. 225). Apropos the ambiguous, contested concept of “sustainability” itself, higher education should be preparing students for a future they will struggle to define.

LEARNER-CENTRED APPROACHES

This poses a tall order for higher education, but one that is not inconsistent with traditional values of the university. There is evidence that college attendance generally has a modest but positive net effect on social conscience and humanitarian values (Pascarella & Terenzini, 1991). If education for sustainability is to accomplish more, it must adopt new strategies. In recent decades, “learner-centred” pedagogy has proliferated in North American higher education reform. This is in keeping with the stress that Wals and Jickling (2002) have placed on student autonomy, critical thinking, and action. Indeed, it has been adopted by many faculty in Canada and the United States (e.g., Beringer, 2007; Michelsen, Adomssent, & Godemann, 2008) and by U.S. higher education accrediting agencies.

Frye (2003) contrasted learner-centred approaches with the older teacher-centred approach. Learner-centred approaches see knowledge as constructed by students in a collaborative and supportive academic culture that provides frequent feedback. Further, this approach calls for multidimensional student performances and deeper understanding. According to Frye, a learner-centred instructor also

- engages students in active-learning experiences
- sets high, meaningful expectations
- helps students become aware of values, beliefs, and preconceptions – and to unlearn them if necessary
- recognizes and stretches student styles and developmental levels
- seeks and presents real-world applications
- understands and values criteria and methods for student assessment
- creates opportunities for student-faculty and student-student interactions.

Discussions of education for sustainability feature various conceptions of the learner-centred approach. Most depart from the notion of academic disciplines or subjects, confines around knowledge that are in fact historically recent and somewhat arbitrary or fluid but defined by subject matters and epistemic traditions. Among the alternative conceptions, Godemann (2008) highlights inter and transdisciplinary models, contrasting them on four themes: (1) integration-oriented co-operation and boundary-crossing; (2) real-life problem orientation; (3) reorganization of knowledge generation/academic structure; and (4) universal vantage point over and above all disciplines. On each theme, interdisciplinary work generally maintains the structure of the academy but seeks to find integration and reduce specialization, whereas transdisciplinary work breaches the divide between academy and society in problem definition, validation of perspectives, knowledge generation, and pursuit of value rationality

(see also Polk & Knutsson, 2008). “Greening the campus” research and practice becomes transdisciplinary sustainability in higher education research and practice when it bridges the subcultural divide between the academic and administrative/operational facets of the university to include non-academic as well as off-campus stakeholders and their knowledges in sustainable-development transformations (Polk & Knutsson, 2008; Stauffacher, Walter, Lang, Wiek, & Scholtz, 2006).

These conceptions are invigorating. Discussion of sustainability pedagogy, however, seldom engages theories of psychological development in the college years.¹ Also rare in the literature are empirical data that show the presence or absence of developmental trends implied by sustainability education models. Knowledge of such psychological theories and data would increase the effectiveness of sustainability education by aligning pedagogical interventions with learners’ developmental capacities and needs. Reciprocally, investigating the development of inter and transdisciplinary contexts could inform psychological theory. The purpose of the next section of this article is to introduce the psychological literature that addresses college students’ intellectual-ethical development and emerging identities, and to relate these to sustainability education. Following that, two kinds of pedagogical innovations are described and data showing their relationship to intellectual-ethical and identity development are presented.

COLLEGE-AGE PSYCHOLOGICAL DEVELOPMENT

The college years are a time of often remarkable and multifaceted psychological change (Chickering & Reisser, 1993; Evans, Forney, & Guido-DiBrito, 1998). The literature provides rich and well-documented descriptions and theories, including intellectual and socio-moral development and psycho-social identity development, both with relevance to sustainability education. The studies relied on here, which have documented students’ psychological changes during the college years, have examined U.S. undergraduate students’ development, that is, young people generally between 17 and 21 years of age. We acknowledge the cultural context as well as the age bracket of these empirical data and associated theories, recognizing that so-called mature-age students (usually thought of as 25 years and older) increasingly enter or return to university studies. These individuals may be at a very different phase of psychological development and maturity due to impacts from their personal and/or professional lives. We are also aware of gender differences in college-age psychological development (Belenky, Clinchy, Goldberger, & Tarule, 1986).

Intellectual and Moral Reasoning

College students experience marked intellectual growth. One particularly influential and durable school of thought was started by William Perry (1970/1998, 1981). He interviewed American undergraduates and found a longitudinal trend across the four years of college in their dealing with issues of intellectual and moral relativism. The stages he described have been found to characterize college development generally. They are relevant to sustainability education because they trace how students become able to think coherently about differing perspectives and claims to knowledge and values, and how they ultimately affirm their own authorship of beliefs within a relativistic

context. A similar portrait emerges from parallel research traditions, such as that on “reflective judgment” by King and Kitchener (1994).

Perry (1970/1998, 1981; see also Belenky et al., 1986) characterized nine psychological “positions,” with developmental steps happening between them. Perry found that many students enter college in the stage he called “dualism/received knowledge” (which he numbered position 2; position 1 is a pure hypothetical form of absolutism). As in all the Perry positions, a particular form of thinking characterizes these students in terms of their stance on both epistemological and value matters (Table 1). “Dualism/received knowledge” is characterized by a belief in “right/wrong” answers that are known to authorities and experts. These students see their task as learning the “right” solutions to questions and problems. As their college encounter with diverse authorities and perspectives continues, students’ thinking is later characterized by “multiplicity/subjective knowledge” (position 3). Students no longer see the world of truth and values in such black-or-white terms. They now realize there are conflicting answers, so trusting one’s inner truth and not relying on external authority becomes legitimate. In “relativism/procedural knowledge” (position 4), students evaluate how authorities define their areas of subject matter, generate questions, and justify their assertions. Further intellectual-ethical development lies in the direction of “contextual relativism” (position 5), while later positions (6 to 9), including “commitment in relativism/constructed knowledge,” have a more ethical flavour.

Perry’s work has been operationalized in the Measure of Intellectual Development (MID), an essay task that is scored for the “positions” and has been applied to a wide range of higher-education settings (e.g., Moore, 1988, 1989, 2002). (Results using this scale are presented later.) An essay prompt asks students to reflect on their own learning or on a complex problem. Scoring of essays requires a high level of training, using an exhaustive technical manual that enables students’ statements to be rigorously assigned to Perry positions (Knefelkamp, Fitch, Taylor, & Moore, 1982). The MID has stood up well to tests of validity and reliability (Evans et al., 1998; Moore, 1989). An equivalent version of the prompt is used post-test to reduce testing threats to internal validity.

General findings using the MID include that few students progress through all the Perry positions. A “time out” at any level allows for exploratory lateral growth, that is, a strengthening and further examination of the existing position. Also, some students may “escape,” becoming detached and alienated, or even retreat toward dualism (Evans et al., 1998). The average U.S. student enters college (i.e., the four undergraduate years) in the midst of transitioning from position 2 to 3, makes a slight but statistically significant gain in the first year of college, levels off, and makes another jump in the last year or so of college. Fourth-year graduating students score at around position 4 or slightly below. Education is a much stronger factor than age in these developmental gains (Moore, 1994).

In general, a body of different approaches affirms the typical trends detected by Perry, despite his limited population. Nonetheless, it should be noted that almost all studies focus on students attending liberal arts education institutions, and, as suggested by Hofer and Pintrich (1997), the patterns of critical and committed reasoning that develop could be viewed as socialization to the particular cognitive style of such institutions. Schommer’s (1990, 1993) work suggested more independence and less structural unity or stages in the components of epistemological beliefs.²

Table 1
Perry Scheme of Positions in College-Age Intellectual Development

Position	Knowledge	Authorities & Learning	Alternate perspectives	Criteria of knowledge	Values & Commitments
2 Dualism	<ul style="list-style-type: none"> Exists absolutely Right or wrong 	<ul style="list-style-type: none"> Know right answers Knowledge transfer 	<ul style="list-style-type: none"> Confusing to think about Not legitimate 	<ul style="list-style-type: none"> Self-evidence 	<ul style="list-style-type: none"> Unconsidered commitment to simple belief in certainty
3 Multiplicity	<ul style="list-style-type: none"> Questions legitimately have multiple answers 	<ul style="list-style-type: none"> Know right answers within expertise Begin to think more independently 	<ul style="list-style-type: none"> All opinions equally valid; grading is on "good expression" 	<ul style="list-style-type: none"> Unable to adequately evaluate points of view, not sure it is legitimate to do so Underlying standards are puzzling 	
4 Relativism	<ul style="list-style-type: none"> Relative to context Right/wrong only in certain contexts 	<ul style="list-style-type: none"> Their judgments can be evaluated Valued for their feedback and critique 	<ul style="list-style-type: none"> Differing perspectives seen as pieces of a larger whole 	<ul style="list-style-type: none"> Differentiate between unconsidered belief and judgment based on evidence and reasoning 	<ul style="list-style-type: none"> Seen as ways to orient oneself in a relativistic world
5 Contextual relativism	<ul style="list-style-type: none"> Contextual & contingent 	<ul style="list-style-type: none"> Resources and advanced inquirers 	<ul style="list-style-type: none"> Multiple truths & values acknowledged 	<ul style="list-style-type: none"> Disciplinary and epistemological assumptions 	<ul style="list-style-type: none"> Begin to move "off the fence" and align choices with personal themes
6 to 9 Commitment in relativism	<ul style="list-style-type: none"> Same as position 5 	<ul style="list-style-type: none"> Same as position 5 	<ul style="list-style-type: none"> Active affirmation of self and responsibilities in a pluralistic world clarifies identity 	<ul style="list-style-type: none"> As in position 5, contingent on basic assumptions & methods 	<ul style="list-style-type: none"> Commitments in marriage, career, religion, etc. made in relativistic frame of reference

Adults' thinking beyond the college years has been found to show less formal reasoning. Some studies have suggested content becomes more important in adults' thinking, which may reflect the "situated" contexts and practicalities of everyday life (Rogoff & Lave, 1984). With respect to process, thinking becomes more complex as well. Some have conceptualized it as "dialectical thinking", focused on processes of change and the dynamic relationships through which this occurs, leading to greater comfort with paradox and uncertainty (Benack & Basseches, 1989; Commons & Stevens-Long, 1991; Riegel, 1979).

"Post-formal thinking," investigated by Labouvie-Vief (e.g., in Labouvie-Vief & Diehl, 2000) and others, emphasizes adults' ability to progressively integrate dualities, particularly reason and emotion. Some adults are experts in a domain of knowledge or practice. In contrast to novices, experts' extensive content knowledge allows them to formulate problems efficiently and to employ special strategies for particular categories of problems (Larkin, McDermott, Simon, & Simon, 1980; see also Hansmann, Meig, Crott, & Scholz, 2003, and Tudor, 1989, for applications of the novice-expert shift to environmental problems). With respect to sustainability challenges, one overall lesson that can be gleaned here is that adult sustainability professionals/experts think differently and more complexly than college students. However, these more mature forms presuppose the path out of dualism, multiplicity, and relativism that for many young adults occurs during college.

Pedagogies at the "learner-centred" end of the pedagogical spectrum have been found to be more efficacious in supporting student developmental gains than traditional techniques because they can challenge multiple learners just beyond their current developmental levels (e.g., Swick, Simpson, & Van Susteren, 1991). Particularly powerful are a strong "learning community," a multidisciplinary instructor team that coaches students to coordinate the aspects of a complex problem, and connections to students' experiences outside formal education (e.g., Thompson, 1990). Such courses, even if only 10 weeks in duration, help 50% to 70% of the students make at least a one-third Perry position advance – roughly twice the percentage of students showing gains from more traditional courses (Moore, 2002).

Psycho-Social Identity Development

As the understanding that a simple answer may have complex implications develops during the college years, students' awareness of their identities in social context changes. Here we turn to another vast area of scholarship, that on identity. As with studies on intellectual and ethical development, sustainability researchers and educators can draw on this area of scholarship to align their educational interventions to students' identity development. Identity pertains to our beliefs or self-concepts about who we are. The notion of identity has been conceptualized and used in many ways in psychology and other social sciences. Two central aspects, however, are a sense of inner sameness and an understanding of identity in relation to social context. As something experienced as stable, identity is both a product and a force: a set of beliefs and a motivator for a way of acting in the world (Rosenberg, 1979). In relation to context, identity results from "reflected appraisal": the evaluations of others inform us about who we are (Cooley, 1902; Mead, 1934/1962). As our contexts change, the stability of identity may be belied. We may thus develop various stable identities, each

in relation to a different context, for example, our profession, our political affiliation and ideology, or our family roles.

Ryan and Deci (2000) argued that three qualities of any identity are desirable: self-direction, relatedness or connection, and competence. These concepts reveal implications for sustainability. A commitment to sustainability calls for certain competencies (e.g., De Haan, 2006), and an identity is needed to provide the motivating force for their use (see also Clayton & Opatow, 2003). But sustainability may also imply a personal identity whose self-chosen directions contravene or are orthogonal to the predominant goals in the culture. Environmental psychologists have argued that some people develop an ecological or environmental identity (EI), a social self shaped by a sense of relatedness to nature (Bragg, 1996; Mathews, 1991). Clayton (2003) validated and used a measure of EI with college students and found that EI scores correlated with pro-environmental attitudes, behaviours, choices in environmental conflicts, and reasons for such choices. Two reasons in particular, “responsibilities to others species” and “the rights of the environment,” strongly correlated with EI, suggesting relatedness or connections that distinguish an EI from typical social identities. Zaveoski (2003) discussed the difficulties of maintaining an EI in a society that acknowledges strictly social identities, for instance, opposing conspicuous consumption (behaviour) or valuing the earth as a living organism (values). Nonetheless, such identities are extremely important and salient to those who hold them, and they play an important role in maintaining environmental activism.

How does identity develop and why are changes in identity important during the college years? Developmental psychologist Erik Erikson (1968) examined the self in relation to social context across the lifespan. Erikson’s theory shows the influence of the psychoanalytic tradition and so is not only concerned with identity as a “self-concept” but also with the inner experience of the person as he or she encounters social forces in an ongoing individual-group dynamic. Each of Erikson’s stages is defined by a psycho-social “crisis” or existential issue (each crisis may also recur). Identity, the characteristic crisis of adolescence and early adulthood, is the “accrued confidence that one’s ability to maintain inner sameness and continuity ... is matched by the sameness and continuity of one’s meaning for others” (Erikson, 1959/1980, p. 94). Identity is thus located in the individual and the culture. It is “a defined ego within a social reality ... a subjective experience and ... a dynamic fact” (p. 22). It entails the integration of one’s various identifications, and it is an ongoing developmental process based partly on reflected appraisal (Erikson, 1968). Thus, Erikson’s conception of identity adds a developmental dimension to that of the social psychologists discussed above.

Marcia (1993) elaborated Erikson’s theory systematically and empirically. He found that young people’s identities can be characterized as “diffused,” “foreclosed,” “in moratorium,” or “achieved,” depending on whether the person had explored alternatives thoroughly, and separately, or had made commitments (see Table 2).

Although identity first gels in adolescence, college is a critical influence in its development. College offers an extended period of exploration and models of intellectual and ethical commitment. A typical liberal arts education exposes the student to many new facets of reality, potential identities, and challenges to the present self, without which one’s own identity might be foreclosed. Marcia’s identity “moratorium” might not be available were one to immediately enter a particular career or other community

Table 2
Identity Statuses Defined by Exploration and Commitment

Criteria	Identity statuses			
	Identity diffusion	Identity foreclosure	Identity moratorium	Identity achievement
Exploration of alternatives	present or absent	absent	in process	present
Commitment	absent	present	vague	present

with its set roles, norms, knowledge, and expectations. Chickering and Reisser's (1993) widely cited work on identity development in college identified advances in competencies, emotion management, interdependence, relationships, purpose, and integrity as the component "vectors" of identity development.

Seen through the lens of identity development, sustainability courses matter greatly, as does the hidden or "shadow" curriculum of campus life (i.e., informal sustainable living and learning opportunities on campus expressed, for instance, in operational resource efficiencies such as energy or water), supportive yet challenging learning communities, and overt institutional examples of a commitment to sustainable development. Indeed, sustainability calls for even more thorough-going exploration than in traditional liberal arts and for commitment to culturally novel life paths. Because of students' developmental stage, the entire undergraduate experience, if it exposes students to vigorous sustainability debate and practice, has large social transformative potential. The formal and informal curriculum should be structured to realize the sustainability mandate of higher education (see also Barth et al., 2007; Leal Filho, 1999; Michelsen, 2000). To achieve this, developmental psychology can help educators pay attention to the inner development in the students around them, and learn to speak to this part of the student.

INNOVATIVE SUSTAINABILITY PEDAGOGIES: TWO REPORTS

Because sustainability challenges incorporate many points of view on value questions and call for a response that is both intellectually disciplined and ethically committed, they offer great potential for advancing students' development. They also raise issues with respect to how institutions can support the emerging identities that students will need as they confront sustainability challenges throughout the rest of their lives.

In this section, we describe examples of two kinds of innovative education for sustainability pedagogies and illustrate their effects on student development. The first innovation is a place-based, interdisciplinary case-study course whose effects on students' intellectual development were measured with the MID. The second is the transparent integration of student-led sustainability activism within for-credit courses, using the campus as a site for transdisciplinary exploration. We report qualitative (self-report and anecdotal) data on identity development from two examples of this second kind of course.

Intellectual Development in an Experimental Core Course

Western Washington University's Huxley College of the Environment in Bellingham, Washington, an upper-division college serving third-year junior and fourth-year

senior majors, undertook an experiment in its introductory curriculum between 2001 and 2004. As reported below, 153 students were enrolled in a course intended to stress interdisciplinary problem-solving. The students were all in the College of the Environment, but majors varied: approximately a third of the students were science majors and two-thirds were spread between policy, planning, geography, and environmental education. Men comprised 54% and women 46% of the group; most students were between ages 20 and 22. The course was taught to classes of 25 students or fewer, by faculty from different disciplines in a learning-community model. The course used a highly motivating and complex local social-environmental problem that required students to use and integrate disciplinary as well as practical world knowledge: the science and highly contested politics of cleaning mercury-contaminated sediments from the city's bay. Students read case narratives (similar to those used in public administration and business schools) that put them in the problem-solvers' seats, interacted with guest speakers (often the real figures from the narratives), took field trips, and completed integrative group assignments (i.e., a substantial "policy memo" justifying a clean-up choice on scientific, social, policy, and value grounds) and presentations. Instruction in problem-solving processes was explicit. Thus, the pedagogy was much like the interdisciplinary model described by Steiner and Laws (2006), which involved students via rich, written case narratives describing real-world problem-solving challenges.

Student learning in eight sections of the course was assessed by pre- and post-course administration of the MID. The pre-post study did not include a control group, nor do comparative data exist from the course pre-2001. The study objective was simply to monitor the effects of a new form of learner-centred pedagogy and to evaluate the teaching approach.³ The results depict the students' levels along the Perry positions, including transitional positions.⁴ As shown in Figure 1, completing the course was associated with an upward shift in the distribution of scores, that is, the course positively affected students' intellectual-ethical development beyond dualism toward contextualized relativism. For statistical analysis, the categorical positions shown in Figure 1 were transformed to a continuous variable (Moore, 2000). ANCOVA, using pre-MID as a covariate, showed the increase was significant (means pre 2.89, post 3.15; $F=2.157$; $R^2=.204$; $p=0.013$).

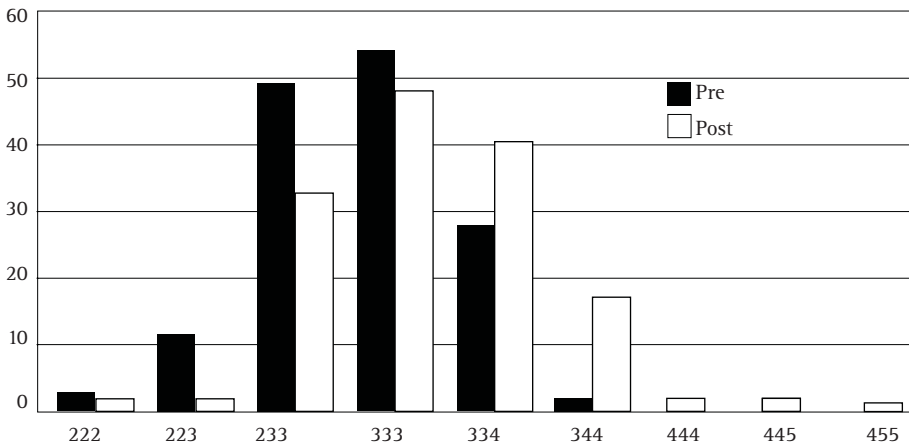


Figure 1. Pre and post distributions of MID raw scores ($N=153$)

Across all students, there were no gender effects: women and men both had a pre-test mean of 2.89; at post-test, women averaged 3.11, and men averaged 3.16. There were, however, some variations in magnitude of the average gain by section of the course, as shown in Table 3 (results were obtained by using section-by-section t-tests; total n is less than in Figure 1 because not all students completed both pre- and post-tests). In the ANOVA model, the instructor was significant at $F=2.695$, $p=.024$.

Table 3
Pre-Post MID Test Results by Course Section

Instructor	Pre-course mean	Post-course mean	Mean gain	n	Probability	Effect size	Percent showing positive change
A	2.9	3.0	0.10	16	0.05	0.6	44
A	2.9	3.5	0.60	21	0.00003	1.1	81
B	2.8	3.4	0.60	10	0.025	1.2	60
C	3.05	3.2	0.15	16	0.2	0.4	44
D	3.0	3.0	0.00	15	1	0.0	27
E	2.7	3.1	0.40	14	0.028	0.75	57
F	2.8	3.0	0.20	21	0.045	0.54	52
G	2.8	3.0	0.20	22	0.006	0.69	59

Notes: Instructor A taught the course twice in this period; total n=135.

Students were assigned to sections to roughly balance majors and genders, increasing the comparability of the samples; thus, the section effect is likely due to the differing instructional styles.⁵ The gains across most sections are typical of wherever learner-centred pedagogies are used, and are sometimes greater than even a year or more of regular college instruction (Moore, 2002). They suggest movement away from simple dualistic conceptions of knowledge and value. Figure 1 shows a trend toward position 4 thinking, or “relativism.” Two students were solidly in this position at pre-course, but 23 students (15%) were at or above it post-course, with transitional scores (“334” or above) shown by 65 students (42%). A student whose essays showed movement from positions 3 to 4 said the course “taught me the importance of examining all aspects and factors of an environmental problem before forming an opinion.” Another spoke of needing to ensure that he “process[es] information and not just regurgitate[s] it.”

Although only three students showed any sign of position 5, the data do suggest what college students may attain. These three students became “contextual relativists.” They saw knowledge as relative to particular frames of reference, showed a capacity for detachment, thought about their own thinking, and evaluated their own ideas, as well as those of others. They differentiated between an unconsidered belief and a considered judgement. Authorities were seen as people who can and should be questioned. One student who showed an emerging position 5 discussed how it was important for him to be “challenged to think and discuss,” to form his own interpretation, and to “add new insights and critique the basic assumptions.”

It must be recognized that position 5 is not the end of the Perry scheme. Position 5 thinkers, by seeing alternative perspectives, frequently have difficulty making a decision. The next developmental step, however, is not cynicism but “commitment” (positions 6 through 9). As with the other positions, this growth does not always occur, but it involves degrees of ownership of one’s own decisions with awareness of relativity;

balancing commitments; acceptance of paradox; and being wholehearted while tentative or holding deep values yet also being ready to learn. Arguably, these qualities are called for by the emancipatory vision of sustainability education discussed by Wals and Jickling (2002).

Since problem-solving was a key theme in the class, discussion among the diverse faculty teaching the course had led to a common-denominator – a seven-step problem-solving process conception. Two limitations, worked through with the students, were the suggestion of linearity in the actually iterative problem-solving process and the implication that all steps were independent and equally important. In fact, problem definition may be most critical, and some steps are requisite to others. Taken together, however, the seven steps provided a working conception of the whole process (see also Bardwell et al., 1994). Students in the last three sections listed in Table 3 were given special but equivalent MID prompts that also asked them to respond to complex socio-environmental problems. Besides the MID, these were scored by separate criteria for the quality of their use of the steps (on a scale from 0 [absent] to 3 [explicitly used and integrated into the process]). We present only a rough portrayal of the steps; the students' pre- to post-course changes in the pattern of their use are shown in Figure 2.

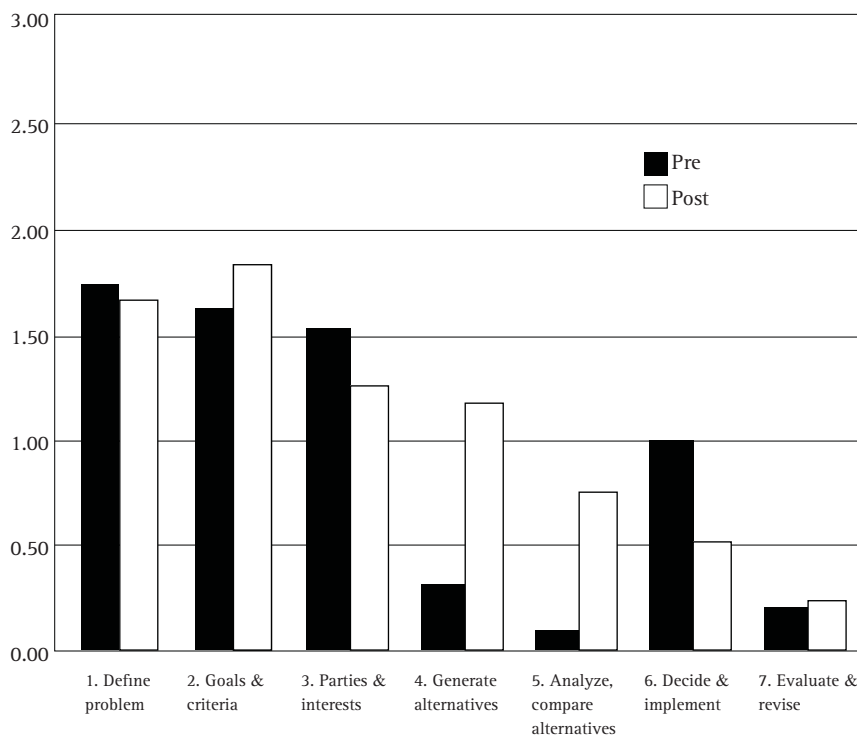


Figure 2. *Pre vs post, average quality of use of problem-solving steps on 0 to 3-point scales, all three Fall 2003 sections (N=62)*

As Figure 2 shows, average student scores were at best about half the possible score. Use of some steps decreased, perhaps reflecting the different problems or the students' focus on using their own new skills (as opposed to focusing on other parties,

step 3). The decrease in the “decide and implement” step may be a gain: less jumping to conclusions. Students showed increases in searching for alternatives and in comparative analysis. What is particularly interesting is the increase in the latter. Two instructors taught methodologies by which to systematically compare alternatives vis-à-vis goal-derived criteria. Although ANOVA showed this had no significant effect on MID scores, such analytical methods bear a formal resemblance to position 4 in the Perry scheme, wherein students differentiate opinion from judgment. It may be that the problem-solving scheme, with its stress on systematic analysis of alternatives, bootstrapped thinking about thinking for these students.

These findings suggest that the use of local place-based, interdisciplinary, ill-structured problem-solving and of learning-community/learner-centred pedagogies, plus teaching explicit analytic tools, may help drive intellectual and socio-moral development toward the kind of situated and committed critical learning that emancipatory education for sustainability envisions. Further research on post-secondary students in interdisciplinary, project-based sustainability learning is needed regarding their intellectual and socio-moral development; the effectiveness of such pedagogy for sustainability education has been documented in other contexts (e.g., Barrett, Hart, Nolan, & Sammel, 2005; Barth & Godemann, 2006).

Identity Development While Empowering Students to Make Their Campuses More Sustainable

The second type of pedagogical innovation we use as illustration draws from each author’s separate experiences guiding students in researching and advocating sustainable practices on their campuses. By using the campus as a learning laboratory, as advocated by Vezzoli and Penin (2006), these courses are more immersive than the core course described above (see also Brunetti, Petrell, & Sawada, 2003; Leroy & van den Bosch, 2001; Pike, Shannon, Lawrimore, McGee, Taylor, & Lamoreux, 2003). The courses are conceived as “sustainability apprenticeships”: students work under the guidance of an experienced environmental studies academic/sustainability activist and learn sustainability theory and practice “on the job” (Beringer, 2006b). This action-oriented, community service-type learning experience takes advantage of the formal learning of the classroom combined with the informal learning opportunities associated with the campus as a “sustainability lifeworld” (e.g., Stoltenberg, 2000). We present descriptions of the courses and qualitative data in order to explore the impact of this kind of experience on students’ fundamental sense of who they are. Thematically, we emphasize identity, community, and empowerment outcomes. Future studies may complement qualitative with quantitative analysis of identity-status changes, for instance via the Extended Objective Measure of Ego Identity Status (EOM-EIS) (Adams, Bennian, & Huh, 1989), as well as examine Perry-type cognitive gains in relation to identity changes.

Identity Outcomes of a Sustainability Audit Course

In 2005, second author Beringer taught an undergraduate sustainability course in the Environmental Studies core curriculum at the University of Prince Edward Island (UPEI) in Canada. In order to launch systematic sustainability work at UPEI with central roles for students, a campus-wide audit relying on the Campus Sustainability

Assessment Framework (CSAF) (Cole, 2003) was selected as the focal task. The CSAF is a standardized tool which was designed specifically for Canadian universities, in response to requests from students and other campus change agents to have a common framework to advance the sustainability in higher education movement in Canada (Cole & Wright, 2005). The CSAF has since been revised and is now disseminated by the Sierra Youth Coalition (Guerin & Cole, 2003).

The CSAF requires a substantial commitment of resources. The audit has 10 sections, with a total of 169 ecological, social, and economic indicators. The human resources for this task came from the 36 second- to fourth-year Science, Arts, and Business students in the course. They worked in small self-chosen groups to complete one of the ten CSAF sections. Students knew that their CSAF research reports were to be published on the Web (Beringer, 2005). The completed UPEI CSAF report would provide a baseline of “green” practices at a commuter college campus with a sparse history of such practices or of student activism. It would also serve as the reference document from which to launch a strategic campus sustainability plan.

To assess sustainability learning, students responded to journal questions designed to stimulate critical self-reflection and assessment of their learning. The journal questions were given to students in class as homework assignments and/or sent to students via e-mail; most students chose to complete the journal assignments by e-mail. Data were compiled manually and analyzed according to standard thematic content analysis. Several themes related to identity development are highlighted here.

First, while talking about their learning, students mentioned discovering the possibility of “making a difference”:

This is a new way of teaching a course and a very good way to get students involved with their university. (student A)

This course gives us a chance to get out from the bored classroom, and running around campus to do the project! (student B)

[This] does not [just] teach you what these practices accomplish, but it also teaches the means and methods that are used to reach these end goals. (student C)

I find that it first requires the individual to be the driving force behind their education and not just a drone in a room. (student D)

The identity of “learner” was being transformed by these students as they simultaneously became change agents. They were looking at their campus very differently than as a resource for passive learning – in contrast to most previous courses. Moreover, this sense of empowerment was seen as part of a collective identity among at least some of those in the class:

I am sure this task is not going to be easy for any of us, but I feel that we will learn a lot from our research and each other, as we move along together. (student A)

This project is beneficial to UPEI and allows for individual and group work. (student E)

Another theme is already visible in the quotes above, in the reference to “their” campus. In their own perception, the students’ sense of belonging and sense of community at UPEI seemed to have increased as a consequence of the CSAF project. The following quote emphasizes this sense of investment:

It is really important to UPEI is like a ... community. Now, we have a small group of people are doing the assessment [sic]. After the assessment, the whole campus community will be expected to co-operate to build sustainable campuses. (student F)

Identity is a relational concept and these students were sensing a new role in relation to formerly indifferent aspects of a large institution. Finally, many students went further and related the campus context to the wider values and practices of the sustainability movement:

I believe that we should live sustainably so that we do not completely destroy the biosphere of this planet. (student D)

We need to sustain our present needs and future generation needs. At the same time, we also have to seek the balance between economic, environment, and social value. (student E)

Thus, sustainability may have been providing a new, broader frame of reference for these students’ emerging social identities. Supporting this outcome of the course, students benefited from the national and international links to the campus sustainability movement that the course highlighted: the national Sierra Youth Coalition Sustainable Campuses Project in Canada and the UN Decade of Education for Sustainable Development 2005–2014. These links seemed critical for a campus serving mostly local students in a setting and culture that values its insularity and sense of traditions. Some of the keener students went on to become not only active members of the Sierra Youth Coalition Sustainable Campuses campaign but also part of the international team representing youth at the UN Climate Change meetings.

Identity Outcomes of a Campus Planning Studio Course

Eleven years ago, Western Washington University was revising its Institutional Master Plan (IMP) and top administrators wanted “informed student input” as part of the process. The result – the Campus Planning Studio (CPS) – became an annually offered course (now offered every term) that is open to any student. In CPS, students define and carry out in-depth research on campus sustainability; the projects concern campus-management action, such as transportation and food services. A key element is the instructors’ relationships with administrative or student-activist decision makers, who serve in person as clients with real uses for data and real deadlines for real deliverables and who attend students’ final presentations. This immersion immediately impresses the students. Although some students have enough experience acting in a complex problem setting to be effective, most do not, and this learning is the most significant in the course. As with the UPEI course described above, students are motivated intrinsically and work extraordinarily hard, and their products are presented and posted on a website.

Every quarter, CPS enrolls 15 to 18 students, mostly of traditional college ages but spanning first-year to seniors (the course is repeatable for credit) and from many disciplines, with about half coming from environmental studies. The instructor coaches the students on the choice of currently active issues to work on, provides background, frames the larger world of campus sustainability, and guides each group as they develop research questions, study plans, and then carry out their project. Resources, such as content or methods experts, are drawn as needed from across campus. Work is intense, with strong feedback given in response to drafts and practice presentations. The pedagogy is intentionally transdisciplinary: disciplinary boundaries are pragmatically blurred to fit the needs of problems stemming from the real world; clients and research informants are necessarily approached as offering essential perspectives and non-academic knowledge; and dialogue around different values (often related to differing positions and power within the institution) is opened up, illustrating value-rationality. Similarly project-based transdisciplinary examples are offered in the sustainability in higher education literature (e.g., Beringer, 2006b; Dale & Newman, 2005; White, 2003; see also *International Journal of Sustainability in Higher Education*, 7(3) [2006]).

In two recent quarters of CPS, 34 students were administered a post-only set of self-reflective questions related to identity.⁶ Questions asked whether the students felt their identity as a learner was affected, and whether they felt the course made them part of something meaningful and larger than themselves. Answers were largely affirmative for both: respectively, 68% for the first item and 97% for the second. In addition, 94% felt they had had an impact on the university. Open coding of students' elaboration on these yes/no responses drew out several qualitative themes, as follows.

Identity and competence: In various ways, 14 students described a greater sense of competence tied to the work in the course:

I learned important people skills when it comes to contacting and interviewing people, presenting material, being sensitive to the audiences, and how to put together a report.

I think I gained some good experience in research techniques and in communication skills.

I know now about more resources and can give personal help.

I am smarter now, that changes who I am, who I can relate to.

I have the confidence to pursue answers to questions which affect my life.

Identity in relation to the university: Seventeen students expressed a greater sense of being related to the university:

The administration is less of a 'wizard-behind-the-curtain.'

Working with administration was a very gratifying experience. Especially because the results of my report as well as most others in the class were, surprisingly, 'good news.'

I now have a better understanding of administration and administrators at WWU and I don't feel so distinctly separate from them. I like the student-administrator collaboration.

I have provided information, and in doing so, translated it, so that the greater campus and community can now learn as I did.

Identity and self-direction: Thirteen students stated they had experienced changes in identity and how those changes had increased their sense of themselves as directing their own life and learning:

I really enjoyed how it was a student-led project. It was a great experience for me to not have a defined curriculum and having to explore the boundaries of the course for myself and directing my own efforts.

The self-directed nature of the course helped me to be more self-directed.

I feel that I have learned how to be more of a self-directed learner.

I felt my opinion really mattered in the goals process meeting, and it made me feel respected and empowered as a student.

Agency: Twenty-three students expressed an increased sense of personal efficacy in the contexts of the university and the global sustainability movement. Some examples include:

I ... felt my presentation sparked some good conversations among the people who can make a change. I also feel like I helped start something that will have an increasing impact as time goes on.

Dining Services at least seems to be taking notice – if we keep on applying pressure, along with constructive ideas, I think we will see an impact.

We influenced people, made them question campus policies.

Changed conception of learning: Fourteen students felt their conceptions of learning had changed and that the different context prompted them to think about the creation of knowledge:

By learning how to learn as one part of a group working toward a common goal, rather than a sponge soaking up prescribed knowledge.

I really enjoyed how it was a student-led project. It was a great experience for me to not have a defined curriculum and having to explore the boundaries of the course for myself and directing my own efforts.

Doing a real world research project where your sources are people instead of books and your results stimulate change in addition to just thought. I feel this is the 1st project I have done which significantly [a]ffect[s] people in my community.

Table 4
Percentage Response to Post-Course Retrospective Identity Questions

	Strongly disagree	Disagree	Agree	Strongly agree
Changes I experienced are important to me personally	3.1	6.3	53.1	37.5
I feel I have an increased sense of competence	0	6.3	59.4	34.4
I learned more about making changes happen than in other courses I have taken	0	12.5	43.8	43.8
I feel more in charge of my own learning as a result of this course	0	21.9	46.9	31.3
I feel I learned about other points of view as a result of this course	3.1	12.5	56.3	28.1
Increased sense of the potential roles for myself in my future	0	9.4	37.5	50.0
Increased sense of "ownership" of Western itself	0	15.6	50.0	34.4
The changes in myself give me positive feelings	0	3.1	68.8	28.1
This course increased my commitment to the goals of sustainability	0	6.3	31.3	63.5

Some comments reflected a collective sort of learning:

The information that we collected will actually be used by the university making this not only a learning experience for the students in this class, but the university as a whole.

In addition to the qualitative coding of explanations to the identity questions, we also asked for agreement/disagreement with nine statements related to sustainability identities. The results are summarized in Table 4 and show a strongly positive impact.

These stories, expressed in student citations, illustrate what we refer to as emerging "sustainability identities." In terms of identity, the qualitative data from these two courses reveal the emergence of the subjective senses of competence, continuity, and purpose referred to by Erikson (1968) and Chickering and Reisser (1993). These courses provide a key social frontier with alternative identities available for exploration and feature communities and vocations dedicated to sustainability. Sustainability is often discussed at a high and even obfuscating level of abstraction, and practical applications, at least on the institutional level, are generally inaccessible to students. Usually, then, sustainability is available to students' ideological identities, but this alone is only a shallow part of development and can be alienating or disempowering.

In these courses, however, the students' school work takes on new and personal meaning because students are moving from merely holding values to acting on them. The validation for such action provided by the instructor, and by the class group itself, affirms individuals for standing out in favour of not-yet-consensus ideals. Shoring up emerging vocational identities are the practical research, group process, and presentation skills that students gain. Often, these students have only read about or simulated research, not done it. In these "sustainability apprenticeship" experiences, they have reason to do research and care about how good it is.

The students' perceptions of themselves undergo further advance as they see how differently significant others now view them. In particular, the high visibility of their

efforts in the eyes of decision-makers and the broader campus community can solidify commitment to their new role and status. In the instances where their hard efforts bear fruit in the form of changed institutional practices, the students know they have been part of a broad change process. In cases where their proposals fail with administrators or other students, they have the opportunity to reflect on how society will respond to the complex challenges of sustainability. How one is to sustain a “sustainability identity” is ultimately a collective psychological challenge that these curricular innovations help us all meet. What at least some of these students take away from these courses is a strengthened sense of who they are (identity) and who they can be (empowerment) in relation to sustainability challenges, and possibly beyond. Both of these affirm their ability to manage conflicts of interest and stakeholders’ divergent values, as well as the dynamic process and uncertainty of outcomes that are central to many sustainability challenges.

CONCLUSION

We have argued that emancipatory sustainability education at the post-secondary level needs to be informed by psychological theory on college-age intellectual, moral, and identity development. The literature on these variables suggests that the college years offer special opportunities. We have presented data that suggest sustainability education can shape the intellectual, moral, and identity development of college-age students. Within the limitations of the studies – pre-post design without a control group, anecdotal data, tracing identity changes without analyzing cognitive development – the data suggest that active, problem-based learning can be a very effective form of sustainability education. Learner-centred transdisciplinary pedagogies such as place-based case studies and project-based courses that use the campus as a learning laboratory can strongly support these dimensions of individual growth.

Many studies about the positive effects of real-life and inter- and transdisciplinary learning settings on students’ competence development already exist. Including the psychological variable of identity development in sustainability in higher education research and pedagogy affirms the intellectual, ethical, motivational, affective, and social dimensions of psychological maturation that have been documented for the college years. By contextualizing these processes of psychological growth within an identity movement from “sustainability learner” to an empowered, confident “sustainability change agent,” students themselves as well as academic staff, university management, and off-campus stakeholders can clearly witness the sustainability learning outcomes many higher education institutions now seek for their graduates. With respect to sustainability in higher education research and practice/pedagogy, connecting the acquisition of sustainability competencies to identity development and other processes of psychological growth embeds the educational issue of competencies, their acquisition and development, in the underlying ontogenetic psychological processes. A framework of educational psychology adds robustness to competence research and theory. Furthermore, it forges the link to empirical work on ecological/environmental identity (EI), a link that opens up a rich and largely unexplored research agenda on a “sustainability identity” as embedded within and/or as distinct from EI and/or social identities. Considering the growing emphasis on inter- and, in particular, transdisciplinary sustainability research, pedagogy, and practice, such a research agenda on questions of sustainability identity development promises theoretically grounded and

empirically validated insights into how individuals and social groups enter into and maintain a commitment to sustainability in the dominant culture of unsustainability that they seek to transform.

As the data also indicated, not all students are comfortable with this style of teaching and learning; instructors must be prepared for resistance and to accommodate different learning styles, for instance, by including structured, formal lectures from time to time. Sustainability calls for new levels of intellectual challenge appropriate to ill-structured problems. Further, it calls for unprecedented personal identities forged from awareness of social change/activist alternatives and commitment to them. Studying and measuring these transformations and, above all, caring about the students who are experiencing them adds needed psychological depth to pedagogical thinking about sustainability education. ♣

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NOTES

1. We distinguish here between sustainability education (or education for sustainability) and environmental education. The environmental education literature certainly draws on psychological concepts and theories, and it has long used and studied problem-based learning as a pedagogy (e.g., Hungerford & Volk, 1990). We are advocating an extension to sustainability education.
2. See Hofer and Pintrich (1997) for an insightful summary and analysis of traditions in this complex area of research.
3. The essays were scored by a certified professional MID rater (not one of the researchers), who, due to the timing and content of essays, was not blind to their pre or post origins. The rater's extensive experience and the rigorous scoring manual,

however, minimize the rater's expectancy bias.

4. Explanation of MID ratings from Moore (2000): Individual ratings on the MID are represented by a 3-digit number that reflects the dominant and (if necessary) the subdominant position/s rated in the essay. This system extends the Perry scheme continuum from 4 steps – that is, positions 2, 3, 4, and 5 – to 10 steps: 222, 223, 233, 333, 334, 344, 444, 445, 455, and 555. Solid ratings (like 333) reflect a “stable position” perspective; the two steps between each stable position indicate transitional essays. As examples, 223 represents “dominant position 2 opening to position 3,” while 233 indicates “dominant position 3 with trailing position 2.” The ratings thus reflect an assessment of the cognitive complexity displayed by the essay with respect to classroom learning along a linear, simple stage model continuum.
5. Some instructors were assigned to teach the course against their wishes and proclivities. One instructor (D, in Table 3) had particular difficulty changing from an authoritative information-delivery model to a learner-centred one. Although this course was strongly supported by the college leadership, we think this testifies to the importance of faculty initiative and buy-in, as well as systematic support (intellectual and financial) when adopting instructional innovations.
6. For self-reported changes such as these, retrospective questions asking research participants for assessments of their position now as opposed to the start may be more appropriate than traditional pre/post test designs (Howard et al., 1979).