Keywords: education for sustainability, education for sustainable development, systems thinking, inter/transdisciplinarity, critical realism, Greimas’s actantial model, semiotic square.

Abstract

Sustainability education is fundamentally systemic and transdisciplinary, placing emphasis on the linkages and interconnectedness between disciplines to create emergent ideas which can address our urgent sustainability challenges. Its measure of success, progress towards sustainability, requires education that extends beyond the cognitive domain to engage students’ ‘head, heart and hands’. This chapter argues that, in contrast, most modern higher education is fundamentally reductionist, arranging learning within discrete modules and disciplines and rewarding students’ cognitive performance.

Whilst there are frequent calls in the literature and from global bodies for a fundamental redesign of and in education to address these requirements, the author can see little evidence that this is happening. With sustainability an ever-diminishing prospect, this is a time-critical issue. Taking a pragmatic view, this chapter focuses on what can be done to deliver an educational experience which facilitates the development of knowledgeable and responsible global citizens within the existing educational paradigm.

Using a systematic functional semiotic framework, a number of the key distinctive features of the course are discussed, including its curriculum and learning styles. It also reflects on the conceptual and practical successes and challenges of the course, both to the individual learner and to the university of its operation.

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A round peg into a square hole

Transdisciplinary sustainability education in a modular mass education system

Alison J. Greig

Introduction

There is an urgent need for graduates with the skills and competences to address existing and anticipated complex global challenges, such as those framed by the UN’s Sustainable Development Goals. This chapter reflects on the requirements and the challenges of delivering the kind of education that creates graduates who are equipped to become what [Shephard (2008](C:\\Users\\smitchell\\Desktop\\My Titles\\Ellis 15032-3173\\02 Ellis CE files\\15032-3173-FullBook.docx" \l "Ref_453_FILE150323173015" \o "(ManLink):Shephard, K. (2008) Higher education for sustainability: seeking affective learning outcomes, International Journal of Sustainability in Higher Education, 9:1, 87–98. UserName - DateTime: a321-7/19/2019 5:43:15 PM): 88) describes as ‘influential citizens who value their environment and appreciate that they have a responsibility to help to sustain it’. In order to address ‘wicked’ sustainability problems, which have no obvious optimal solution, sustainability education (SE) must equip students ‘to deal with rapid and accelerating change, complexity, contested knowledge and inevitable uncertainty’, (Lotz-Sisitka et al., 2015 73) and must generate, integrate and link use-inspired knowledge to transformational action in ‘participatory, deliberative, and adaptive settings’ ([Wiek, Withycombe and Redman, 2011](C:\\Users\\smitchell\\Desktop\\My Titles\\Ellis 15032-3173\\02 Ellis CE files\\15032-3173-FullBook.docx" \l "Ref_459_FILE150323173015" \o "(ManLink):Wiek, A., Withycombe, L. and Redman, C.L. (2011) Key competencies in sustainability: a reference framework for academic program development. Sustainability Science, 6:2, 203–218. UserName - DateTime: a321-7/19/2019 5:43:37 PM): 203). Critical pedagogies which are interdisciplinary and transdisciplinary, integrating the natural and social sciences, economics, the arts and humanities, are an essential part of such an education. To deliver this, we need to address the learning content, learning outcomes, pedagogy and the learning environment of the existing system of higher education ([UNESCO, 2017](C:\\Users\\smitchell\\Desktop\\My Titles\\Ellis 15032-3173\\02 Ellis CE files\\15032-3173-FullBook.docx" \l "Ref_457_FILE150323173015" \o "(AutoLink):UNESCO 2017 Education for Sustainable Development Goals: Learning Objectives. Available at UserName - DateTime: a321-7/19/2019 5:07:35 PM)). We also require a philosophy of education able to accommodate sustainability’s ambiguous and contested concepts ([Sachs, 1997](C:\\Users\\smitchell\\Desktop\\My Titles\\Ellis 15032-3173\\02 Ellis CE files\\15032-3173-FullBook.docx" \l "Ref_451_FILE150323173015" \o "(AutoLink):Sachs, W. (1997) Sustainable Development, 71–82. In M. Redclift & G. Woodgate (eds), The International Handbook of Environmental Sociology, Cheltenham: Edward Elgar. UserName - DateTime: a321-7/19/2019 5:07:32 PM); [Bourke and Meppem, 2000](C:\\Users\\smitchell\\Desktop\\My Titles\\Ellis 15032-3173\\02 Ellis CE files\\15032-3173-FullBook.docx" \l "Ref_423_FILE150323173015" \o "(AutoLink):Bourke, S. and Meppem, T. (2000) Privileged narratives and fictions of consent in environmental discourse. Local Environment, 5:3, 299–310. UserName - DateTime: a321-7/19/2019 5:07:18 PM)) as well as different claims on knowledge and situations where knowledge is often uncertain and provisional in nature ([Huckle, 2004](C:\\Users\\smitchell\\Desktop\\My Titles\\Ellis 15032-3173\\02 Ellis CE files\\15032-3173-FullBook.docx" \l "Ref_436_FILE150323173015" \o "(AutoLink):Huckle, J. (2004) Critical realism: A philosophical framework for higher education for sustainability. In Higher education and the challenge of sustainability. Dordrecht: Springer. UserName - DateTime: a321-7/19/2019 5:07:24 PM)).

There is a large and growing literature which is devoted to describing the philosophies of education which are consistent with sustainability learning (e.g. [Scott, 2015](C:\\Users\\smitchell\\Desktop\\My Titles\\Ellis 15032-3173\\02 Ellis CE files\\15032-3173-FullBook.docx" \l "Ref_452_FILE150323173015" \o "(AutoLink):Scott, L.C., (2015) The Futures of Learning 3: What kind of pedagogies for the 21st century? Paris: UNESCO Education Research and Foresight. UserName - DateTime: a321-7/19/2019 5:07:33 PM); [Wals and Corcoran, 2012](C:\\Users\\smitchell\\Desktop\\My Titles\\Ellis 15032-3173\\02 Ellis CE files\\15032-3173-FullBook.docx" \l "Ref_460_FILE150323173015" \o "(ManLink):Wals, A.E. and Corcoran, P.B. (eds) (2012) Learning for sustainability in times of accelerating change. Wageningen: Wageningen Academic Pub. UserName - DateTime: a321-7/19/2019 5:43:42 PM)). The potential of critical realism as an appropriate underpinning philosophy is discussed by [Plant (2001](C:\\Users\\smitchell\\Desktop\\My Titles\\Ellis 15032-3173\\02 Ellis CE files\\15032-3173-FullBook.docx" \l "Ref_448_FILE150323173015" \o "(AutoLink):Plant, M. (2001) Critical Realism: A Common Sense Philosophy for Environmental Education? Paper presented at the 26th ATEE Conference, Stockholm. Available at www.leeds.ac.uk/educol/documents/150510.htm (accessed 09 April 2019). UserName - DateTime: a321-7/19/2019 5:07:30 PM): 4). He points out, for example, that a critical realist perspective, which ‘has an ontology claiming that reality is socially constructed whilst maintaining that underlying structures and mechanisms of the real world determine social arrangements and understandings’, can be helpful as it prevents environmental problems being perceived as arising ‘out there’ instead of inside our heads and thus concealing the fact that people live in an essential relationship to nature. [Bhaskar (2010](C:\\Users\\smitchell\\Desktop\\My Titles\\Ellis 15032-3173\\02 Ellis CE files\\15032-3173-FullBook.docx" \l "Ref_420_FILE150323173015" \o "(ManLink):Bhaskar, R. (2010) ‘Contexts of interdisciplinarity: Interdisciplinarity and climate change’, 1–24. In Bhaskar, R., Frank, C., Høyer, K.G., Næss, P. and Parker, J. (eds) Interdisciplinarity and Climate Change: Transforming knowledge and practice for our global future. London: Routledge, UserName - DateTime: a321-7/19/2019 5:43:58 PM)) also see its value, arguing that the complex, open, socio-ecological systems that are our most pressing sustainability challenges, including climate change, biodiversity loss and resource depletion, can only be properly understood in terms of what he calls ‘the four planar social reality’. This is the idea that every social event occurs in at least four dimensions: that of material transactions with nature; social interactions between humans; social structure proper; and the stratification of the embodied personality. Having this CR perspective implies a necessity for the creative employment of models, analogies, and insights from a variety of different fields and disciplines, drawing on not only interdisciplinary knowledge but also methodological pluralism ([Nastar et al., 2018](C:\\Users\\smitchell\\Desktop\\My Titles\\Ellis 15032-3173\\02 Ellis CE files\\15032-3173-FullBook.docx" \l "Ref_443_FILE150323173015" \o "(ManLink):Nastar, M., Boda, C. and Olsson, L. (2018) A critical realist inquiry in conducting interdisciplinary research: an analysis of LUCID examples. Ecology and Society, 23, 3 UserName - DateTime: a321-7/19/2019 5:44:02 PM)).

Unfortunately, whilst the philosophical arguments may be strong, and there are numerous scholars (e.g. [Sterling, 2004](C:\\Users\\smitchell\\Desktop\\My Titles\\Ellis 15032-3173\\02 Ellis CE files\\15032-3173-FullBook.docx" \l "Ref_456_FILE150323173015" \o "(AutoLink):Sterling, S. (2004) Higher education, sustainability, and the role of systemic learning. In Higher education and the challenge of sustainability (pp. 49–70). Dordrecht: Springer. UserName - DateTime: a321-7/19/2019 5:07:35 PM); [Sterling and Huckle, 2014](C:\\Users\\smitchell\\Desktop\\My Titles\\Ellis 15032-3173\\02 Ellis CE files\\15032-3173-FullBook.docx" \l "Ref_437_FILE150323173015" \o "(AutoLink):Sterling, S. and Huckle, J. (eds) (2014) Education for sustainability. London: Routledge. UserName - DateTime: a321-7/19/2019 5:07:25 PM)) calling for a transformation both of and in education in order to achieve a more appropriate approach to sustainability within higher education, there are few signs that such a transformation is gathering pace. As [Concoran (2010](C:\\Users\\smitchell\\Desktop\\My Titles\\Ellis 15032-3173\\02 Ellis CE files\\15032-3173-FullBook.docx" \l "Ref_425_FILE150323173015" \o "(AutoLink):Concoran, P.B. (2010) Foreword, (xiii) in Jones, P., Selby, D. and Sterling, S., (eds), Sustainability education. Perspectives and Practice across Higher Education. London: Earthcan. UserName - DateTime: a321-7/19/2019 5:07:19 PM)) observes, these calls run concurrent with sustainability itself becoming a diminishing prospect, and there is growing concern that time to redress the situation is rapidly running out.

One reason for this inertia may, at least in part, be due to the lack of attention paid to the reasons for this torpor. [Scott (2015](C:\\Users\\smitchell\\Desktop\\My Titles\\Ellis 15032-3173\\02 Ellis CE files\\15032-3173-FullBook.docx" \l "Ref_452_FILE150323173015" \o "(AutoLink):Scott, L.C., (2015) The Futures of Learning 3: What kind of pedagogies for the 21st century? Paris: UNESCO Education Research and Foresight. UserName - DateTime: a321-7/19/2019 5:07:33 PM)) cites challenges such as institutional apathy, entrenched disciplinary traditions and the fierce protection of what is considered by some as a serious affront to academic freedom (see [Peterson and Wood, 2015](C:\\Users\\smitchell\\Desktop\\My Titles\\Ellis 15032-3173\\02 Ellis CE files\\15032-3173-FullBook.docx" \l "Ref_445_FILE150323173015" \o "(AutoLink):Peterson, R. and Wood, P. (2015) Sustainability: Higher Education’s New Fundamentalism. New York: National Association of Scholars. UserName - DateTime: a321-7/19/2019 5:07:29 PM)). He notes also that socio-cultural protectionism may also play a part. Through the use of a case study, this chapter explores some of these practical constraints and suggests how, using a CR lens, it may be possible to deliver an educational experience which facilitates the development of knowledgeable and responsible global citizens within the existing educational paradigm.

Critical realism, disciplinarity and modularity

[Gordon (2014](C:\\Users\\smitchell\\Desktop\\My Titles\\Ellis 15032-3173\\02 Ellis CE files\\15032-3173-FullBook.docx" \l "Ref_433_FILE150323173015" \o "(ManLink):Gordon, L.R. (2014) Disciplinary decadence and the decolonisation of knowledge. Africa Development, 39:1, 81–92. UserName - DateTime: a321-7/19/2019 5:44:05 PM): 85) argues that academic disciplines are the result of academic efforts to ‘colonise reason’ and uses the term ‘disciplinary decadence’ to explain ‘the phenomenon of turning away from living thought, which engages reality and recognises its own limitations, to a “deontologised” or absolute conception of disciplinary life’ ([Gordon, 2014](C:\\Users\\smitchell\\Desktop\\My Titles\\Ellis 15032-3173\\02 Ellis CE files\\15032-3173-FullBook.docx" \l "Ref_433_FILE150323173015" \o "(AutoLink):Gordon, L.R. (2014) Disciplinary decadence and the decolonisation of knowledge. Africa Development, 39:1, 81–92. UserName - DateTime: a321-7/19/2019 5:07:22 PM): 85). A requirement to a go beyond disciplines in the production of knowledge, what Gordon calls a ‘teleological suspension of disciplinarity’, is an essential element of SE.

The barriers to this are cultural as well as philosophical. For example, [Blackmore and Kandiko (2011](C:\\Users\\smitchell\\Desktop\\My Titles\\Ellis 15032-3173\\02 Ellis CE files\\15032-3173-FullBook.docx" \l "Ref_422_FILE150323173015" \o "(AutoLink):Blackmore, P. and Kandiko, C.B. (2011) Motivation in academic life: A prestige economy. Research in post-compulsory education, 16:4, 399–411. UserName - DateTime: a321-7/19/2019 5:07:18 PM)) argue that disciplines persist due to academics prioritising personal attainment and social approval through the creation of a ‘prestige economy’ ([Bascom, 1948](C:\\Users\\smitchell\\Desktop\\My Titles\\Ellis 15032-3173\\02 Ellis CE files\\15032-3173-FullBook.docx" \l "Ref_415_FILE150323173015" \o "(ManLink):Bascom, W. R. (1948) Ponapean prestige economy. Southwestern Journal of Anthropology, 4:211–221. UserName - DateTime: a321-7/19/2019 5:44:09 PM)) in which research publications, grants and citations form ‘prestige goods’. In a similar vein, [Moran (2006](C:\\Users\\smitchell\\Desktop\\My Titles\\Ellis 15032-3173\\02 Ellis CE files\\15032-3173-FullBook.docx" \l "Ref_442_FILE150323173015" \o "(AutoLink):Moran, M. (2006). Interdisciplinarity and Political Science. Politics, 26:2, 73–83. UserName - DateTime: a321-7/19/2019 5:07:28 PM)) describes disciplines as units of power which control the organisation of knowledge in order to maximise ‘prestige’, and [Hicks et al. (2010](C:\\Users\\smitchell\\Desktop\\My Titles\\Ellis 15032-3173\\02 Ellis CE files\\15032-3173-FullBook.docx" \l "Ref_435_FILE150323173015" \o "(ManLink):Hicks, C. C., Fitzsimmons, C. and N. V. C. Polunin. N.V.C (2010) Interdisciplinarity in the environmental sciences: barriers and frontiers. Environmental Conservation 37: 464–477 UserName - DateTime: a321-7/19/2019 5:44:17 PM)) contend that anything which challenges this established order is therefore uncomfortable and ‘risky’ for academics and the institutions they represent. Nastar [et al. (2018](file:///C:\Users\smitchell\Desktop\My%20Titles\Ellis%2015032-3173\02%20Ellis%20CE%20files\15032-3173-FullBook.docx#Ref_443_FILE150323173015)) note that the kinds of horizontal and vertical institutional integration conducive to SE currently runs counter to increasing compartmentalized, disciplinary university structures.

The modularisation of degree education, which was one of a number of significant changes to the higher education landscape in the final two decades of the 20th century, had the potential to breakdown this disciplinary stranglehold. With students able to move easily between disciplines, it was an opportunity to ‘decolonise degrees’, expand students’ epistemological horizons and transcend monocultural thinking. In practice, however, educational structures and practices remain almost entirely characterised by the compartmentalization of existing discipline structures, as the drivers for modularisation became largely practical rather than philosophical ([Gold, 1991](C:\\Users\\smitchell\\Desktop\\My Titles\\Ellis 15032-3173\\02 Ellis CE files\\15032-3173-FullBook.docx" \l "Ref_432_FILE150323173015" \o "(ManLink):Gold, J.R. (1991) Why modularisation, why now, and what implications does it have for geographical teaching? Journal of Geography in Higher Education, 15:2, 180–187, UserName - DateTime: a321-7/19/2019 5:44:28 PM)). Modularisation was, for example, favoured by university administrators in their drive for efficiency and the desire to protect income streams by discouraging the ‘leakage’ of students to other disciplines. Indirectly too, disciplinary boundaries have been reinforced through attempts by academic staff to reduce the intellectual incoherence and potential arbitrariness of degree qualifications.

Crucially, modularisation also became part of the rise of a neoliberal political, economic and cultural agenda within higher education. It became part of the creation of ‘corporate style universities’, intent on preparing students to be competitive in the global marketplace rather than as places to think and be. With increasing attention paid to the fecundity of institutions, the overhaul of the curriculum was aimed at the interests of the market and has served to narrow the parameters of the purpose of higher education ([Giroux, 2018](C:\\Users\\smitchell\\Desktop\\My Titles\\Ellis 15032-3173\\02 Ellis CE files\\15032-3173-FullBook.docx" \l "Ref_428_FILE150323173015" \o "(AutoLink):Giroux, H. (2018) Pedagogy and the politics of hope: Theory, culture, and schooling: A critical reader. London: Routledge. UserName - DateTime: a321-7/19/2019 5:07:20 PM)). Alongside disciplinarity, modularity must be challenged for SE.

The basic principle of a modular course is the division of the curriculum into units of learning, with distinct learning outcomes which are assessed and confer credit at the end of each unit. One of the consequences of this arrangement, however, is that it moves students’ focus from a long-view of a course to a short-term module view and is fundamentally reductionist. Students’ success is judged as the sum of their iterative progression and institutional success by their satisfaction as fee-paying consumers. Once again this presents particular problems for SE, whose primary focus is to create pictures of a complex and messy whole, rather than serial, detailed and uncontested understandings of particular aspects of that whole.

Given these constraints, it is perhaps unsurprising that SE is most often seen in university curricula as another ‘subject’. Titles such as ‘Environmental Science *and* Sustainability’ or ‘Civil Engineering *with* Sustainability’ betray their treatment of sustainability through a specific disciplinary perspective or as a ‘bolt-on’ application. The online portal www.bachelorsportal.com, for example, lists 1380 such undergraduate courses, most of which will be using the narrowly calculative rationality of positivism. Nastar [et al. (2018](file:///C:\Users\smitchell\Desktop\My%20Titles\Ellis%2015032-3173\02%20Ellis%20CE%20files\15032-3173-FullBook.docx#Ref_443_FILE150323173015)) observe that in sustainability research there is also a strong natural science hegemony which predominantly frames sustainability and our understanding of sustainability challenges and that this has resulted in an emphasis on the creation of ‘solution’ strategies based on scientific principles. Their observation, which is equally relevant to SE, highlights a further barrier to impactful sustainability education.

In some universities, SE has been largely banished to the extra-curriculum, where it appears largely in the guise of ‘campus greening’, allowing the university to concentrate on its mono-disciplinary core curriculum. Although some universities have paid lip-service to sustainability being important enough to integrate in all that it does, we have yet to see evidence of any using sustainability for whole system re-design, which would suggest [Sterling’s (2004](C:\\Users\\smitchell\\Desktop\\My Titles\\Ellis 15032-3173\\02 Ellis CE files\\15032-3173-FullBook.docx" \l "Ref_456_FILE150323173015" \o "(AutoLink):Sterling, S. (2004) Higher education, sustainability, and the role of systemic learning. In Higher education and the challenge of sustainability (pp. 49–70). Dordrecht: Springer. UserName - DateTime: a321-7/19/2019 5:07:35 PM)) stage four paradigm shift and towards what [Lotz-Sisitka (2015](C:\\Users\\smitchell\\Desktop\\My Titles\\Ellis 15032-3173\\02 Ellis CE files\\15032-3173-FullBook.docx" \l "Ref_439_FILE150323173015" \o "(AutoLink):Lotz-Sisitka, H., Wals, A.E., Kronlid, D. and McGarry, D. (2015) Transformative, transgressive social learning: Rethinking higher education pedagogy in times of systemic global dysfunction. Current Opinion in Environmental Sustainability, 16: 73–80. UserName - DateTime: a321-7/19/2019 5:07:26 PM): 75) calls ‘transition towards doing better things differently (transformation) rather than doing what we do better (optimization)’.

Effective SE demands not just that students and practitioners have a critical appreciation of knowledge from different disciplines but also that they can bring these together within a single framework to identify the linkages, key actors and dynamics of these as a functional system. Further, it is necessary that they do so within a philosophical framework which acknowledges the limitations of positivism, and that they have an awareness that the empirical world reduces questions about what there is (ontological questions) to questions about what we can know (epistemic questions).

Critical realism and interdisciplinarity

The terms ‘multidisciplinary’, ‘interdisciplinary’, ‘cross-disciplinary’ and ‘transdisciplinary’ are often defined ambiguously and used interchangeably in educational literature. [Greig and Priddle (201](C:\\Users\\smitchell\\Desktop\\My Titles\\Ellis 15032-3173\\02 Ellis CE files\\15032-3173-FullBook.docx" \l "Ref_429_FILE150323173015" \o "Greig, A.J and Priddle, J. (2019) Can we map students’ development as agents for change in response to a sustainability course? A conceptual model. Research in Education (In Press))9) provide a useful clarification of these terms and argue for interdisciplinarity as the minimum for SE, as it is only here that we begin to see emancipation from traditional disciplinary boundaries and fixed methodological positions.

[Bhaskar (2010](C:\\Users\\smitchell\\Desktop\\My Titles\\Ellis 15032-3173\\02 Ellis CE files\\15032-3173-FullBook.docx" \l "Ref_420_FILE150323173015" \o "(AutoLink):Bhaskar, R. (2010) ‘Contexts of interdisciplinarity: Interdisciplinarity and climate change’, 1–24. In Bhaskar, R., Frank, C., Høyer, K.G., Næss, P. and Parker, J. (eds) Interdisciplinarity and Climate Change: Transforming knowledge and practice for our global future. London: Routledge, UserName - DateTime: a321-7/19/2019 5:07:16 PM)) posits that critical realism can be a useful broker for interdisciplinary approaches, since as a philosophical framework it encompasses an ontology which extends from mathematics, ‘hard’ and social sciences to a critical engagement with human action and identity. It therefore leads to a systemic worldview which overcomes current disciplinary silos and embraces the kind of complexity found in natural systems. Furthermore, its ability to address ‘extra-scientific’ factors drawn from the social sciences and humanities (such as politics, ideologies, cultural interests and practices) means it has the unique capability of situating the weaknesses of actualist, reductionist mono-disciplinary accounts of science. [Price (2014](C:\\Users\\smitchell\\Desktop\\My Titles\\Ellis 15032-3173\\02 Ellis CE files\\15032-3173-FullBook.docx" \l "Ref_449_FILE150323173015" \o "(AutoLink):Price, L. (2014) Critical realist versus mainstream interdisciplinarity. Journal of Critical Realism, 13:1, 52–76. UserName - DateTime: a321-7/19/2019 5:07:31 PM)) goes further, arguing for ‘critical realist interdisciplinarity’ because it acknowledges the empirical, actual and real layers of reality and can potentially provide explanations that allow broader and deeper understanding of the complexity which characterises sustainability.

For example, [Mingers (2015](C:\\Users\\smitchell\\Desktop\\My Titles\\Ellis 15032-3173\\02 Ellis CE files\\15032-3173-FullBook.docx" \l "Ref_441_FILE150323173015" \o "(AutoLink):Mingers, J., (2015) Helping business schools engage with real problems: The contribution of critical realism and systems thinking. European Journal of Operational Research, 242:1, 316–331. UserName - DateTime: a321-7/19/2019 5:07:27 PM)) explains that if the world consists of structures and mechanisms that have powers and liabilities to generate the events that actually occur, these structures are distinct from the events they generate. Although events may occur at a particular point in time, the structures exist before and afterwards, and at any time may or may not be exercising their causal powers in interaction with each other. It is this which Mingers argues gives rise to the fundamental distinction between the domains of the real (structures and mechanisms) and the actual (events, whether observed or not). He notes that the domain of the empirical is the small subset of events that are in fact observed and become the basis for research.

[Mingers and White (2010](C:\\Users\\smitchell\\Desktop\\My Titles\\Ellis 15032-3173\\02 Ellis CE files\\15032-3173-FullBook.docx" \l "Ref_440_FILE150323173015" \o "(ManLink):Mingers, J. and White, L. (2010) A review of the recent contribution of systems thinking to operational research and management science. European Journal of Operational Research, 207:3, 1147–1161. UserName - DateTime: a321-7/19/2019 5:44:56 PM)) also point out the similarities between critical realism themes such as totality, holistic causality, emergence, open systems, autopoiesis and levels of stratification and their development within the field of systems theory or systems thinking (see Table 15.1). He shows how concepts such as systems forming wholes; a hierarchy of systems with emergent properties; structure and process; and systemic structure and interaction generating observed behaviour can be translated almost directly into the language of systems thinking. SE has embraced systems thinking as an approach which can expand our awareness to see (w)holistic relationships between parts and wholes, that is, made up of integrated wholes which cannot be understood by their parts alone and which contrast positivist and reductionist approaches. Mingers suggests both schools of thought have much to offer each other: systems thinking provides clearer articulations of circular causality, e.g. through concepts such as feedback, and CR can provide systems thinking with a more rigorous philosophical underpinning.

Table 15.1 Critical realism and systems thinking

*Source:* adapted from [Mingers and White, 2010](C:\\Users\\smitchell\\Desktop\\My Titles\\Ellis 15032-3173\\02 Ellis CE files\\15032-3173-FullBook.docx" \l "Ref_440_FILE150323173015" \o "(ManLink):Mingers, J. and White, L. (2010) A review of the recent contribution of systems thinking to operational research and management science. European Journal of Operational Research, 207:3, 1147–1161. UserName - DateTime: a321-7/19/2019 5:45:03 PM)

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| --- | --- | --- |
| Critical realism:  Bhaskar’s early work  (e.g. *Realist Theory of Science*, 1975 and *The Possibility of*  *Naturalism*, 1979) | Critical realism: Bhaskar’s later work  (e.g. *Dialectic: The Pulse of Freedom*, 1993 and *Plato etc.: Problems of Philosophy and Their Resolution*, 2009) | Systems thinking |
| structures, mechanisms, ‘things’ | totality | systems |
|  | parts/wholes | parts/wholes |
| powers, liabilities, tendencies | holistic causality | emergent properties |
|  | internal relations | relationships |
| open and closed systems | open systems | open and closed systems |
| stratified ontology | recursive embeddings | hierarchy or nesting of systems |
| emergent properties | emergent properties | emergent properties |
| intransitive and transitive domains |  | the observed and the observer |
| mechanisms generate events |  | structure generates behaviour or process |
|  | tensed, rhythmic spatial processes | process, dynamics |
|  | absence, negativity, real non-being |  |
|  | autopoiesis | autopoiesis |
|  | transformative agency | soft systems, second order cybernetics |
|  |  | positive and negative feedback relations |
|  |  | boundaries |

Sustainability education and holism

The principle of holism which exists in systems theory and critical realism has yet another dimension in SE and is important at the scale of the individual student, institution and society. Here it relates to requirement for change (towards sustainability) and requires an educational paradigm which extends beyond the cognitive domain to embrace emotional and cultural dimensions. For example, at an individual level, it is well known that the cognitive and intellectual understanding of sustainability is only weakly associated with individuals or society becoming more sustainable ([Chaplin and Wyton, 2014](C:\\Users\\smitchell\\Desktop\\My Titles\\Ellis 15032-3173\\02 Ellis CE files\\15032-3173-FullBook.docx" \l "Ref_424_FILE150323173015" \o "(AutoLink):Chaplin, G. and Wyton, P. (2014) Student engagement with sustainability: Understanding the value – action gap. International Journal of Sustainability in Higher Education, 15:4, 404–417. UserName - DateTime: a321-7/19/2019 5:07:19 PM)), and [Shrivastava (2010](C:\\Users\\smitchell\\Desktop\\My Titles\\Ellis 15032-3173\\02 Ellis CE files\\15032-3173-FullBook.docx" \l "Ref_454_FILE150323173015" \o "(AutoLink):Shrivastava, P. (2010) Pedagogy of passion for sustainability. Academy of Management Learning & Education, 9:3, 443–455. UserName - DateTime: a321-7/19/2019 5:07:34 PM)) calls on SE to seriously contend with this basic fact. These so called ‘knowledge-action’ gaps and ‘value-action’ gaps appear to be particularly prevalent in matters concerning the environment and are the subject of substantial research and debate amongst psychologists (e.g. cognitive dissonance theory) and more recently social scientists (e.g. social practice theory). From this research, it is possible to glean the conditions under which behaviour change may take place but not the predictors of change. Most, however, would agree that whilst cognitive education is necessary for changing human behaviour, it is not sufficient and that there also needs to be a personal emotional engagement ([Fear et al., 2006](C:\\Users\\smitchell\\Desktop\\My Titles\\Ellis 15032-3173\\02 Ellis CE files\\15032-3173-FullBook.docx" \l "Ref_427_FILE150323173015" \o "(ManLink):Fear, F.A., Rosaen, C.L. and Bawden, R.J. (2006) Coming to critical engagement: An autoethnographic exploration. Lanham: University Press of America. UserName - DateTime: a321-7/19/2019 5:45:30 PM); [Biesta, 2010](C:\\Users\\smitchell\\Desktop\\My Titles\\Ellis 15032-3173\\02 Ellis CE files\\15032-3173-FullBook.docx" \l "Ref_421_FILE150323173015" \o "(AutoLink):Biesta, G.J. (2010) Why ‘what works’ still won’t work: From evidence-based education to value-based education. Studies in Philosophy and Education, 29:5, 491–503. UserName - DateTime: a321-7/19/2019 5:07:17 PM); [Shrivastava, 2010](C:\\Users\\smitchell\\Desktop\\My Titles\\Ellis 15032-3173\\02 Ellis CE files\\15032-3173-FullBook.docx" \l "Ref_454_FILE150323173015" \o "(AutoLink):Shrivastava, P. (2010) Pedagogy of passion for sustainability. Academy of Management Learning & Education, 9:3, 443–455. UserName - DateTime: a321-7/19/2019 5:07:34 PM)). In a similar vein, [Kreber (2012](C:\\Users\\smitchell\\Desktop\\My Titles\\Ellis 15032-3173\\02 Ellis CE files\\15032-3173-FullBook.docx" \l "Ref_438_FILE150323173015" \o "(AutoLink):Kreber, C. (2012) Critical reflection and transformative learning. The handbook of transformative learning: Theory, research, and practice. London: Wiley UserName - DateTime: a321-7/19/2019 5:07:25 PM)) contends that whilst critical thinking and reflection are essential pre-requisites for transformational learning (within which action and change are implicit), these cognitive traits are also, on their own, insufficient. Critical thinking and reflection are widely and positively promoted in all higher education ([Pithers and Soden, 2000](C:\\Users\\smitchell\\Desktop\\My Titles\\Ellis 15032-3173\\02 Ellis CE files\\15032-3173-FullBook.docx" \l "Ref_447_FILE150323173015" \o "(AutoLink):Pithers, R.T. and Soden, R. (2000) Critical thinking in education: A review. Educational research, 42:3, 237–249. UserName - DateTime: a321-7/19/2019 5:07:30 PM)), not only SE, but in SE they are applied towards a specific outcome – sustainability.

[Rogers (1994](C:\\Users\\smitchell\\Desktop\\My Titles\\Ellis 15032-3173\\02 Ellis CE files\\15032-3173-FullBook.docx" \l "Ref_450_FILE150323173015" \o "(AutoLink):Rogers, M.E. (1994) Learning about Global Futures: An Exploration of Learning Processes an Changes in Adults. DEd thesis. Toronto: University of Toronto. UserName - DateTime: a321-7/19/2019 5:07:31 PM)), [Hicks (2002](C:\\Users\\smitchell\\Desktop\\My Titles\\Ellis 15032-3173\\02 Ellis CE files\\15032-3173-FullBook.docx" \l "Ref_434_FILE150323173015" \o "(AutoLink):Hicks, D. (2002) Lessons for the future: The missing dimension in education. London: Routledge. UserName - DateTime: a321-7/19/2019 5:07:23 PM)) and others emphasise the importance of non-cognitive dimensions of learning: affective, existential, empowerment and action dimensions for what is described by [Dettmer (2005](C:\\Users\\smitchell\\Desktop\\My Titles\\Ellis 15032-3173\\02 Ellis CE files\\15032-3173-FullBook.docx" \l "Ref_426_FILE150323173015" \o "(AutoLink):Dettmer, P. (2005) New blooms in established fields: Four domains of learning and doing. Roeper Review, 28:2, 70–78. UserName - DateTime: a321-7/19/2019 5:07:19 PM)) and [Sipos et al. (2008](C:\\Users\\smitchell\\Desktop\\My Titles\\Ellis 15032-3173\\02 Ellis CE files\\15032-3173-FullBook.docx" \l "Ref_455_FILE150323173015" \o "(AutoLink):Sipos, Y., Battisti, B. and Grimm, K. (2008), Achieving transformative sustainability learning: engaging head, hands and heart. International Journal of Sustainability in Higher Education, 9:1, 68–86. UserName - DateTime: a321-7/19/2019 5:07:34 PM)) as transformational sustainability learning (TSL). In shorthand this holistic learning is often referred to as learning with ‘the head, the heart and the hands’ and corresponds to the cognitive (head), psychomotor (hands) and affective (heart) domains of learning. For [Dettmer (2005](C:\\Users\\smitchell\\Desktop\\My Titles\\Ellis 15032-3173\\02 Ellis CE files\\15032-3173-FullBook.docx" \l "Ref_426_FILE150323173015" \o "(AutoLink):Dettmer, P. (2005) New blooms in established fields: Four domains of learning and doing. Roeper Review, 28:2, 70–78. UserName - DateTime: a321-7/19/2019 5:07:19 PM)), the purpose of learning beyond the conventional cognitive domain is to bring about personal change in the learner, and Sipos [et al. (2008](file:///C:\Users\smitchell\Desktop\My%20Titles\Ellis%2015032-3173\02%20Ellis%20CE%20files\15032-3173-FullBook.docx#Ref_455_FILE150323173015)) go further, citing personal and societal transformations to sustainability.

While universities grapple with the challenges of delivering education for sustainability which is holistic, at least at the level of an individual student, the application of Bhaskar’s transformational model of social action (TMSA) reveals they are not currently holistic individually or collectively. Bhaskar’s TMSA model focuses on the ways in which specific societal practices (e.g. the society of an academic institution) are enabled and constrained by the societal positions that people and agents occupy. It notes that society is a collection of practices, structures and conventions capable of creating emergent properties (a concept also found in systems theory) and material effects, dependent upon the action of appropriate practices. It sees actors (e.g. staff) as distinct from structures (e.g. university rules and processes), their capacity to act and impact again dependent upon the positions they occupy, the resources they control (e.g. seniority), etc. If universities, even universe-cities, are to promote universal values, representing universal relevance, such universalized emancipation inevitably entails continuous negotiations between freedom and constraint, evolving justifications of intrinsic worth.

Zooming out to a world scale, policymakers too are consistently seeking ways to use education to create a more sustainable world, a notable example being the inclusion of quality education as one of the UN’s 17 Sustainable Development Goals.

The semiotic design of an MSc in sustainability

Our aim was to develop and deliver a Master’s level course which has, as its explicit goal, the enabling of graduates to become catalysts to inspire and effect change towards sustainability, that is, which will progress a student from ‘firstness to thirdness’ ([Peirce, 1985](C:\\Users\\smitchell\\Desktop\\My Titles\\Ellis 15032-3173\\02 Ellis CE files\\15032-3173-FullBook.docx" \l "Ref_446_FILE150323173015" \o "(AutoLink):Peirce, C. S. (1985) Logic as semiotics: The theory of signs (4–27). In R. E. Innis (eds), Semiotics: An introductory anthology Bloomington: Indiana University Press. UserName - DateTime: a321-7/19/2019 5:07:29 PM)), from an interest, wish or empathy through understanding, having a desire to change, then to gaining the skills and capabilities to change and eventually realising this change. Given the urgent imperative to create a world that is more sustainable than the one currently in prospect, it also had to reconcile the adoption of instrumental (behaviour change) and emancipatory (human development) approaches to sustainability education ([Wals et al., 2008](C:\\Users\\smitchell\\Desktop\\My Titles\\Ellis 15032-3173\\02 Ellis CE files\\15032-3173-FullBook.docx" \l "Ref_461_FILE150323173015" \o "(ManLink):Wals, A.E., Geerling-Eijff, F., Hubeek, F., van der Kroon, S. and Vader, J. (2008) All mixed up? Instrumental and emancipatory learning toward a more sustainable world: Considerations for EE policymakers. Applied Environmental Education and Communication, 7:3, 55–65. UserName - DateTime: a321-7/19/2019 5:45:42 PM)), and in practical terms this had to be achieved within the existing modular structures, quality assurance systems and within the existing administrative arrangements and pervading academic context.

The course has been running at Anglia Ruskin University since 2013, with 12–18 students each year and the following data has been extracted from anonymous surveys administered in the first week and mid-way through the course plus unsolicited comments extracted from assignment reflections. Embracing the concept of holism, students are drawn from a wide range of disciplinary backgrounds, from the natural and social sciences, to disciplines which focus on human actions, such as health and social care, journalism, history and business. Phenomenologically, it is designed as a three-part learning journey along which students first LEARN, that is develop their knowledge in sustainability and their skills to apply this knowledge, EXPERIENCE how others are practically ‘doing’ sustainability and finally move on to PRACTICE, implementing the changes and reflecting upon the impact of this on themselves, each other and the planet.

[Greimas’s (1966](C:\\Users\\smitchell\\Desktop\\My Titles\\Ellis 15032-3173\\02 Ellis CE files\\15032-3173-FullBook.docx" \l "Ref_430_FILE150323173015" \o "(AutoLink):Greimas A.J. (1966) Sémantique structural. Paris: Presse universitaires de France. UserName - DateTime: a321-7/19/2019 5:07:21 PM)) actantial model can be used to theoretically analyse real or thematized action. It structures narratives into six component forces or actants. In Greimas’s terms:

the subject actant will be endowed successively with the modalities of competence, and in this case the ‘subject’ assumes those actantial roles which manifest the subject in terms of wanting, the subject in terms of knowing, and the subject in terms of being able to do, and which then indicate the three states in the acquisition of its modal competence.

([Greimas et al., 1982](C:\\Users\\smitchell\\Desktop\\My Titles\\Ellis 15032-3173\\02 Ellis CE files\\15032-3173-FullBook.docx" \l "Ref_431_FILE150323173015" \o "(ManLink):Greimas, A.J., Courtés, J., Crist, L. and Patte, D. (1982) Semiotics and language: An analytical dictionary. Bloomington: Indiana University Press. UserName - DateTime: a321-7/19/2019 5:45:48 PM): 6)

Figure 15.1 illustrates an actantial analysis of the modalisation of being from a student’s point of view. The Subject/Object line represents desire/virtualisation (want to, have to); the lower horizontal with Helper and Opponent facilitating or hindering progress shows the student’s developing competence/actualisation (be able to, know how to); the top horizontal from Sender to Receiver conveys the cycle of fresh motivation, confirmation, sanction, as the subject acquires new states of performance/realisation (being, doing). Applying the model, (1) the subject (e.g. student) wants/desires or does not want/desire to be joined to (2) an object (e.g. sustainability); (3) the sender (e.g. our present-day sustainability challenges) instigates the action, while (4) the receiver (e.g. people, the planet) benefit from it; (5) a helper (for example, the MSc sustainability) helps to accomplish the action, while (6) an opponent (the current education system) hinders it. Table 15.2 provides evidence from individual students, influenced, motivated or mandated, progressing from desire/virtuality to competence/actuality and performance/reality.

[Insert 15032-3173–015-Figure-001 Here]

Figure 15.1 Greimas’s actant analysis: sustainability

Greimas and students’ learning journey

Firstness – want to, have to

This course invariably recruits students who have a deep emotional connection to sustainability, albeit often developed within a reductionist cognitive, knowledge-based experience of higher education (Table 15.1, columns 1/2). For some it is an opportunity to alter their career path to one which more closely aligns with their values and belief systems, and many feel they will achieve this by ‘learning more about sustainability’. Students gain a critical understanding of the conceptual frameworks of sustainability but also of SE, so that not only what they are being taught but also how and why they are learning becomes an explicit part of their developing knowledge system. Their habituation, however, is displayed by feedback such as ‘The lectures themselves were wonderful, but for me there was far too much “introductory” talking around them’ (Student A, 2016).

An interdisciplinary systems approach persistently and consistently emphasises the interconnectedness and emergent properties of all that they learn, and they reflect on the impact of this knowledge on them as individuals. In a questionnaire survey after week 1 of the course, all students acknowledge that ‘You cannot study sustainability without engaging with a range of subjects’, and even, ‘I enjoy looking at the interaction between different systems’. No one has agreed with the question, ‘I would prefer to study specific topics one at a time’, suggesting that they are at least accepting of the approach, although 40% admit ‘I am less confident with some subject areas than others’.

Secondness – know how to, be able to

During the second trimester, students are immersed in a very different learning environment and learning style, and learning often takes place within the affective and sensorimotor domains of [Dettmer (2005](C:\\Users\\smitchell\\Desktop\\My Titles\\Ellis 15032-3173\\02 Ellis CE files\\15032-3173-FullBook.docx" \l "Ref_426_FILE150323173015" \o "(AutoLink):Dettmer, P. (2005) New blooms in established fields: Four domains of learning and doing. Roeper Review, 28:2, 70–78. UserName - DateTime: a321-7/19/2019 5:07:19 PM)). There is an emphasis on the experiential exploration of narratives and the subjective, contested and emotional responses they educe rather than on rational and evidence-based justification. Learning activities are intended to create a personal and emotional connection with the possibility of transformation. The terms, ‘inspiring and brilliant ’ are often used to describe their feelings about this experience, and whilst all are at least both accepting and valuing the learning style, a small minority (6%) question the ‘academic content’ of these residentials, indicating a continued expectation of instructivist cognitive learning (Table 15.2, column 2).

Thirdness – being, doing

The Work Placement and Major Project Modules which run in the final trimester have been designed to provide an opportunity for students to apply or ‘practice’ the knowledge and skills they have gained in the rest of the course. Their reflection on their work and research practice is assessed synoptically.

The formal assessment for the work placement module requires students to reflect on how the course has prepared them for their personal practice as a catalyst of change. This assignment also provides a useful insight into the way that the course’s various learning approaches impact students. Comments (see Table 15.2, column 3) demonstrate that they have built their confidence in a systems approach and are intending to utilise this in their future careers. For example, one describes how she consolidated her learning from the course during her placement:

I have moved myself to the next level as I believe this experience has strengthened my ability to think more holistically. I already held theoretical understanding of being a systems thinker. . . . However, this experience enriched me with real world understanding.

(Student B, 2015)

Student C (2015) references her learning in a professional context, noting that

I have developed my ability to think in systems in a professional capacity greatly during this placement. This is in many ways due to the achievement of my first objective, which caused me to think in systems whilst completing the sustainability audit.

Students’ reflections also provide evidence that this course is creating agency for change (Table 15.2, column 4). For example, Student D (2015) writes simply, ‘I love the authority that doing this MSc has given me’ whilst Student E (2017) provides more detail, describing how:

Overall this work placement has been immensely positive and enriching in terms of both my professional and personal progression. On both accounts it has forced me to step outside of my normal realms of comfort, the results of which have often surprised me.

The personal dimension of the learning is also expressed by Student G (2016), who describes how the course ‘has been an extremely valuable experience, not only in terms of the development of my skillset, but also in showing me that work can be aligned with your values, have purpose and be a further expression of who you are’*.*

This journey continues beyond the course, with 85% of graduates continuing to practice the knowledge and skills they developed during the course (Table 15.2, column 5).

Table 15.2 Student reflections on their journey from ‘oneness to thirdness’

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Desire/Virtuality | | Competence/Actuality | Performance/Reality | |
| 1 Want to | 2 Have to | 3 Know how to/be able to | 4 Being | 5 Doing |
| *‘Sustainability has played a major part in my life in the last couple of years. It all started in 2015 when* . . .*’*  *‘nurture my*  *personal integrity and develop a career integrated with what I am passionate about’* | *‘living in a country*  *where sustainability is, more often than not, viewed as an afterthought ‘*  *‘expertise to start a meaningful*  *career in the sustainability sector, helping to*  *tackle some of the challenges we face as a society’*  *‘my duty to be a good example’* | *‘this experience has strengthened my ability to think more holistically’.*  *‘I have developed my ability to think in systems’*  *‘ . . .  . lots of dots started joining up* . . . *’* | *‘This course has showed me that work can be aligned with your values, have purpose and be a further expression of who you are’*  *‘it has forced me to step outside of my normal realms of comfort, the results of which have often surprised me’*  *‘This course has helped me to believe in myself again and get back to doing what I love’* | *‘I am using what I learned in the MSc sustainability in the practitioner’s guide’*  *‘I am using the approaches I learned to change the provision of person-centred care’*  *‘I am helping businesses by rediscovering purpose’* |

Conclusions

The previous account demonstrates that it is possible to deliver the holistic learning experience necessary for sustainability within a ‘conventional’ discipline-based higher education system by using systems thinking and an underpinning critical realism philosophy to support students into becoming interdisciplinary/transdisciplinary thinkers and developing a holistic and systemic worldview. In so doing, we effectively overcome the constraints of intellectual (disciplinary) and administrative (modular) silos.

A learning journey provides a useful metaphor to indicate and signpost changes from firstness to thirdness, and there is evidence to suggest that if students are given sufficient support and opportunity for critical reflection, they can overcome their habituation in reductionist thinking.

Critical realism, which argues for ontology and against the epistemic fallacy, helps us place the natural world in reality rather than knowledge of reality. Further, it argues for an interconnected and structured ontology, that is, an open system where mechanisms and structures operate and interconnect without the constant conjunctions of the experimental context ([Bhaskar, 1975](C:\\Users\\smitchell\\Desktop\\My Titles\\Ellis 15032-3173\\02 Ellis CE files\\15032-3173-FullBook.docx" \l "Ref_416_FILE150323173015" \o "(AutoLink):Bhaskar, R. (1975) A Realist Theory of Science. Leeds: Leeds Books. UserName - DateTime: a321-7/19/2019 5:07:14 PM)). This is essential because the serious and urgent problems we face are invariably widely open, inter-woven and multi-dimensionally complex systems and transcend the reductionist and partial approaches of many disciplinary-based education systems.

Universities themselves are large complex systems where the forces resisting change in ways of thinking and doing are extremely powerful. UK universities are currently struggling to navigate a complex policy environment and the commodification of education which is strangling the purpose of higher education. Systems thinking and critical realism may also be a useful approach for universities to return to becoming places to think and be.

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