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Walter Leal Filho
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The Contribution of Social Sciences to Sustainable Development at Universities

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The Contribution of Social Sciences to Sustainable Development at Universities

Springer

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Preface

Institutions of higher education have been among the leading places where sustainability is promoted on campus and beyond. For example, universities and colleges have been on the forefront of embracing green building design and adopting technological innovations to reduce their ecological footprint. As suggested by these examples, higher education institutions' efforts to transition toward sustainability have been largely dominated by natural science and engineering-based approaches. Consistent with the broader sustainability movement, however, universities and colleges are beginning to recognize that this is not enough and that the transition to sustainability cannot be achieved without attention to the human dimension. Administrators, campus sustainability, and other university staff, faculty members, students, alumni as well as external constituents all play roles in which sustainability innovations and initiatives are considered and pursued, how they are implemented, and through their behaviors or participation (or lack thereof), determine the ultimate success of sustainability efforts.

The social sciences, with their focus on human behavior and interactions, therefore have an important role to play in understanding and overcoming the sustainability challenges confronting universities and colleges. Yet, in our experience, relatively little is known about just what role the social sciences can play to help higher education institutions transition to sustainability or their role is fraught with misperceptions. As such, we believe the potential contributions of the social sciences to advancing campus sustainability are currently not being optimized.

The goal of this book, to the best of our knowledge the first on this topic, is to address what we perceive as some of the challenges to the greater use of the social sciences to advance the sustainability goals and efforts of higher education institutions. The chapters introduce readers to different, relevant theories from a range of basic and applied social science disciplines and illustrate how these can be applied to a variety of sustainability challenges confronting higher education campuses. Moreover, we asked the authors to avoid the use of disciplinary jargon which has traditionally made much of social science research inaccessible to non-experts, and they delivered! In light of this, readers should find the book's content comprehensible and "user-friendly."

Readers will gain a sense of the breath of the social science disciplines that can contribute to advancing campus sustainability efforts, of the types of questions that

the respective social science disciplines focus on and thus, the types of campus sustainability challenges they can help to address, the methods these scientists use, and the many and various types of contributions the social sciences can make to developing, implementing, and evaluating campus sustainability initiatives.

This book is structured in two parts. Part I presents an overview of theoretical frameworks and analyses. It outlines some of the issues concerning campus sustainable development research, the links with internationalization of higher education institutions and fostering of competences, among other issues.

Part II introduces a set of projects and case studies on social sciences and sustainable development at universities, including on assessing resources and dynamic capabilities to implement the projects and aspects of community-specific sustainability initiatives, and takes a look at obstacles to curriculum greening. It also introduces a case study on changing energy behavior through community-based social marketing.

We thank the authors for their willingness to share their knowledge, know-how, and experiences and hope that the content gathered here supports current and future efforts toward realizing the potential of the social sciences in advancing sustainable development on campuses across the globe.

Enjoy your reading!

Winter 2015/2016

Walter Leal Filho
Michaela Zint

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Part I
Theoretical Frameworks and Analyses

Rethinking Education for Sustainable Development: Interdisciplinarity, Community and Environmental Justice

P. Kolenick

Abstract

As a perspective on education for sustainable development at universities, the purpose of this Chapter is to explore a reconceptualization of education for sustainable development through Stephen Sterling's conceptions of education as an agent of change, and alternatively, as a subject of change. This study is a personal point of view that is speculative and limited to sustainability programs and curricula at Canadian universities with implications for the role of education for sustainable development within the realm of the prospective contribution of the social sciences to the study and practice of sustainability.

Keywords

Education for sustainable development (ESD) · Sustainability transition · Higher education · Interdisciplinary education · Community engaged learning · Social justice · Environmental justice · Regional centres of expertise (RCE)

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1 Introduction

In this Chapter the potential of Education for Sustainable Development—a term popularized over the past several decades by agencies such as the United Nations Educational, Scientific and Cultural Organization (UNESCO)—will be considered as a significant part of the prospective contribution of the social sciences at universities, as institutions of higher education, toward the transition to the sustainable campus of the twenty-first century. As a perspective on education for sustainable development at universities, the purpose of this Chapter is essentially to "rethink" education for sustainable development, within the realm of the social sciences and their potential contribution to the sustainable campus, through Stephen Sterling's (2003) argument that the common perception of education as an "agent" of change that has been maintained over several decades must shift paradigmatically to the notion of education itself as a "subject" of change if indeed a transition toward the sustainable campus is to take place. The nature of this study is one of a personal point of view that is speculative and limited to sustainability programs and curricula at Canadian universities with implications, however, for universities worldwide.

This shift in thinking about the very nature of education in the field of sustainability is linked and associated closely with the orientation of this particular volume, with its aim on social science theory, models, and findings through a diversity of perspectives and research conducted worldwide. One may draw, however, upon a wide range of literature in the field of the social sciences and sustainability in higher education, which includes, for example: the state of the sustainability movement in universities and society at large (Tovey 2009); preparation of prospective university graduates on issues of sustainability (Roberts 2013; Sibbel 2009; Thomas and Day 2014); development of interdisciplinary sustainability curricula and the integration of sustainability in teaching, research and the operational practice at higher education institutions, (Barth 2013; O'Rafferty et al. 2014; Stubbs and Schapper 2011); professional development in sustainability of academics at universities (Holdsworth et al. 2008); roles of faculty and staff in achieving campus sustainability (Brinkhurst et al. 2011); perceptions of students and faculty of sustainability as part of an interdisciplinary framework (Mobley et al. 2014); the potential of transformative learning (Singleton 2015); and, systems thinking in curricula to foster learning in sustainability (Habron et al. 2012). In each, if not all, of these areas of study, an educative process is conceivably taking place. As such, the broader aim of this Chapter is to explore the potential contribution of education for sustainable development, or sustainability education, within the realm of the social sciences in the transition toward the sustainable campus.

Over a decade ago, Becker and Jahn (1999) compiled a collection of cross-disciplinary perspectives of the social sciences on sustainability—similar to the work compiled in this volume. In his contribution, Michael Redclift shared an observation of how sustainability as a concept has been informed by the natural sciences as manifested, for example, by the Intergovernmental Panel on Climate Change (IPCC) with its emphasis on "good science" that is rigorous, reliable, and

objective, and further, "timeless and placeless, in some sense independent of human intervention, waiting, as it were, to be discovered" (Redclift 1999, p. 268); the natural sciences are, however, viewed in contrast to the social sciences which are "pluralist in conception" and not "'timeless' or 'placeless,' but closely identified with particular times and places" (Redclift 1999, p. 268). More recent scholarship has looked to the theoretical development and practice of sustainability in higher education. Jones et al. (2010), for example, consider the interdisciplinary study of sustainability, international trends, as well as sustainability from a variety of disciplines and professions including: geography, business studies, nursing, law, the fine arts, theology, social work, and teacher education among others; further recent volumes include Johnston's (2013) *Higher Education for Sustainability: Cases, Challenges, and Opportunities from Across the Curriculum*, and notably, Barth's (2015) *Implementing Sustainability in Higher Education,* which raises issues of the role of Higher Education in Education for Sustainable Development with a focus on the important question of how universities can equip learners with the skills and capabilities necessary to make significant contributions to a truly sustainable future. In addition, however, Barth asks a more fundamental question of how curricula itself needs to change in order to facilitate transitions toward the sustainable campus —a question considered in this Chapter.

2 Sustainable Development at Universities: Three Positions

The prospective contribution of the social sciences to sustainable development, and particularly education for sustainable development, can be found through the interdisciplinary programs and community engagement among Canadian universities, for example, in light of recent initiatives such as the United Nations University Regional Centres of Expertise (RCE) on Education for Sustainable Development as part of the Decade of Education for Sustainable Development (DESD), 2005–2014 (UNU-IAS 2013a). As a unique contribution of the social sciences to sustainable development at universities, education for sustainable development (ESD) has a prospective role in furthering global transitions toward the goal of sustainable living for future generations, with immediate implications for issues of the natural environment, yet also for issues of social and environmental justice, such as poverty, the marginalization of women, and North/South inequalities. This role, however, dates back, following the Brundtland Report (WCED 1987), to Agenda 21 (Chap. 36) of the Rio Declaration on Environment and Development (1992), which called for the promotion of education, public awareness and training, as critical "for improving the capacity of the people to address environment and development issues" (UNSD 1992)—a milestone declaration accompanied by a series of international declarations and charters, relevant especially for the promotion of sustainable development at universities, such as the Talloires Declaration (1990), the Copernicus Charter (1994), and the Ubuntu Declaration (2002) (IISD 1996; UNU-IAS 2013b).

Looking toward the future, universities as institutions of higher education have a potential leadership role to play in moving humanity from a position of business as usual based on high consumerism, and the continuing depletion of natural resources, to a transition of living sustainably within planetary limits (Sterling and Maxey 2013b, p. 304). The concept of a sustainability transition is characterized as long-term and multi-dimensional, involving "fundamental transformation processes through which established socio-technical systems shift to more sustainable modes of production and consumption," noted historically through "socio-technical" transitions, for example, of pipe-based water supply, or the shift from carriages to automobiles (Markard et al. 2012, p. 956). In light of the warning among scientists worldwide of the impending geographical, social and economic effects of climate change this century (IPCC 2014), arguably a global transition in energy supply needs to take place from a worldwide dependence on fossil fuels (e.g., coal, oil, natural gas) to the advancement of alternative sources of energy, such as wind and solar power. The potential contribution of universities toward the advancement of a societal and global sustainability transition will be considered in this Chapter, particularly through interdisciplinary and community-engaged curricula with implications for issues of social and environmental justice.

2.1 Sustainability Programs at Canadian Universities

There are at least five identifiable aspects of universities that may be considered as part of the contribution that can be made toward the transition to sustainability within societal and global contexts. These aspects include initiatives undertaken in the areas of governance, operations, research, curricula, and community engagement. The Rio+20 Declaration of 2012 for Higher Education notes several prospective commitments, such as the operational "greening" of campus facilities including, for example, the adoption of sustainable procurement practices, sustainable mobility options for students and faculty, programmes for waste minimization, recycling and reuse, as well as curricula that integrates sustainable development concepts, and the direction of research on issues of sustainability through a sharing of scientific and technological knowledge (UNCSD 2011). Significantly, these initiatives are reflected in the study of sustainable development and sustainability in higher education, which has also drawn attention to aspects of the governance, or formal administration, of sustainability programs (e.g., campus greening, energy efficiency, recycling), research focused on topics of sustainability (e.g., climate change, water management), as well as the development of integrated or interdisciplinary curricula, and engagement with communities for the design of sustainable programs and practices (Vaughter et al. 2013, p. 2253).

An informal, limited and non-exhaustive review of sustainable development, or sustainability, programs among Canadian universities through the Association of Universities and Colleges of Canada (AUCC 2014) reveals a commitment generally to "greening" programs for facilities and operations (e.g., energy efficiency, waste

management, transportation), and other aspects included with less frequency, such as governance, for example, as well as the development of interdisciplinary curricula, collaborative research programs, and opportunities for engagement with communities. The governance of sustainability programs is undertaken through administrative bodies, such as the Office of Sustainability at the University of Alberta, which is organized by a three-tiered program of planning across facilities and operations, teaching and research, as well as engagement with faculty, students, and communities (University of Alberta 2014a). In addition to the administrative offices responsible for sustainability programs and research on campus, Canadian universities rely upon policies and strategies to mark out their responsibilities, such as the Sustainability Academic Strategy at the University of British Columbia, which is defined in part through its responsibility to explore various facets of sustainability through research and curricula across disciplines and fields of study in the humanities, social sciences, natural and applied science, and the medical and health fields (University of British Columbia 2014b). Among the other aspects of sustainability, however, the development of interdisciplinary curricula is particularly illustrative of the work underway at Canadian universities, even though there exist wide variations from degree programs with courses that touch upon concepts of sustainable development, or sustainability, to entire faculties or colleges with programs devoted especially to the study of sustainability as it applies integratively to a wide range of disciplines and professional practices (Table 1).

Regardless of the curricula in place, however, the impact of various programs in sustainable development, or sustainability, at universities is determined arguably to a considerable degree by the mindset, thinking, or positioning of those programs. Three positions—status quo, reform, and transformative—may be applied toward an understanding of the place of education for sustainable development within the context of the university as an institution of higher education (Hopwood et al. 2005), combined with Gregory Bateson's (1972) three orders of learning and change (as cited in Sterling 2003, 2011).

2.2 The Status-Quo and Reform Positions

Supporters of the status quo (or conformist) position recognize the need for change but see neither the environment nor society as facing insurmountable problems. Sustainability, as a goal, may be attained relatively easily through increased information and awareness, combined with an unquestioned deference to improved management techniques and technologies (Hopwood et al. 2005, p. 13). Educationally, this position is reflective of an adaptive or "bolt-on" response where, for example, new modules or courses may be added, or campus greening is carried out without fundamental change to the strategies, operations and programs of universities (Sterling 2003, p. 282). In terms of learning, the status quo position is perhaps on par, and a good match with Bateson's first-order level of learning and change. First-order learning is essentially about doing more of the same; that is, "change

Table 1 Sample sustainability curricula descriptions at Canadian universities

University	Sample description
Dalhousie University	College of Sustainability—first and second year components of the ESS (Environment, Sustainability And Society) program are integrated, multidisciplinary and team-taught by faculty members across all seven Dalhousie faculties (http://www.dal.ca/faculty/sustainability.html)
Simon Fraser University	Faculty of Environment—an interdisciplinary program offering a range of issues including aboriginal and archaeological origins of society, human and physical geography, environmental management and resources issues, business and sustainability, and more (http://www.sfu.ca/fenv.html)
University of Alberta	A range of options for studying and researching sustainability is offered through degree programs (e.g., Environmental Studies, Forest Business Management, Resource Economics and Environmental Sociology) (http://www.sustainability.ualberta.ca/en/EducationResearch.aspx)
University of British Columbia	Sustainability courses either concentrate on the concept of sustainability, including its environmental, social and economic dimensions, or incorporate one or more aspects of sustainability as a distinct course component, unit, module, challenge or activity (http://sustain.ubc.ca/courses-teaching/degree-programs)
University of Calgary	Undergraduate and graduate degree programs are offered with sustainability-focused (core) courses focusing on the concept of sustainability, and sustainability-related courses incorporating sustainability as a distinct course component or module, that may concentrate on a single sustainability principle or issue (http://www.ucalgary.ca/sustainability/courses)
University of Saskatchewan	School of Environment and Sustainability—interdisciplinary, problem-oriented and experience-based graduate and undergraduate learning for issues of environment and sustainability, with research focused on sustainable ecosystems, sustainable communities, and water security (http://www.usask.ca/sens/)
University of Victoria	Sustainability is incorporated into curriculum and experiential learning to train tomorrow's leaders to address complex interdisciplinary challenges of sustainability and climate change (http://www.uvic.ca/sustainability/education/index.php)
University of Waterloo	The School of Environment, Enterprise and Development—focused on the intersection of environment and sustainability with business and development (https://uwaterloo.ca/environment/)
Western University	The Centre for Environment and Sustainability—an interdisciplinary initiative supported by the Faculty of Science (host faculty), Faculty of Engineering and Faculty of Social Science, and other contributing faculties (http://www.uwo.ca/enviro/)
York University	Faculty of Environmental Studies—directed toward interdisciplinary, analytical, and collaborative research, education and action on critical and changing environmental issues (http://fes.yorku.ca/)

within particular boundaries and without examining or changing the assumptions or values that inform what you are doing or thinking" (Sterling 2011, p. 22). This type of learning is concerned primarily with information transfer, or learning about things, occurring in "likely subjects" like biology or geography in various faculties and departments across university campuses. Consequently, this approach to learning and change tends not to challenge the beliefs or assumptions of the learner (Sterling 2013, p. 35); that is, "higher education is not primarily engaged in the provision of deep learning to students, but in first-order learning: the transmission of information and the development of instrumental skills aligned (increasingly) to the perceived needs of the economy" (Sterling 2004, p. 51). Notably, the status quo position is distinguished as having a minimal effect on universities, as well as on the values and thinking of faculty members and students, in which the "take-up" of sustainability concepts is piecemeal and largely disconnected. As Sterling (2003, p. 285) concedes, however, while a long way from leading faculties and students to sustainable living, it is "better than nothing," and can open the doors of universities to more fundamental change.

The reform position offers a "building-in" or an integration of sustainability concepts and practices, where existing assumptions may begin to be questioned with the potential for meaningful changes in policy and curricula. Like the status quo position, the focus is on technology, good science and the dissemination of information, and is dominated by academics and mainstream non-governmental organizations (Hopwood et al. 2005, p. 17). This position is unique in that it is directed toward "learning for change" with the explicit understanding that "the necessary values, knowledge and skills are known and can be taught" (Sterling 2003, p. 285). Reform is essentially the modus operandi of education for sustainable development, which looks to sustainable development in its relation to disciplines within a university setting as not "added to an overcrowded curriculum, but a gateway to a different view of curriculum, of pedagogy, of organisational change, of policy and particularly of ethos" (Sterling 2004, p. 50). In terms of Bateson's levels of learning and change, the reform position corresponds to his second-order learning, which is deemed as "more challenging and involves the learner (or learning organization) critically examining, and if necessary changing, his/her/its beliefs, values and assumptions" (Sterling 2011, p. 23). While first-order learning and change is directed toward "doing things better" (i.e., with more efficiency and effectiveness), second-order learning is more concerned with "doing better things"—that is, this mode of learning raises questions about purposes and values. Efficiency and effectiveness—yes, but to what end? (2011, p. 23).

Through the reform position and its correlate of second-order learning, the notion of interdisciplinary learning in particular has potential as a way for the social sciences to contribute to sustainable development at universities. Notably, the interdisciplinary approach to curricula lends itself well to problem-based inquiry, which requires multiple perspectives, "as no one discipline will suffice to capture social, cultural, regulatory, technological, scientific, economic and ecological dimensions of lived experience" (Stefanovic 2008, p. 423). Whether it is through, for example, multidisciplinarity (i.e., investigating educational phenomena from

multiple disciplines), cross-disciplinarity (i.e., an extension of one discipline into the area of another, as in business ethics), or perhaps transdisciplinarity (i.e., an application of perspectives across disciplines that transcends the disciplinary organization), an interdisciplinary approach to curricula, in general, places at premium the importance of demonstrating to students that issues of sustainability require "broad consultations," and further, a firm grounding in problem-based approaches to inquiry of social and environmental issues (Esbjörn-Hargens 2010, p. 73; Stefanovic 2008, p. 424). Taken from an interdisciplinary, or integral, point of view, education and learning are unmistakably multidimensional as "we need to include the insights and truths from a myriad of perspectives as they all have something to offer a more complete understanding of any topic or phenomena" (Esbjörn-Hargens et al. 2010, p. 5). If universities are to play a role in the leadership toward transitions of sustainability in the twenty-first century, then they "need to find ways to facilitate interdisciplinary efforts that draw on the strengths of many different disciplines, allowing them to combine and integrate their knowledge around specific sustainability challenges" (Matson 2009, p. 41). A few universities in Canada (see Table 1, above), for example, have developed interdisciplinary programs in the form of schools or colleges directed toward problem solving, as well as institutions set up with the purpose of housing multiple disciplines for the study of sustainable development. These endeavours provide opportunities not only for the bringing together of various disciplines, but also the emergence of an envisioned approach to sustainable development, as indicated in the Copernicus Guidelines for Sustainable Development (2005) for the development of interdisciplinary curricula (and research). This vision, however, is reinforced by the promotion of networking (i.e., promoting interdisciplinary networks of environmental experts at the local, national, regional and international levels, with the aim of collaborating on projects both curricula and research), and further, partnerships (i.e., partnering with communities, government, non-governmental organizations, and others to develop coordinated approaches, strategies and actions) (UNECE 2005).

At Dalhousie University, for example, an interdisciplinary approach is taken while delivered collaboratively by members of various faculties across the campus, including agriculture, agriculture and planning, arts and science, arts and social sciences, computer science, engineering, health professions, management, medicine, and science. Significantly, this view of curricula offers a space for "students to understand the complex real world of sustainability problems from a variety of perspectives and conceptual frameworks" (Dalhousie University 2014), in contrast to the traditional approach to education at universities, which "fragments and sectoralizes information so that one discipline has no understanding of its impact on the other" (Wright 2010, p. 203); that is, "a student graduating with a business degree from the university might understand the financial benefits of oil extraction, but not the full environmental, political, and social ramifications and costs (and vice versa for a student in political science or biology)" (2010, p. 203). In this manner, the interdisciplinary approach to curricula for sustainability education carries the potential toward an understanding of complex and worldly problems related to issues of societal and global sustainability. To its credit, interdisciplinary study

offers up a "transcendence" over individual disciplines that "embraces and extends the ideas of others until the boundaries between 'mine,' 'his' and 'hers' dissolve" (Carson 2007, as cited in Stefanovic 2008, p. 424). In this sense, interdisciplinary education for sustainability takes on an enlarged perspective for bringing scholars and students together in "real world" problem solving.

This perspective can be enhanced potentially through the relationships of universities with outlying communities. Western University, for example, offers a community-learning program designed to engage students, staff, and faculty in "meaningful experiential learning opportunities" that help to meet the needs of communities while promoting a sense of civic engagement, empathy, and social responsibility among students (Western University 2015). Similarly, the community-engaged learning program at the University of British Columbia places students in community settings, such as non-profit organizations or inner city schools, as a required part of academic courses, or as voluntary co-curricular placements (University of British Columbia 2014a). The community-service learning program at the University of Alberta likewise encourages students to "contribute in real ways to community organizations and gain valuable experience at the same time" by incorporating service-learning into academic coursework linked to issues and problems of sustainability (University of Alberta 2014b). Community-engaged, or community-service, learning programs present an opportunity for universities, as institutions of higher education, to venture beyond their normal confines toward a more integrated and community-engaged practice, reminiscent of the African expression, "unbuntu"—meaning, "I am what I am because of who we are" as an "acknowledgement of the significance of community and human interconnectedness" (Thiele 2013, p. 140).

In 2005, the United Nations University announced Regional Centres of Expertise on Education for Sustainable Development as a contribution to the UN Decade on Education for Sustainable Development (2005–2014). Taken within the realm of community-engaged programs of study, the Regional Centres of Expertise offer a space for universities to engage with outlying communities in addressing problems of immediate concern, described in this context as "a meeting point, a clearinghouse, a knowledge broker, and a platform for information exchange and sharing" (Mochizuki and Fadeema 2008, p. 376). The regional focus of the Regional Centres of Expertise is perhaps where they can be potentially the most effective in bringing universities together, at a faculty level, with the interests, concerns, and problems of outlying communities. In this way, RCEs can play a "central role in developing an integrated regional approach to ESD, bringing the best of knowledge from the natural sciences, social sciences and humanities and integrating this knowledge with the best of educational practices of their community and regional partners" (2008, p. 378). Regional Centres of Expertise lend themselves well within universities, as institutions of higher education, as a means of "bridging the gap" between communities, governmental departments, businesses, and other organizations and stakeholders (Keen et al. 2005, in Sedlacek 2013, p. 75), or as van Ginkel observes, "RCEs… create a natural framework for helping higher education institutions to break out of their normal confinement and play a positive, meaningful

role in society" (as cited in Glasser 2008, p. 115). Yet questions can be raised with respect to the inclusivity of Regional Centres of Expertise as offering spaces or platforms within a university setting for dialogue and collaboration on issues of sustainable development that is truly in the spirit of "broad consultations" as suggested from an interdisciplinary, and moreover, a community-engaged point of view.

2.3 Regional Centres of Expertise, Environmental Justice, and the Transformative Position

In considering the prospect of Regional Centres of Expertise as venues of education for sustainable development, Stefanovic (2008, p. 420) refers to recent research that raised concerns of "the lack of integration of ESD with issues of environmental justice." In a survey of a Regional Centre of Expertise located in the city of Toronto, Canada, for example, it was found that issues such as "poverty alleviation" and "peace studies" were not identified by any of the responding organizations as a primary area of focus; in fact, over 80 per cent responded that these concepts were "not a focus" at all (2008, p. 420). In his pioneering work, Bullard (1993) offers this definition of environmental justice as "any policy, practice, or directive that intentionally or unintentionally differentially impacts or disadvantages individuals, groups, or communities based on race or color; as well as exclusionary and restrictive practices that limit participation by people of color in decision-making boards, commissions, and staffs" (as cited in Bowen and Wells 2002, p. 689). In this way, environmentalism is defined and valued in broader terms beyond the preservation of uninhabited wilderness as inclusive of a place where people live, work, play and worship—hence, environmental justice takes into its purview people and their place in the environment, including urban environments. The consideration of issues of justice within the realm of environmentalism requires that the environment be viewed not simply as green spaces and conservation, but more broadly as a place that comprises everyday, social experiences. As Stein (2002, pp. 1–2) observes, "This more inclusive view of human/nature interaction brings environmental issues *home*, so to speak, and makes it clear that environmental injustice includes a range of urban and rural issues that expose poor communities and communities of color to unfair risks and burdens" [italics in original] with attention, for example, to the clear-cutting of forests, the dumping of industrial wastes, water rights and quality, as well as hazardous work (and underemployment), substandard housing and numerous other disadvantages associated with the irresponsible use of the land and ecosystems.

As a concept, environmental justice emphasizes the distribution of responsibilities for issues such as waste disposal and water management, which invariably impact local communities. By definition, however, environmental justice is concerned with the problem of inequity in the distribution of environmental risk, yet further, serves to acknowledge "the diversity of the participants and experiences in

the environmental-justice movement" (Schlosberg 2002, p. 12); and this point is affirmed by critical theorist, Nancy Fraser (1997, p. 12), who notes, "Justice today… requires both redistribution and recognition" (as cited in Schlosberg 2002, p. 13). The significance of the latter aspect is indicated, for example, by Buzzelli (2008, p. 11), who points to a study of a landfill siting in Hamilton, Canada that found "residents were more concerned with their lack of inclusion in the planning process than with more direct environment and health linkages." While environmental justice as recognition, or as a participatory political process, has perhaps not been as readily acknowledged, as Schlosberg (2002) suggests, with most of the attention been given to historical events in protest of the inequitable distribution of environmental responsibilities (e.g., Warren County, North Carolina),[1] the issue of recognition was adopted by the First National People of Color Environmental Leadership Conference in 1991. In this declaration, the recognition of difference and mutual respect, as well as political participation and self-determination are spelled out, for example, as "the right to participate as equal partners at every level of decision making, including needs assessment, planning, implementation, enforcement, and evaluation" (University of Colorado 2015). Yet, significant to the prospect in particular of education for sustainable development at universities, the Principles call for "the education of present and future generations, which emphasizes social and environmental issues, based on our experiences and an appreciation of our diverse cultural perspectives" (University of Colorado 2015). In mind of Stefanovic's (2008) concerns with respect to the lack of integration of education for sustainable development with issues of social and environmental justice, there is potential (and moral imperative) in this field of study for the social sciences to contribute to an interdisciplinary, yet also community-engaged, practice of educating for sustainable development at universities that includes, in particular, the marginalized and dispossessed in a conversation about sustainable development as marked by a diversity of perspectives and worldviews as humanity makes its way into the twenty-first century.

Returning to the positions of sustainable development (Hopwood et al. 2005) in correlation with Bateson's (1972, as cited in Sterling 2011, p. 24) levels of learning and change (Table 2), we are left with the third order of learning and change, which

[1]In 1973, the State of North Carolina made plans to build a landfill for soil contaminated by 31 thousand gallons polychlorinated biphenyl (PCB); the site of the landfill was Shocco, a small town in Warren County that was 75 % African American. Local leaders organized protests against construction of the landfill, and their protests attracted support of civil rights groups across the United States that turned national attention to the issues of institutionalized environmental racism. After several lawsuits, public hearings, and scientific studies, Warren County commissioners reached a compromise with the State government in 1982, with the promise by the North Carolina State government that the landfill would not be expanded and that Warren County would not become a waste county; however, water was later discovered under the landfill, revealing contamination. Finally, in 2003, North Carolina started a program to actively destroy the PCB contamination. (http://sites.duke.edu/docst110s_01_s2011_sb211/what-is-environmental-justice/history/).

Table 2 Levels of learning and change

Orders of change/learning	Seeks/leads to	Can be labeled as
First order change, cognition	Effectiveness/efficiency	"Doing things better"—conformative
Second order change, meta-cognition	Examining and changing assumptions	"Doing better things"—reformative
Third order change, epistemic learning	Paradigm change	"Seeing things"—transformative

is concerned with the notion of transformative learning that requires essentially a shift in thinking, or a paradigm change.[2]

Transformative learning entails a "journey through higher orders of learning" that involves among other attributes a greater challenge or threat to existing beliefs and ideas (i.e., more resistance), more emergent learning, and the achievement of greater flexibility and less rigidity in the development of thought (Sterling 2004, p. 60) that takes educational practice in the field of sustainability potentially beyond the reform position of education as primarily "agent of change" to the notion of education as "subject of change" (Sterling 2003, pp. 22, 48). This is a point that Sterling (2003, p. 237) argues further.

> I have often argued… that the achievement of individual or social change *through* education requires change *in* education…. At one level, this argument is often accepted: what is frequently not appreciated is the depth of cultural change that appears necessary both in society and in education, in the light of the sustainability imperative. The response deemed necessary in education tends to be cosmetic, while the main focus of any attention remains an instrumental and behaviourist "change *through* education," while underlying values and contradictions "*in* education" as a system of interest go largely unexamined and unchallenged. [italics in original]

The question may be raised, however, as to whether the values underlying education for sustainable development have indeed been left unexamined because the structures and processes underlying curricula and its implementation at universities have also been left unexamined and unchallenged; that is, a rethinking, or reconceptualization, of education for sustainable development (or sustainability education) may be dependent on the developmental process in which curricula, for example, takes shape. In other words, educative practice precedes the development of theoretical perspectives and models of sustainability education. Such a process may entail a problem-based approach to questions and issues of sustainability, comprising a shift toward interdisciplinarity—including both natural and social sciences—and necessarily a commitment to engage with outlying communities on problems of direct interest to society. Such an approach to the development of

[2]Sterling (2003, p. 327) proposes the evolutionary (Wilberian) view of paradigm change in concert with Bateson's (1972) levels of learning and change; this is in contrast to Thomas Kuhn's perspective of incommensurable paradigms, where "the partial validity of earlier paradigms becomes lost in a dualistic attempt to distance the advocated paradigm from the old, and prove the validity of the new."

sustainability curricula and programs may include an emphasis on environmental issues normally associated with the natural sciences (e.g., water pollution, soil contamination, wildlife conservation), yet also issues associated with the prospective contribution of the social sciences to sustainable development—that is, a much more comprehensive understanding of sustainable development from an environmental and economic perspective, yet also from a social and cultural point of view in keeping with the United Nations' Rio+20 (2012) Conference, which recognizes the significance of the environmental, economic, social, and cultural dimensions of sustainable development.[3]

3 Conclusion

In this Chapter, the prospective contribution of education for sustainable development has been explored in light of recent developments, for example, of interdisciplinary and community-engaged curricula at Canadian universities. In this endeavour, three positions of sustainability (i.e., status quo, reform, and transformative) have been considered as a way of taking stock of the progress that has been made toward the sustainable campus, and moreover, what further work is required. Among the three positions of sustainability (Hopwood et al. 2005), the reform position is perhaps the most recognizable among sustainability programs at universities, with its emphasis on the integration of sustainability concepts into various disciplinary, and interdisciplinary, programs of study in both the natural and social sciences—the modus operandi of education for sustainable development; however, a further transition toward the sustainable campus may require a transformative approach to sustainability education, characterized by a shift in the way education itself is conceptualized—that is, a shift (as Sterling 2003 argues) from education as an "agent" of change toward education itself as a "subject" of change.

The notion of education as a change agent is reflective of various programs of "education for," such as education for peace, education for HIV awareness, or education for sustainable development. While this approach to learning has its merits in the promotion of awareness and behavioural change, for example, it is not without limitations. Notably, the conception of education for sustainable development "breathes a kind of intellectual exclusivity and determinism that conflicts with ideas of emancipation, local knowledge, democracy and self-determination" (Wals and Jickling 2002, p. 222); and so, an important question may be raised as to how one might deal with "the inevitable tension among the divergence of interests, values, and worldviews on the one hand—and the need for the shared resolution of issues that arise in working on sustainability in higher education on the other" (Wals and Corcoran 2006, p. 103). Although a sense of solidarity, or consensus,

[3]The United Nations' Rio+20 Conference recognized the importance of not endangering the cultural heritage of Indigenous peoples (http://www.unesco.org/new/en/culture/themes/culture-and-development/the-future-we-want-the-role-of-culture/); consequently, the concept of sustainability is now comprised of environmental, economic, social, and cultural dimensions.

may be found through the practice of educating for sustainable development, this is at once an inherent strength, yet also a weakness, especially taken within the context of universities, distinguished by the various disciplines in both the natural and social sciences, as well as outlying communities, characterized by diverse perspectives, worldviews, and material realities.

A transformative approach to education for sustainable development speaks in particular to its reconceptualization among educators at universities in the transition to the sustainable campus. In practice, however, a shift toward transformative learning may entail at the very least an integrative or interdisciplinary curriculum of problem solving, incorporating both the natural and social sciences; further, a transformative practice may also involve the inclusion of diverse ways of knowing and perspectives found among outlying communities. Regional Centres of Expertise of education for sustainable development, for example, may serve potentially as a hub, or platform, upon which interdisciplinary and community-engaged curricula for sustainability education may emerge. As an educative platform, these Centres may serve essentially as a catalyst for the transition toward a sustainable campus marked by a diverse network of perspectives, including those of the natural and environmental sciences, yet further, the social sciences, with implications for the development of curricula (and research) on issues, for instance, of social and environmental justice found in the time and place of unique urban landscapes.

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Sustainable Internationalization? Measuring the Diversity of Internationalization at Higher Education Institutions

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Abstract

Sustainability and internationalization are considered to be core values of Higher Education Institutions (HEIs), but their relationship is rarely investigated. The current study develops a framework to create a sustainable internationalization policy for an HEI; it analyzes how to measure the sustainability of an internationalization policy in two steps. First, this study presents a theoretical framework for a cost-benefit analysis of HEIs' sustainable internationalization policies using three sustainability pillars (economic, ecological, and social), each with examples for their own measurable indicators. Second, this research operationalizes the economic pillar of the framework to enable a specific measurement of the economic sustainability of internationalization. The empirical analysis identifies the distribution of funding for internationalization as a promising indicator. To demonstrate the implementation of this part of the framework, this study analyzes how German HEIs distribute their monetary investments in internationalization activities to countries worldwide. Using data from the German academic exchange service (DAAD), this research investigates the distribution using descriptive statistics. In a second step, the methodology of the Lorenz curve is empirically applied to the distribution of funding. Universität Hamburg is used as a case study to visualize the different funding tendencies

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among German HEIs. The findings suggest that the distribution of resources for internationalization says more about the sustainable character of an HEI than the absolute amount of invested resources. To evaluate the sustainability of an HEI's internationalization strategy, it is therefore necessary to look at the distribution of target countries in addition to the mere absolute level of funding.

Keywords
Internationalization · Sustainability · Lorenz curve · German academic exchange service (DAAD) · Higher education institution (HEI)

1 Introduction

International travel impacts the three key pillars of sustainability—social, economic, and environmental—and is increasingly a supported component of higher education curricula. The current study addresses the overarching problem of how to create a sustainable internationalization strategy for Higher Education Institutions (HEIs). This study proposes a new perspective by measuring the distribution of resources between countries instead of the total amount of investments, thus following a common insight from analyses of income distributions, namely, that more resources do not automatically mean a better quality of life (Gastwirth 1972), but their distribution has to be considered as well. This research expects that bridging the scientific communities interested in both internationalization and sustainability will increase study and reflection on both aspects of campus development.

The introduction of sustainability in HEIs is based on important milestones, such as the United Nations Conference on Environment and Development in Rio de Janeiro in 1992 and the confirmed need for sustainable development in education through the UN Decade of Education for Sustainable Development between 2005 and 2014 (Barth 2013). The concept of sustainability has since been expanded in academia to include on-campus events, extra-curricular activities, and curricula (Leal Filho 2010; Leal Filho et al. 2015), and its study now involves multiple disciplinary perspectives well beyond the environment (Sundsbø et al. 2015). More research on how to extend the concept in this way seems needed, however, as an exploratory survey in the field of internships and sustainability (Hale et al. 2013) has indicated large disparities between sustainability discourse and practice.

New scientific and cultural perspectives derived from educational travel change the minds of future generations, and a majority of authors agree on its *benefits* (Delgado-Márquez et al. 2013; Hale et al. 2013; Paige et al. 2009). Topics covered in the literature on the causes and effects of educational travel as part of an internationalization strategy include pedagogical benefits, intercultural competence, chances and challenges, funding or administrative barriers, and examples of best practices. While qualitative approaches tend to focus on inter-cultural competence or linguistic backgrounds (Fortuijn 2002), quantitative analyses use proxies such as

the number of students or gender distribution (Elkin et al. 2005; Marin 2014; Mitchell 2012; Rodríguez González et al. 2011; Souto-Otero et al. 2013). Some studies have applied both approaches by combining surveys and interviews (Findlay et al. 2006; Otero 2008). Unlike Hale et al. (2013), who frame internationalization as a form of alternative tourism, this research considers internationalization to be a part of an HEI's strategic policies.

The topic of sustainability and educational travel is thus far mostly neglected in the literature [for a review, see Hale et al. (2013)]. Much of the research on the sustainability of HEIs focuses on future plans (Swearingen White 2014) or research outputs (Lozano 2011) but does not mention the HEIs' internationalization strategies. Therefore, this study offers an integrated perspective on the sustainability of HEIs' internationalization programs. In the next section, this study presents a theoretical framework for a cost-benefit analysis of HEIs' sustainable internationalization policies using three sustainability pillars (economic, environmental, and social), each with examples for their own measurable indicators. Following the theoretical section and review, this study presents the theoretical framework for a cost-benefit analysis of sustainable internationalization. This research operationalizes the cost side of the framework and measures the economic sustainability dimension using the distribution of resources for internationalization as an indicator metric for diversity. Universität Hamburg is then used as a case study to visualize different funding tendencies among German HEIs.

2 Framework for a Sustainable Internationalization Strategy

International exchange is considered to be strongly beneficial to the intercultural competence of students and researchers and thus to greater awareness of cultural diversity at HEIs (Little and Cordero 2014). With greater cultural diversity awareness, learning about and appreciating different systems of values, cultural techniques and traditions (including one's own) will likely increase (Hale et al. 2013; World Summit on Sustainable Development 2003). Students and researchers who have taken part in internationalization programs increasingly see themselves as global citizens and develop a sense of responsibility for nature and culture on a global scale: "Cultural diversity guarantees sustainability because it binds universal developmental goals to plausible and specific moral visions" (World Summit on Sustainable Development 2003, 7). Consequently, cultural diversity resulting from internationalization programs is crucial to raising awareness, implementing and prioritizing the concept of sustainability and sustainability-related concerns in HEIs.

However, another line of research has recently focused on the cultural, ecological and economic costs of HEIs' internationalization programs, specifically of educational travel. In particular, in line with the literature on critical tourism, concerns have been raised related to the danger of disrupting local communities (Hale et al. 2013) and the CO_2 emissions associated with travel (Little and Cordero 2014). Additional challenges include the generally high financial cost of

internationalization programs for HEIs (Mitchell 2012; Rodríguez González et al. 2011). However, there is not yet a unified consideration of both costs and benefits due in part to the difficulty of comparison across diverse metrics with uneven units and weighting factors (Barth 2013). Our study aims to contribute to this comparative scheme by proposing a framework for comparison.

The goals of higher welfare and awareness of cultural diversity are included within sustainability-related concerns. To weigh the costs and benefits of different sustainability pillars, this study proposes a framework that allows the recognition of different types of costs and benefits that influence the overall sustainable character of a given HEI's internationalization policy. Though simplistic, the framework in principle allows the assignment of indicators (e.g., number of students participating in the program, invested money and personnel, CO_2 emissions caused) to the various pillars of sustainability that enable empirical measurements of the cost factors that influence the sustainability of an HEI's internationalization program (see Fig. 1). However, measurements of the indicators do not unambiguously translate into costs or benefits. Rather, different dimensions that determine how the indicators are valued and related to each other must be considered. The cost-benefit framework uses an input perspective on where resources are invested and an output perspective on the produced benefits (Layart and Glaister 1994). In between, the international exchange transitions the resources into benefits along the pillars of sustainability.

From the input perspective, the presented framework highlights three standard pillars of sustainability (social, environmental and economic pillars; see Fig. 1) and provides indicators to measure the respective costs (e.g., How many students participated per year in the HEI's program? How much money was spent?). In addition, the framework points to three example dimensions (absolute number, gender and cultural diversity) to assess the benefits of internationalization programs. The list of pillars and dimensions is not exhaustive, and new dimensions or new pillars can be added (e.g., age or social background dimensions and political or human rights pillars). However, the framework is limited here to three pillars and dimensions of HEI internationalization programs as a demonstration of this concept.

A cost-benefit analysis allows for the evaluation of the potential consequences of internationalization policies and offers a possibility to reinforce best practices in HEIs (Layart and Glaister 1994). While the cost-benefit framework is not the only way to account for the sustainability of HEIs, it accords best with both viewing HEIs as organizations (Waheed et al. 2011) and with the desire to bring the distinct approaches in the literature on the benefits and costs of internationalization into a dialogue.

Our framework covers three pillars of sustainability that are operationalized using forms of human, environmental, and economic capital for the internationalization program of a given HEI. The invested human capital can be measured by the amount of people exchanged through the program as well as the staff assigned to it (Marin 2014; Rodríguez González et al. 2011; Souto-Otero et al. 2013). The environmental capital can be measured in terms of the increase in the HEI program's carbon footprint, and the economic capital can be measured by the volume

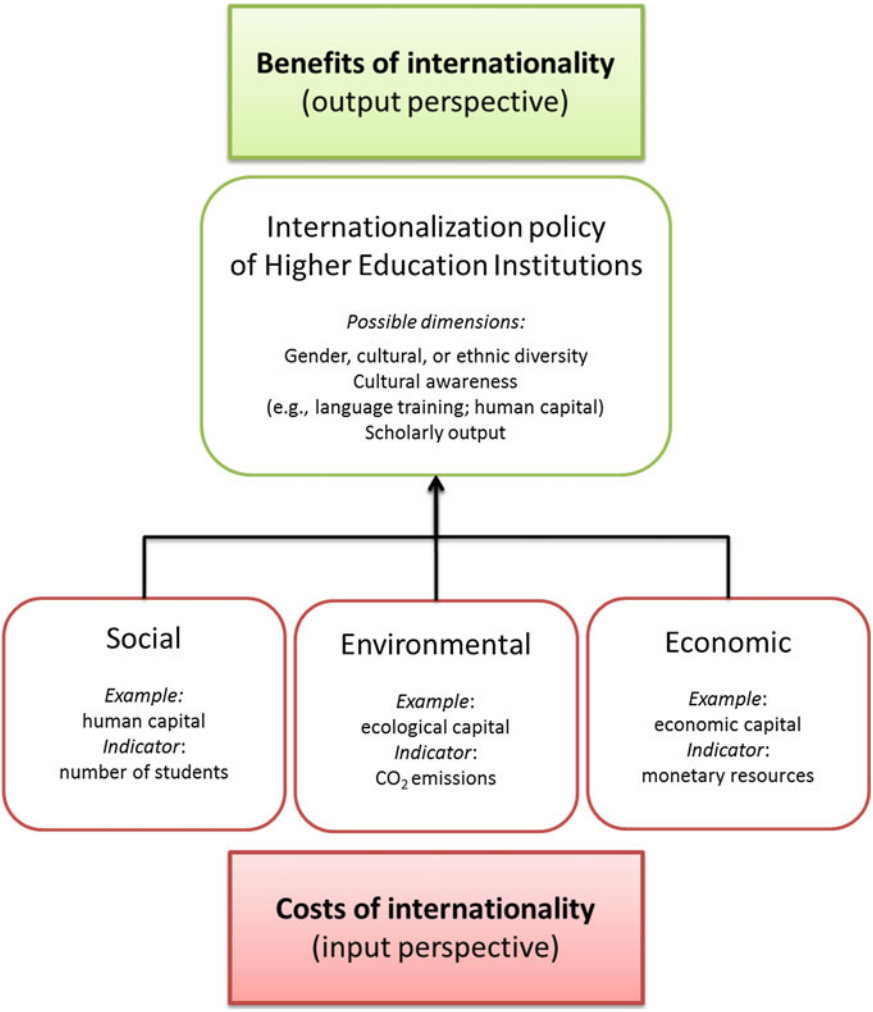

Fig. 1 Framework for a sustainable internationalization policy. Indicators represent measurable proxies of project capital ranging from conceptual dimensions (e.g., cultural diversity) and pillars (e.g., social pillar) to explicitly quantitative observations (e.g., the number of students)

of monetary investment (Souto-Otero et al. 2013). Obviously, these indicators do not measure the three pillars of sustainability comprehensively, but they can be understood as their proxies.

Traditionally, the literature has looked exclusively at absolute numbers of funded students or invested resources (e.g., Marin 2014; Rodríguez González et al. 2011). Given the various metrics of the different dimensions (e.g., gender and cultural diversity), however, this study proposes that the true relation between the costs and merits of an HEI internationalization strategy cannot be determined from the

absolute numbers alone because, as outlined above, a crucial link between internationalization and sustainability rests in cultural diversity (World Summit on Sustainable Development 2003). To assess whether internationalization funding is sustainably spent, it is crucial to look at the distribution of the expenditures. The mix of countries funded is a tool for fostering cultural diversity by an internationalization program. Increases in cultural diversity awareness may vary depending on how remote the target countries are from the program's own socio-cultural sphere. If the majority of total investment flows into exchanges with countries that share the cultural values of the HEI's country, the effects on cultural diversity should be expected to be small compared with those of an internationalization program that encourages exchanges with, for instance, developing countries. Finally, a program may encourage exchanges of a broad range of students and researchers from countries that are far removed from the HEI's own cultural sphere, thus resulting in increased appreciation of cultural diversity. From a sustainability perspective, however, such a practice does not unequivocally translate into benefits, as it may considerably increase the strains on other forms of capital, e.g., through the carbon footprint of the funding program.

While our framework accounts for the importance of an integrated multi-pillar and multi-dimension cost-benefit analysis, these data focus on one dimension of one pillar, namely, the diversity dimension of the economic pillar. This research uses the equality of the funding distribution as a proxy for cultural diversity. Our study aims to show that it is possible to evaluate the costs of an HEI's internationalization policy with respect to a desired outcome (sustainability). To measure diversity, this study uses the Lorenz curve because it is the most common approach used to measure the level of inequality of resource distribution (Gastwirth 1972; Lee 1999).

3 Methods

This research uses data from 2011 to 2013 on the expenditures for the different exchange programs funded and administered by the DAAD, which is the primary donor supporting internationalization at German HEIs. Data from the World Bank on the national economic status of the countries involved in these exchanges are used to examine the economic diversity of the participant nations. Using both a descriptive and comparative quantitative methods, this study analyses how the distribution of resources changes between the observed years and between different groups of institutions by comparing the distribution of invested resources in internationalization of all German HEIs with the data from the large German HEIs and the Universität Hamburg.

Data on the investments of German HEIs in internationalization were provided by DAAD for the three years available. With an annual budget of approximately 430 million € (DAAD 2013), the DAAD is the major donor for internationalization in Germany. It is also the largest national funder of internationalization worldwide

in terms of expended resources, with almost 120,000 supported students in 2013 alone (DAAD 2013). The funding programs range from a semester abroad for young students to PhD programs, yet they also include short visits of guest lecturers to HEIs as well as support for the construction of HEIs outside Germany.

Data measuring the distribution of internationalization funding are provided for 2011, 2012 and 2013 from the DAAD and the Universität Hamburg. The obtained information allowed us to code the variable total funding and account for it in three groups: total funding for all HEIs, total funding for large HEIs (according to the DAAD, a large HEI is defined as having more than 20,000 students), and total funding for the case study institution Universität Hamburg. This grouping accounts for different conditions that large and small HEIs face in terms of student numbers. The variable displays the total funding for all German HEIs within the DAAD funding scheme. Total funding includes all financial allocations to a specific HEI, thus covering direct payments to the HEI as well as payments to individual people affiliated with the HEI, i.e., scholarship holders. The dataset differentiates the target countries for each HEI.

In 2011, 232 HEIs were funded, while in 2012 and 2013, 236 HEIs were funded (DAAD 2013). The second group shows the total funding for large HEIs. This variable includes 27 HEIs (see Table 1). The third group details the total funding for our case study, the Universität Hamburg. This university is one of the largest HEIs in Germany, with 41,760 enrolled students, 10,541 scientific employees (in the equivalent number of full-time positions) and an annual budget of 595 million € for 2012 (Universität Hamburg 2013).

Table 1 Variable overview: internationalization funding for German HEIs

Variable name	Description	Unit of measurement
Total funding for all HEIs (excluding Universität Hamburg)	Amount of DAAD funding for all HEIs per target country and year	€
Total funding for large HEIs (excluding Universität Hamburg)	Amount of DAAD funding for only large HEIs per target country and year. Large HEIs include the following universities: Freie-Berlin, Humboldt-Berlin, Bochum, Bonn, Duisburg-Essen, Düsseldorf, Erlangen-Nürnberg, Frankfurt am Main, Freiburg, Giessen, Göttingen, Fern-in Hagen, Halle-Wittenberg, Hannover, Heidelberg, Kassel, Kiel, Köln, Leipzig, Mainz, Marburg, München, Münster, Potsdam, Stuttgart, Tübingen, and Würzburg.	€
Total funding for Universität Hamburg	Amount of DAAD funding for Universität Hamburg per year	€
Population	Population size of country of origin/target country	Millions

Information on the population sizes of the world's countries was obtained from the World Development Indicators (WDI) database (World Bank 2014). For an overview of the variables, see Table 1.

To measure the distribution of resources spent for internationalization (total expenditures) from Germany by target country, Lorenz curves were calculated. The Lorenz curve is a graphical representation of the cumulative distribution of resources regarding a theoretical equality percentage growth rate between funding and population. The Lorenz curve is the most commonly used traditional form used to analyze countries' income distributions (Gastwirth 1972; Lee 1999). It relates the accumulated distributions of population size and funding. The Lorenz curves are presented in a graphic where the horizontal axis shows the cumulative percentage of the population and the vertical axis represents the cumulative percentage of resources spent. The 45° line displays the total equality of distribution in the resources based on population; e.g., each 1 % of the world's population would be assigned 1 % of the funding. The second line displays the actual distribution of funding with regard to population. The funding data are ordered consecutively from the countries receiving the least funding to those countries receiving the most. Therefore, it is possible to identify the least-funded countries in the lower left and the most-funded countries in the upper right of the figure. If resources were distributed equally among countries, this function would coincide with the 45° line.

4 Results

The HEI funding data indicate a general increase in funding over time, with the exception that the mean funding in 2011 by large HEIs was higher than that of 2012 (Table 2). This small decrease in average funding by large HEIs is related to the fact that the funding was distributed between more students in the German HEIs in 2012, as the total funding by large HEIs increased (see Table 3). The number of funded countries remains similar.

Table 3 shows the total internationalization resources invested in Germany for all HEIs, for the large HEIs, and for Universität Hamburg as well as the average funding per student in the 5th and 6th semesters for 2011, 2012, and 2013. To allow for comparison between the HEIs, the funding per student includes only students in the 5th and 6th semesters (Table 3). At this stage of their study program, students often spend a semester abroad. The data show an increasing trend over time in all cases, except that the funding per student by large HEIs in 2012 and 2013 was lower than the funding in 2011 due to an increased number of funded students. The average funding per student is lowest for Universität Hamburg throughout the observed years. The average students at Hamburg Universität receive less funding than the overall average student, especially compared with the students at the large HEIs.

Table 2 Descriptive statistics of the variables population size and internationalization funding for German HEIs

Variable	Year	Number of funded countries per year	Mean	Std. Dev.	Min	Max
Total funding for all HEIs (excluding Universität Hamburg)	2011	161	706,565	1,432,051	0	11,900,000
	2012	158	729,799	1,519,843	0	12,600,000
	2013	152	765,361	1,613,265	0	12,900,000
Total funding for large HEIs (excluding Universität Hamburg)	2011	154	331,222	70,7225	0	6,502,021
	2012	148	335,682	74,3592	0	6,814,722
	2013	149	354,124	800,551	0	6,887,177
Total funding for Universität Hamburg	2011	80	11,514	28,196	0	200,986
	2012	81	11,269	30,615	0	241,390
	2013	82	13,525	38,203	0	316,598
World population	2011	214	32.4 million	128 million	9844	1340 million
	2012	214	32.8 million	130 million	9860	1350 million
	2013	214	33.3 million	131 million	9876	1360 million

Table 3 Resources spent for internationalization in absolute numbers and per student

Variable	Year	All HEIs (excluding Universität Hamburg) (€)	Large HEIs (excluding Universität Hamburg) (€)	Universität Hamburg (€)
Total funding of HEIs	2011	229,501,584	100,021,234	3,517,368
	2012	246,909,967	105,330,004	3,665,777
	2013	261,686,091	111,824,737	4,165,081
Average funding per student (mean, only 5th and 6th semesters/Universität Speyer has been excluded from this dataset due to its focus on master's programs)	2011	850	1156	780
	2012	854	1147	785
	2013	865	1151	841

Summarizing this first part of the results, the large HEIs show a similar pattern of distribution, while the whole funding system and Universität Hamburg's internationalization pattern are different from that of the other large HEIs in Germany. Turning to the perspective of the distribution of funding, Figs. 2, 3 and 4 display the Lorenz curves for all HEIs in Germany, for all large HEIs and for Universität Hamburg, respectively, for 2013, which is the most current year available. The form of the distribution is relatively stable over the years. Note that the figures showing all HEIs and the large HEIs exclude Universität Hamburg.

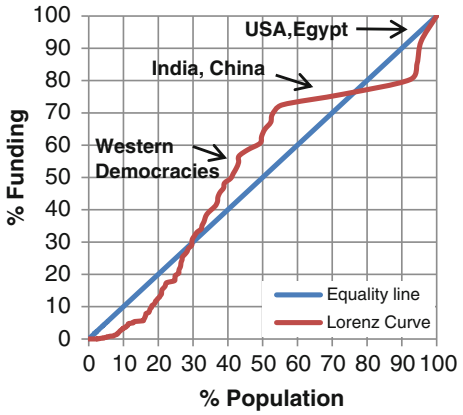

Fig. 2 Distribution of internationalization funding for all HEIs in 2013

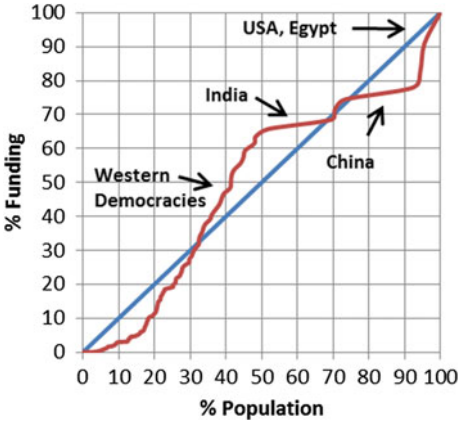

Fig. 3 Distribution of internationalization funding for large HEIs in 2013

The shape of the resource distribution worldwide for each of the three groups (all HEIs, large HEIs and Universität Hamburg) shows continuity in some patterns; for instance, large, populous, and poor countries are underrepresented in the funding scheme (cf. Figs. 2, 3 and 4). Looking at the three figures in more detail, remarkable similarities and differences can be observed. First, the distribution of resources between all HEIs (Fig. 2) and large HEIs (Fig. 3) is quite similar. This result is not too surprising, as large HEIs provide nearly half of the overall funding (44 %, see Table 3). Another similarity is the temporal persistence of the curve's shape due to long-running institutional programs that distribute resources in a consistent manner (see Figs. 5, 6, 7, 8, 9 and 10, below). Typically, poor and small countries are in the lower left corner, the large western democracies are in the middle of the Lorenz curve, the large countries (China and India) are observable with the flat-line breaks in the function and the USA and Egypt (due to the Arab Spring special funding program) are in the top right corner, as they receive the largest amount of funding, and the countries were sorted on the basis of the amount of funding. This result

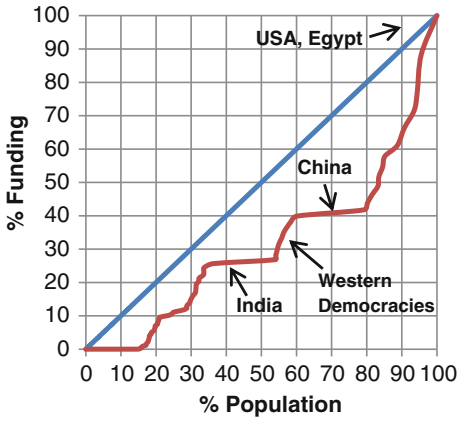

Fig. 4 Distribution of internationalization funding for Universität Hamburg in 2013

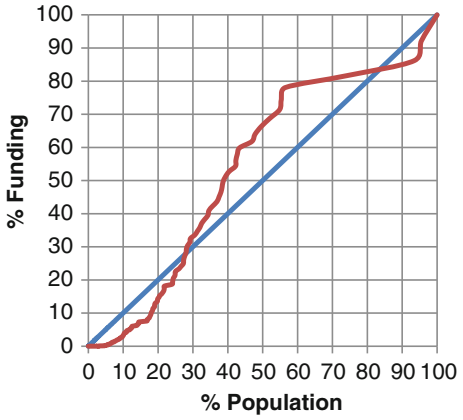

Fig. 5 Distribution of internationalization funding for all HEIs in 2011

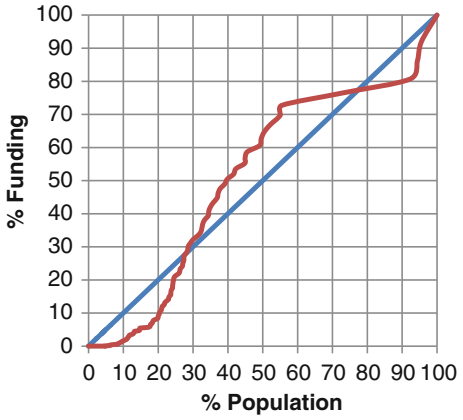

Fig. 6 Distribution of internationalization funding for all HEIs in 2012

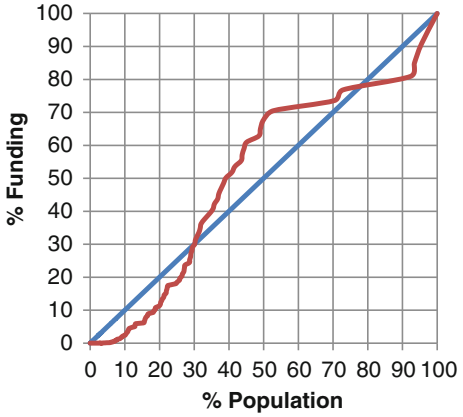

Fig. 7 Distribution of internationalization funding for large HEIs in 2011

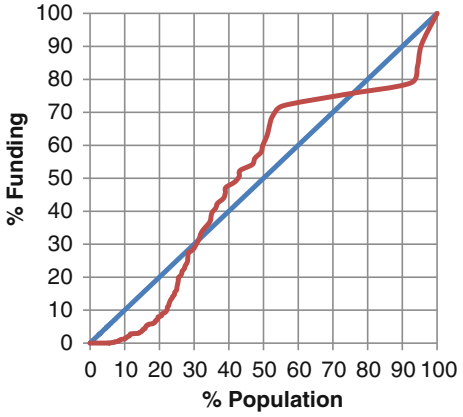

Fig. 8 Distribution of internationalization funding for large HEIs in 2012

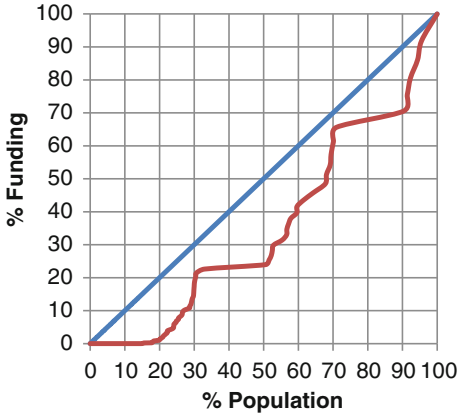

Fig. 9 Distribution of internationalization funding for Universität Hamburg in 2011

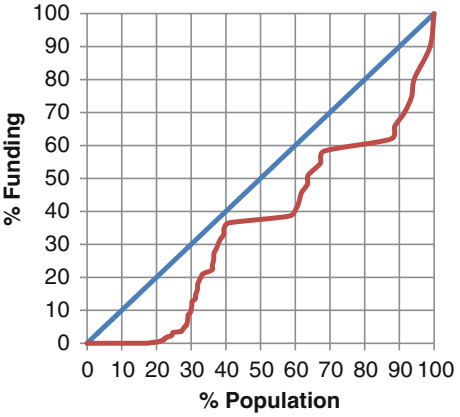

Fig. 10 Distribution of internationalization funding for Universität Hamburg in 2012

suggests that poorer countries receive less funding per capita than higher income countries.

Universität Hamburg's distribution of resources differs markedly from those of the other groups (Fig. 4). There are two significant differences in the form of the curve (slope) and the position of the curve between Universität Hamburg and the other groups. The former is due to the effect of the large countries in terms of population (i.e., China and India), which are ranked in a lower position in the case of Universität Hamburg in comparison with the other institutions. That the curve is fully below the 45° line is due to a higher proportion of countries that do not receive any type of funding from the DAAD. The effect of China and India and the reduced number of supported countries are discussed next.

The first explanation for the different distribution (i.e., differences in the shapes of the Lorenz curves) is that the number of countries that are funded by Universität Hamburg on average is fewer than that of all of the large HEIs and all of the HEIs (cf. Table 2). From the 214 countries in 2013, 159 were funded by all HEIs, 149 were funded only by large HEIs, and 82 were funded by Universität Hamburg in 2013. The total list of 214 countries includes small countries such as Antigua, Aruba, and Barbados that are small in population (with populations below 1 million) and that are not likely to be funded. However, there are also large countries, such as Azerbaijan (population 9.5 million) that have not been funded by Universität Hamburg. The other important characteristic of the funding distribution is the set of large step-changes that all of the figures show in different parts. These changes are related to large countries in terms of population, such as China and India. Figures 2 and 3 show one significant break (in Fig. 3, very close 2 significant breaks) going from left to right; this break is caused by the impact of China and India together because they received similar amounts of funding and, in order from the poorest to the wealthiest in DAAD funding, they are one behind the other.

Figure 4 shows that these countries are in different places in terms of ranking with respect to the funding scheme of Universität Hamburg. Thus, the curve shows two larger breaks. As the two countries show up further to the left in the Universität Hamburg case, they received relatively less DAAD funding from Universität Hamburg than from the average HEI.

The reason the Lorenz curve is above the equality line is that the countries in the middle of the distribution receive more funding than the percentage of the population that they represent. The countries in this group are the large western democracies. China and India appear in the group of countries that receive most of the funding, yet even this funding is outweighed by the large populations they represent.

5 Discussion

Regarding the overarching question of how to measure the sustainability of an internationalization policy, this study analyzes how the distribution of resources changes between 2011 and 2013 and between different groups of institutions. This research compares the distribution of invested resources in internationalization of all German HEIs with the data from large German HEIs and the Universität Hamburg. Stable results were found across three years, with generally consistent patterns. Large, populous, and poor countries are underrepresented in the funding schemes, while high-income countries receive more support. The present study examines sustainable internationalization strategies as an emergent phenomenon by viewing internationalization policies partially as products of the actions of HEI leadership but also introducing the priorities of students and including mid-level staff and decision-makers (such as German Exchange Service officials and campus Internationalization Department staff). This perspective accords with the view that middle management in particular is a driver of campus sustainability (Brinkhurst et al. 2011).

Our analysis shows that the distribution of resources for internationalization says more about the sustainable character of an HEI than the absolute number of invested resources: Given that the absolute and average amounts of funding of Universität Hamburg and the other groups are quite similar, the differences detected when comparing the Lorenz curves underscore the importance of analyzing the distribution of resources when discussing the sustainability of internationalization strategies.

One important finding is that poorer countries receive less funding per capita than higher income countries. While this result may not be surprising per se, it becomes important when internationalization strategies are discussed in the context of sustainability, as exchanges with (culturally) different countries are expected to yield positive benefits in terms of sustainability.

One important characteristic of the literature on internationalization is its fragmentary character; authors look at the cost (Little and Cordero 2014) or at the benefits (Delgado-Márquez et al. 2013; Hale et al. 2013; Paige et al. 2009) of internationalization. For this reason, this study wanted to present an integrative framework of sustainable internationalization. This framework should be further discussed and developed, but the form of the cost-benefit framework could be integrated into many parts of the literature. The second contribution concerns the procedure used to measure the sustainability of internationalization. The literature on internationalization focuses on absolute numbers of students or gender distributions or absolute invested resources (Elkin et al. 2005; Marin 2014; Mitchell 2012; Rodríguez González et al. 2011; Souto-Otero et al. 2013), while this research focused on the distribution of the resources.

Universities such as Hamburg that use less funding from the exchange services may be in a unique position to both expand their international focus and to do so in a more equitable manner. New resource acquisition in this environment is not tied to a previously established infrastructure. On a broader scale, an international comparison study may reveal economic and cultural priorities of HEIs around the globe.

6 Conclusion

This study raises the question of how to create an HEI's sustainable internationalization policy. The contribution has been twofold; this study has presented a theoretical framework for a cost-benefit analysis of HEIs' sustainable internationalization policies using three sustainability pillars. The theoretical section has also operationalized the economic pillar of the framework to measure economic sustainability using cultural diversity in funding as an indicator metric. Our research shows that the distribution of resources for internationalization (diversity) says more about the sustainable character of an HEI than the absolute amount of invested resources.

From a sustainability perspective, it is therefore advisable to balance the invested capital in such a way that the positive social and economic effects of internationalization for sustainable development are preserved without an excess of ecological, social, and economic costs. Our research contributes to the challenge in measuring campus sustainability from various perspectives in the social sciences. First, this study discussed the question of the sustainability of internationalization from an insufficiently investigated perspective: the distribution of economic resources. Second, it is possible to replicate this measure in other HEIs, at least in Germany. Third, this research proposed a new framework to measure a sustainable internationalization policy using a cost-benefit analysis. The significance of the research is derived from linking the important HEI goals of internationalization and sustainability using a unified framework within a social science perspective to work toward campus sustainability.

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Delf Rothe's research focuses on the growing prominence of resilience as a political concept in security and development policy. He is interested in the intersection between environmental and security politics and has published on global climate governance, risk, environmental conflict, climate-induced migration and securitization theory. He holds a Ph.D. in political science from the Universität Hamburg.

Looking Beyond Fossil Fuel Divestment: Combating Climate Change in Higher Education

Robin Xu

Abstract

The fossil fuel divestment movement is altering the landscape of climate activism on US campuses. Student-run divestment campaigns are now pushing for college Boards of Trustees to withdraw investments from the top 100 public coal companies and top 100 public oil and gas companies. Despite student fervor, however, divestment has remained a controversial tactic. Why has the movement not enjoyed widespread success, despite heavy student pressure? This chapter examines the hypothesis that pushing for divestment alone will not achieve broad success because it does not appeal to a wide enough range of motives that may persuade people to engage in pro-environment behavior. This chapter will study the stated motives for why a selection of colleges have agreed or declined to divest. A detailed analysis of how these stated motives fall into a theoretical framework of motives for pro-environment behavior reveals the motives to which divestment successfully appeals, as well as the motives to which it fails to appeal. The purpose of detecting gaps where divestment fails to appeal is to identify areas that can be better addressed by a multi-pronged approach to climate activism. This chapter concludes with a brief suggestion of other actions that might be included in a holistic climate action plan.

Keywords

Climate change · Student activism · Fossil fuel divestment · Sustainability

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1 Introduction: Motives for Pro-environment Behaviors

Secretary-General Ban Ki Moon of the United Nations has recognized anthropogenic climate change as the defining challenge of our age (Rosenthal 2007). It seems natural that college students would be eager to take up this challenge, as universities have been the breeding ground for activism on other defining challenges like inequality, apartheid, and war. As the best and brightest of the upcoming generation, how are students responding to the climate crisis?

One effort, led by the non-profit 350.org, is the movement for fossil fuel divestment. According to Gofossilfree.org, the movement calls for institutions to "immediately freeze any new investment in fossil fuel companies, and divest from direct ownership and any commingled funds that include fossil fuel public equities and corporate bonds within five years." Since the movement's inception in 2011, its public face has been the college student. All across the United States, student-run campus divestment campaigns are pushing for trustees to commit to an endowment investment policy that excludes the top 100 public coal companies and top 100 public oil and gas companies according to the potential carbon dioxide emissions of their reported reserves. Despite student fervor, however, divestment has remained contentious. As of September 2014, only 13 colleges have agreed to divest (gofossilfree.org/commitments). Numerous others have declined to divest, or declined to officially consider the issue.

Why has the movement not enjoyed widespread success, despite heavy student pressure? To help answer this question, this chapter explores how a theoretical model based on findings from the field of psychology can inform the creation of more effective and unified climate action on college campuses. The purpose of this chapter is to examine the hypothesis that pushing for fossil fuel divestment alone will not achieve broad success on campuses because it does not appeal to a wide enough range of motives that psychology research has shown might persuade people to engage in pro-environment behavior, defined loosely here as behaviors that contribute to the ability of humanity to live within the regenerative capacity of the Earth's ecosystems.

In the literature, explanations for why people engage in pro-environment behavior fall into two major camps. One camp posits that this behavior is galvanized by "pro-social" motives such as concern for humans, other species, and the planet. The other camp follows a rational choice model that predicts that humans will maximize self-interest (Ones and Dilchert 2013). Empirical research conducted by Ones and Dilchert (2012) further breaks these blocs down by investigating environmental-related behaviors and then chronicling the discrete motives that each test subject gives for engaging in pro-environment behaviors. The motives were then classified into the categories within the Taxonomy of Environmental Motives shown in Fig. 1.

- The **environmental concern** motive involves a concern for preventing harm to the Earth's ecosystems and other species. Thus, tactics that emphasize healing and protecting nature are most successful in appealing to this motive.

Fig. 1 Taxonomy of environmental motives (This graphic, created by the author, is a representation of the findings of Ones and Dilchert (2012), available at http://greenfive.org/aashe/greenfive-handout.pdf)

- The **altruism** motive involves a concern for preventing harm to other humans. Tactics that emphasize protecting humans, including future generations, are most successful.
- The **responsibility** motive involves a concern for fulfilling a responsibility. Tactics that create real or perceived obligations, for example through rules that require pro-environment behaviors, are most successful.
- The **health and safety** motive involves a concern for one's own health and safety. Tactics that point out how pro-environment behaviors can also be safer and healthier are most successful.
- The **financial and self-interest** motive involves a concern for one's own gain. Tactics to financially justify pro-environment behaviors are most successful. Apart from financial gain, for colleges the self-interest motive commonly involves gaining positive press.
- The **convenience** motive involves engaging in behaviors that easily fit into the subject's preferred routines and habits. Thus, tactics that increase the ease of engaging in pro-environment behaviors are most successful.
- The **ability and support** motive involves engaging in behaviors because the subject knows how, and because there is strong support from surrounding institutions. Thus, tactics that increase knowledge of pro-environment behaviors and their integration into institutional cultures are most successful.

The idea that examining motives is key to changing behaviors for the benefit of the environment also appears in community-based social marketing. Informed by psychology research on behavior change, community-based social marketing is a strategy for identifying the barriers to switching from environmentally harmful behavior to pro-environment behavior (McKenzie-Mohr 2011). These barriers vary

from person to person, and are also activity specific: for example, the barriers to composting are different from the barriers to divesting.

The barriers identified in community-based social marketing can be conceptualized as the *inverse* of the motives identified by Ones and Dilchert. When motives are strong enough, they incite pro-environment behavior; when barriers are strong enough, they prevent pro-environment behavior. Community-based social marketing reinforces the research done by Ones and Dilchert by asserting that neither a self-interest strategy nor a strategy that attempts to change attitudes is adequate. Instead, a successful campaign to foster pro-environment behavior must focus on overcoming each decision-maker's barriers for the target behavior (McKenzie-Mohr 2011). This is just another way of saying that a successful campaign must appeal to each decision-maker's strongest motives for engaging in the target behavior.

2 Stated Motives of Institutions

Using the Taxonomy of Environmental Motives as a theoretical framework, this chapter will examine the stated motives of a selection of colleges that have released an official decision on divestment.[1] A "stated motive" is defined here as a reason offered in a public statement from institution administrators for why they have agreed or declined to divest. A detailed analysis of how these stated motives fall into the taxonomy will reveal the motives to which divestment appeals and those to which it fails to appeal. Table 1 summarizes these findings.

The purpose of detecting gaps that a singular focus on divestment leaves open is to identify areas that can be better addressed by a multi-pronged approach to climate activism. Not all campuses will accept divestment; it depends on whether or not the arguments in favor of divesting match a particular campus's strongest motives for pro-environment behavior. Therefore, campus climate activism will not be successful if it loses sight of actions other than divestment. This chapter will conclude with a brief index of suggested actions to create a flexible, multi-pronged strategy that may go a long way in improving the chances for success in campus climate activism.

[1]This is not intended to be an exhaustive examination of all colleges that have made a decision on divestment. Rather, it examines a selection of colleges, building off of the work of Jessica Grady-Benson's *Fossil Fuel Divestment: The Power and Promise of a Student Movement for Climate Justice (2014)*, the primary existing scholarly work on the young divestment movement at the time of this chapter's writing. Grady-Benson documented 24 rejections as of early 2014, and the number of rejections has continued to grow since then. Due to time constraints, this chapter does not examine a complete list of rejections, and instead chooses samples from Grady-Benson's list. However, the number of successes is much smaller, so this chapter does examine a complete list of successes up to September 2014, drawn from the official list on Gofossilfree.org, available at http://gofossilfree.org/commitments/. The press releases and official letters themselves are publically available online and were found using a search engine.

Table 1 Summary of stated motives

	Successes: agree to divest	Rejections: decline to divest
Environmental concern	NONE: divestment proponents acknowledge its lack of direct environmental impact	Divestment lacks direct environmental impact, so other actions with direct impact are preferable
Altruism	NONE: divestment proponents acknowledge its lack of direct impact on protecting humanity from climate instability	Divestment lacks direct impact on protecting humanity from climate instability, so other actions with direct impact are preferable
Responsibility	• Colleges have a duty to educate the public about the climate problem	
	• If colleges have an existing policy dictating responsible investment choices, they have a duty to adhere to it	
	• If divestment is in the best interest of the endowment, divesting aligns with fiduciary duty	
	• Colleges do not have a duty to make an ideological statement using their endowment because it may interfere with their primary duty, that of academia	• If divestment is not in the best interest of the endowment, it does not align with fiduciary duty
Financial and self-Interest	• Divestment is financially beneficial because it will reduce risk related to climate change: "stranded asset risk" argument	• Divestment would entail high financial risks and costs from potential increased risk in the portfolio and transaction costs incurred from reallocating assets
	• Divestment will cause little or no financial harm to the endowment	
Convenience	NONE	Tied to the discussion of transaction costs, divestment is difficult to integrate into routine investment behavior
Health & safety	NONE	NONE
Ability & support	NONE	NONE

The limits of this work should be duly noted. This paper stems from an interdisciplinary thesis in Environmental Analysis, not sociology or psychology. Therefore, this work does not attempt to debate the merits of the research that created the taxonomy in Fig. 1 or its supporting arguments. I recognize that there are a variety of other ways to conceptualize motives for environmental-related behavior; I have chosen the taxonomy in Fig. 1 to undergird my own analysis simply because it organizes motives into categories in a straightforward and easily understandable way.

In addition, although it is my hope that this analysis may be helpful to climate activists within other institutional contexts, this work's scope is limited to investigating colleges in the United States only.

2.1 Successes

Among selected colleges that have agreed to divest, the most frequent stated motive offered is social and environmental **responsibility**. Unity College President Stephen Mulkey asserts that, as educators, colleges have a responsibility to educate people misled by denial campaigns about the true nature of the climate problem. Donald Gould, a trustee and chair of the investment committee at Pitzer College, agrees: "…the academy has a duty to educate not only its students but also society at large. Divestment is an educational statement, not a political one." Similarly, Sterling College president Matthew (Derr 2013) writes, "[Colleges] have an obligation to speak out on the critical environmental and social issues facing our country."

The **responsibility** motive also arises in another form, the duty of colleges to adhere to their existing investment policies. In a few cases, colleges could interpret their prevailing mandates in favor of divestment. Stanford University divested from coal partly because its 1971 Statement on Investment Responsibility allows trustees to factor in whether or not "corporate policies or practices create substantial social injury" when deciding where to invest. Likewise, (Hampshire College 2012) interpreted divestment to align with existing Environmental, Social and Governance investment guidelines to seek out businesses that prioritize social benefit and long-term sustainability. Similarly, for (Green Mountain College 2013), divestment aligned with the commitment to socially responsible investments outlined in its strategic plan "Sustainability 2020." When existing policies can be interpreted in favor of divestment, divestment appeals to the **responsibility** motive.

Closely related is the argument, though contentious, that divestment yields financial benefits in the long run. Although Pitzer trustee Don Gould is a notable exception, college trustees usually define their fiduciary duty as an obligation to act in the financial best interest of the endowment.[2] Fiduciary duty is a form of responsibility; thus, when proponents argue that divestment is in the financial best interest of the endowment, they appeal simultaneously to the **responsibility** and **financial and self-interest** motives.

Also known as the "stranded asset risk" argument, the financial argument in favor of divestment asserts that divesting reduces long-term risk to the endowment. This argument claims that fossil fuel stocks are currently overvalued because valuation methodologies do not take into account that 60–80 % of fossil fuel reserves

[2]Cornell University Law School's Legal Information Institute defines fiduciary duty as "a legal duty to act solely in another party's interests." In this case, trustees are subject to a legal duty to act solely in the interests of the endowment on behalf of donors.

will be rendered 'unburnable' if the world enforces measures to keep global warming under 2 °C (Carbon Tracker Initiative 2013). Thus, fossil fuel companies are wasting billions of dollars to find and develop stranded assets, fossil fuels that will never be used. Investments in fossil fuels will become increasingly risky and unpredictable in the future as stranding occurs.

Several colleges have cited this argument. For instance, Thomas Van Dyck, financial advisor for the University of Dayton, states, "Fossil fuel companies have a valuation that assumes every single drop of oil, everything they have in the ground, will be taken out. More and more people are understanding the…valuation risk associated with owning fossil fuel companies." However, despite scattered successes, the stranded asset risk argument remains highly contentious. It hinges on the assumption that the global regulatory atmosphere will become increasingly hostile to carbon-intensive energy sources, severely restricting future fossil fuel use. Even some proponents of divestment, such as (Don Gould 2014), question the viability of this assumption: "'Stranded assets' is…wishful thinking…. [It is] asserting that just because we need to change to cleaner energy that we will change. The evidence, frankly, does not favor that to date" (quoted in Grady-Benson 2014, p. 100). Although a few colleges have stated that the **financial and self-interest** motive—in the form of the stranded asset risk argument—has contributed to their decision to divest, it is not a motive to which the divestment action consistently appeals.

The **financial and self-interest** motive can also be conceptualized as the inverse of a barrier that is overcome. Many colleges divest because they believe it will cause little harm to the endowment. Don Gould asserts, "The proceeds from divestment will be reinvested in something [and] historically, [fossil fuel] companies' stock performance has been roughly in line with the rest of the stock market." Likewise, Unity College's estimates show that "divesting is consistent with maintaining a return that will continue to beat the market averages under current prices." Press releases from both University of (Dayton 2014) and the (Foothill-De Anza Community Colleges 2013) also indicate that they expect no significant effect on investment returns. However, there are conflicting opinions on the anticipated financial effects of divestment and many colleges have rejected divestment on just the opposite view. The next section of this chapter will examine this viewpoint in detail.

It appears, then, that the dominant motive in favor of divestment is **responsibility**. Social and environmental responsibility comes up as a stated motive for almost all who agree to divest. Adhering to existing investment policies and fiduciary duty are also forms of **responsibility**.

Divestment also appeals to **financial and self-interest** in a few cases, but the financial argument is contentious, which limits its appeal. The **financial and self-interest** motive is also invoked when colleges do not believe divestment involves much financial cost or risk.

2.2 Rejections

When examining the stated motives of colleges that reject divestment, it is useful to conceptualize *motives* as the inverse of *barriers*, as each motive most likely involves a barrier to pro-environment behavior rather than any motive to cause environmental harm.

Among these colleges, the **financial and self-interest** motive poses as the most common barrier. Many believe divestment entails high financial risks and costs. Tufts University estimates that their endowment would decrease $75 million in market value over five years, Swarthmore College estimates losses of $10–15 million in endowment income annually, and Pomona College estimates a total decrease of $485 million over ten years. Grady-Benson (2014) identifies three major sources of risk and cost from divestment: potential increased risk in the portfolio, the difficulties of divesting, and transaction costs.

Divestment causes potential increased risk in colleges' portfolios because it constrains the use of diversification, a widely accepted risk management technique. A diversified portfolio contains a variety of investments in different asset classes that are not perfectly correlated. On average, the investments that do well will neutralize those that do poorly, which acts as a buffer against unsystematic financial risk. In the context of divestment, Haverford College president Daniel Weiss states, "A portfolio that excludes a major asset class will under-perform a more fully diversified portfolio." Constraining diversification by avoiding investments in fossil fuel companies could raise potential risk.

The way that endowments are structured also poses difficulties to divesting. Decades ago, colleges used to invest directly in individual companies, which made it easier to divest from certain companies. However, endowment structures have changed in response to evolving markets and standards of investing. Tufts president Tony Monaco offers an explanation of the difficulties that institutions face today:

> …Our endowment, like those at many other universities, makes extensive use of commingled or pooled funds, in which multiple investors hold a "slice" of an investment portfolio…. investors cannot dictate the guidelines of the commingled fund; they can only choose whether or not to invest under guidelines specified by the fund manager. Because of this "in-or-out" choice, if we decided to begin a process of divesting today, Tufts would have to turn over about 60 percent of its current investments and find substitute managers…

Similarly, Bates College estimates that divestment would require liquidating one-third to one-half of their endowment, and expresses concern that reallocating such a large proportion of assets would result in unacceptably high transaction costs. While transaction costs can be construed as the **financial and self-interest** motive, it is also a permutation of the **convenience** motive. Discussions of transaction costs indicate that colleges believe divestment is difficult to integrate into their routine investment behavior.

Discussions of risks and costs often come hand-in-hand with discussions of fiduciary duty. When colleges believe that divestment is not in the best financial interest of the endowment, they conclude that divestment does not align with

fiduciary **responsibility**. For example, the Investment Policy Subcommittee at Bryn Mawr College states that divestment does not align with its responsibility "to provide a return on the investments over time…to preserve the purchasing power of the endowment for future generations." Similarly, President Clayton (Spencer 2014) of Bates states, "The Board of Trustees has a fiduciary responsibility to protect our ability from generation to generation to offer the high quality liberal arts education envisioned by our founders." Likewise, Middlebury College President Ronald Liebowitz asserts that "given its fiduciary responsibilities, the board cannot look past…the uncertainties and risks that divestment would create."

The **responsibility** motive also poses as a barrier when colleges do not feel that it is their responsibility to make a political or ideological statement using their endowment. According to Tulane University president Scott Cowen, "[endowment funds] are given to the university with the understanding that they will be managed…apart from any political positions…" Some colleges express that risking their endowment is not an appropriate way to fulfill their responsibility to combat climate change, and, in fact, places their ability to fulfill responsibilities in unnecessary jeopardy. Daniel Weiss believes divestment would harm Haverford's educational mission: "because [divestment] would likely depress endowment value going forward…it would undermine our ability to achieve our core goal of [education]…" In addition, Harvard University president Drew (Faust 2013) warns, "Conceiving of the endowment not as an economic resource, but as a tool to inject the University into the political process or as a lever to exert economic pressure for social purposes, can entail serious risks to the independence of the academic enterprise." Thus, when colleges believe that divestment may interfere with their primary duty, that of academia, the **responsibility** motive poses as a barrier.

A large number of colleges express dissatisfaction with divestment's minimal direct impact on slowing climate change. In these cases, the **environmental concern** and/or **altruism** motives pose as barriers because colleges believe that divesting will not reduce the negative consequences of unfettered climate change on humanity, other species, and/or the Earth's ecosystems. Bryn Mawr's Investment Policy Subcommittee states: "…divestment will not accomplish the larger and central goal of reducing the use of fossil fuels." Likewise, Pomona's President Oxtoby points out that it is "unclear that divestment would have anything more than a symbolic impact in fighting climate change." The Swarthmore Board of Managers also believes "[divestment] is far from our best option…for having real impact on the fossil fuel industry."

It is widely understood that divestment will cause negligible financial disturbance to fossil fuel companies. Brown president Christina H. (Paxson 2013) asserts, "It is clear that divestiture would not have a direct effect on the companies in question…. divestiture would not reduce profits even if Brown's holdings were orders of magnitude larger." Furthermore, as Harvard's President Faust states, "Universities own a very small fraction of the market capitalization of fossil fuel companies. If we and others were to sell our shares, those shares would no doubt find other willing buyers."

The divestment movement itself acknowledges the minimal direct impact of divestment and asserts that divestment is not an economic strategy, but a social and political one. The movement does not expect to directly reduce greenhouse gas (GHG) emissions or change the behavior of fossil fuel companies, but rather to galvanize climate action by protesting the immorality of the fossil fuel industry, especially its practice of lobbying for special breaks from the government. When colleges withdraw as investors to express their disapproval of fossil fuels, the movement claims that it sends a powerful moral message to policymakers and the public (Grady-Benson 2014).

Colleges commonly argue is that it is hypocritical to attempt to stigmatize fossil fuel companies while continuing to rely heavily on their products. (Davidson 2014) College dpresident Carol Quillen questions "the integrity of making a symbolic gesture while continuing to power campus with…fossil fuels." Harvard's President Faust also finds it inconsistent to boycott a whole class of companies while extensively relying on their products. Swarthmore's Board of Managers agrees: "Divestment's potential success as a moral response is limited…so long as its advocates continue to turn on the lights, drive cars, and purchase manufactured goods, for it is these activities that constitute the true drivers of fossil fuel companies' economic viability." It is clear that the divestment movement's argument about sending a moral message does not appeal sufficiently strongly to these colleges.

The **environmental concern** and/or **altruism** lack-of-impact barriers are often coupled with discussions of costs and risks in order to assert that high or unpredictable costs outweigh minimal benefits. Pomona's President (Oxtoby 2013) finds that the minimal impact of divestment on climate change makes it "hard to make the case that it would be worth the significant cost to future Pomona students." Swarthmore's Board of Managers also assesses that divestment "would have no measurable effect on halting climate change and at the same time would pose an unacceptable risk to the College's finances…. the cost of divestment would far outweigh any potential benefit."

The lack-of-impact barriers are especially apparent when colleges decline to divest, and instead commit to other actions with a more tangible impact. For example, instead of divesting, Haverford's Board of Managers will conduct a review of campus sustainability measures to identify future improvements. (Middlebury 2013) will develop stronger Environmental, Social and Governance guidelines and increase the amount of the endowment dedicated to ESG investments. Tufts will establish a Sustainability Fund, strengthen its climate change education and research, promote interest for sustainability on campus, and harness the policy expertise of faculty and students to engage with policymakers about climate change (president.tufts.edu/recommendations-of-the-tufts-divestment-working-group).

Some colleges that currently prefer other actions, however, do not preclude the possibility of divesting in the future. "At this point, we're not prepared to commit to divest from fossil fuels, but I would never say never," says President Mills of Bowdoin College. At Pomona College, John Jurewitz, an energy economics professor, has proposed an alternative plan that first targets energy efficiency measures and then pushes for a federal carbon tax. For Jurewitz, divestment must be

accompanied by these essential steps (Haas 2013). This line of thinking—reduction of carbon footprint first, divestment second—indicates that pushing for other actions to combat climate change may actually help to further the divestment movement in the long run. Some colleges resistant to divesting now are likely to consider it in the future within the context of a holistic climate action plan.

3 Gaps in Stated Motives

As shown by the variety of responses, the issue of divestment remains contentious. What are the gaps left open by a singularly divestment-centered approach?

It is apparent from the above examination of stated motives that both sides most commonly consider the divestment question using the **responsibility** and/or **financial and self-interest** motives. When these motives are sufficiently strong, colleges choose to divest. When these motives are either not sufficiently strong, or are construed instead as barriers, they decline to divest. If divestment alone is not successful, a multi-pronged approach might be, if it includes actions that appeal more strongly to the target campus's **responsibility** and/or **financial self-interest** motives.

Stated motives also reveal that divestment often does not appeal to **environmental concern** and/or **altruism**. Many colleges believe it will be ineffective in creating real impact to slow climate change. This is a large gap, so an approach that includes actions appealing to these two motives will be more widely successful than divestment alone. This inference is supported by the instances discussed above, in which colleges decline to divest, but commit to other actions with more tangible impacts.

Colleges that have agreed to divest do not mention **convenience** as a motive. Therefore, it appears that divestment may not be easy, but those strongly motivated to divest for other reasons will divest regardless of whether or not it is easy. The above examination of stated motives also does not explicitly find **convenience** as a barrier for colleges that decline to divest. Instead, the difficulties of divesting are tied up in the discussion of transaction costs, and colleges seem more concerned about the high transaction costs of divesting than the actual difficulties it entails. Therefore, actions that do not have high transaction costs will appeal more successfully to the **convenience** motive than divestment does.

It should be noted that divestment is not necessarily all-or-nothing. One potential compromise is for colleges to divest to the extent that it does not involve unacceptably high transaction costs—for instance, to avoid fossil fuel holdings except those embedded in large index fund vehicles, and then compensate for their remaining fossil fuel investments by increasing purchases of clean energy funds. There are many creative strategies for partial divestment that would avoid unacceptably high transaction costs, and this type of compromise might be effective if the **convenience** motive poses as a main barrier to divestment.

It is also evident that **ability and support** is not a strong motive in the face of other barriers. The taxonomy in Fig. 1 construes **ability and support** as having the knowledge necessary to do something, as well as institutional or cultural support in favor of doing it.

However, despite being well informed about divestment, many colleges still decline to divest, and some also disregard student referendums that show widespread support for divestment. These colleges often justify their actions by citing extremely high barriers in the form of costs, risks, and/or responsibilities. Therefore, it appears that the **ability and support** motive is not effective when other barriers are high. However, it is important to capitalize on **ability and support** for actions for which high barriers are not a problem.

Finally, both sides of the debate disregard the **health and safety** motive. An approach that includes actions that appeal to this motive would take advantage of a category that remains untapped by the divestment movement.

4 Conclusion: Looking Beyond Divestment

The above analysis shows that pushing for divestment alone leaves open a variety of gaps that are either completely unaddressed or inadequately addressed. This finding suggests that there is much room for improvement in campus climate and sustainability activism. Rather than focusing exclusively on divestment, campus climate activists should craft adaptable plans by matching specific tactics to each target college's strongest motives for pro-environment behavior. This is especially important when targeting colleges that have already declined to divest. Trying a different set of motives might spur trustees and administrators to take actions other than divestment, rather than doing nothing.

These implications are reinforced by the fact that even colleges that have already agreed to divest recognize the importance of a multi-pronged approach. For example, (Prescott College 2014) sees divestment as a logical next step after developing a Climate Action Plan to minimize campus GHG emissions through investments in energy conservation, renewable energy, and carbon offsets. Similarly, Naropa University regards divestment as a fitting complement to its Statement of Commitment to the Practice of Sustainability, which commits to goals like zero waste, climate neutrality, and 100 % renewable energy. When asked to consider divestment, Pitzer's Board of Trustees instead went above and beyond, committing to a holistic climate action plan of which divestment is only one part. Other aspects include reducing the college's carbon footprint by 25 %, establishing a campus Sustainability Task Force, and exploring investments in offsite renewable energy projects (Grady-Benson 2014). These colleges have chosen to place divestment within the context of other actions to fight climate change.

Moving forward, crafting a broader portfolio of demands for holistic climate action on campuses will keep the conversation open for an ongoing and escalating push against climate change. The following list provides a starting point for crafting such a plan:

(1) **Work towards campus climate neutrality**, or eliminating net GHG emissions by minimizing emissions and then neutralizing remaining emissions.

- **ACUPCC**: American College and University Presidents Climate Commitment is a framework within which colleges create a climate action plan with a target date for campus climate neutrality. The large number of signatories makes ACUPCC an industry standard and source of knowledge sharing between peer institutions.
- **Minimize campus GHG emissions**:
  - Strive for energy conservation through behavioral changes in campus occupants and energy efficiency upgrades in facilities.
  - Install on-site renewable energy production.
  - Minimize new construction and adhere to green construction standards.
  - Support sustainable commuting.
- **Neutralize remaining emissions**:
  - Purchase renewable electricity products and/or Renewable Energy Certificates.
  - Purchase carbon offsets or create a carbon offset program.
  - Purchase and retire cap-and-trade carbon allowances, where applicable.

(2) **Create internal financial mechanisms** within the college to underwrite initiatives to combat climate change.

- **Loan-disbursing green revolving funds**: A green revolving fund underwrites initiatives by providing loans that must be repaid. Once the loan is repaid, the original seed money is then free to be loaned to another project. A green revolving fund is most appropriate for initiatives that generate high savings, such as energy- and resource-efficiency investments.
- **Grant-disbursing funds**: It can be more palatable to use grants to underwrite initiatives that have an uncertain payback period or might not break even, but still have educational and/or environmental value.

(3) **Integrate environmental education** into the college's institutional culture.

- **General education**: Most colleges have some type of mandatory general education, and incorporating climate education can ensure that all students become familiar with climate issues.
- **Curriculum infusion**: Incorporating climate issues into existing classes on other subjects can ensure that students studying a wide variety of subjects are exposed to climate issues.

- **Peer education programs**: Leverage social networks within the student body to spread awareness about climate issues by allowing students who are already interested and well versed in these topics to engage their peers.

It is commonly understood that the role of higher education is to establish the values of the world's next generation of leaders. If climate change is indeed the defining issue of this age, it is vital for leaders in coming decades to be dedicated to a variety of pro-environment behaviors including, but not limited to, divestment. Therein lies the true significance of this work: improving the strategies used on college campuses in anticipation of training sustainability leaders for the wider world. Future research on the motivations behind engaging in pro-environment behaviors, perhaps with a more narrow focus on specific age groups or institutional contexts, could be useful to further inform climate and sustainability activism. Given the dearth of scholarly literature on the young fossil fuel divestment movement, future research on this topic would also be beneficial, for example, exploring the intersection between the literature on sustainability and the literature on social movements to discover how to harness the energy behind this limited movement and channel it towards a broader sustainability goal.

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Beyond Recycling: Developing "Deep" Sustainability Competence

Susan V. Iverson

Abstract

The purpose of this chapter is to advance a competency framework for sustainability, arguing that sustainability initiatives should move beyond basic awareness to deeper knowledge, including understanding of root causes, and development of political skills. This chapter's discussion and critique of sustainability competence is grounded in data from more than 500 undergraduate residents' responses to seven open-ended questions about sustainability initiatives in the residence halls; what sustainability means to them; their environmental values, attitudes, and behaviors. These data were analyzed using qualitative methods to determine students' understanding and definition of sustainability; their green behaviors; and the impact of perceptions about sustainability on green behaviors. Along the three competency domains (awareness, knowledge, and skills), respondents' understanding of sustainability was overwhelmingly environmental (recycling, and reducing waste), and skills did not extend beyond individual actions. Sustainability initiatives must not only develop individual-level competencies (i.e. awareness of personal consumption, reduction of personal waste and energy usage), but also equip individuals to act at institutional and structural levels (i.e. advocating for changes in policy and practices). An expanded conceptualization of sustainability competence would be useful for educators to design initiatives that deepen sustainability competence, developing students' capacity for thinking and acting systemically.

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1 Introduction

The seeds of the contemporary sustainability movement in U.S. higher education go back to environmental activism in the 1960s and 1970s. Today, sustainability efforts on campus range from "greening" facilities to "minimize the ecological footprints of universities" (Tilbury 2004, p. 97), to curricular developments that require "educating about and for sustainability" (p. 98). The latter—education for sustainability (EFS)—calls for restructuring courses, and entire curriculum, to yield "graduates with the personal and professional knowledge, skills and experience necessary for contributing to sustainability" (Tilbury 2004, p. 98).

As EFS grows, little attention has been given to understanding or defining these knowledge or skills, or rather, what competencies for sustainability students should develop and be able to demonstrate through their learning in informal and formal settings, and as citizens after they graduate (Barth et al. 2007; Torres-Antonini and Dunkel 2009). Students have been "raised on recycling" (Dungy 2011, p. 272); however, recycling and volunteerism will not, in and of itself, address the fundamental challenges facing our environment. Educators, then, must identify approaches to EFS that will move students beyond basic competencies for sustainability, to what is known as "deep sustainability"—the capacity to extract and apply meaning (Warburton 2003).

Drawing upon several bodies of work from the social sciences, the aim of this chapter is to advance a competency framework for sustainability that would move beyond an overly narrow conception of sustainability that is limited to individual environmental actions, to deeper sustainability knowledge and the development of political skills. Further, this chapter makes the argument that experiential learning is important to the development of deep sustainability competence. First, this chapter reviews relevant literature on deep learning, experiential learning, and on competencies for sustainability. Next the chapter reports findings from a study of undergraduate students' thinking about sustainability, and then uses these findings as a springboard for discussion and critique of sustainability competencies. Finally, the paper concludes with implications for EFS.

2 Review of Relevant Literature

2.1 Defining Sustainability

As sustainability in higher education continues to grow, the concept of sustainability has vague definitions and some misconceptions (Filho 2000; Wals and Jickling 2002). For the purpose of this chapter, sustainability is comprised of three

dimensions: environmental, economic, and equity (sometimes also referred to as the "social" dimension). The first, *environmental* (sometimes referred to as ecological), tends to dominate discussions. It focuses on the reduction of negative human impact on the ecosystem, and yields efforts such as greening campus facilities, recycling campaigns, and energy reduction initiatives. These environmental efforts illuminate *economic* concerns and benefits. For instance, programs to reduce energy usage produce financial gains in addition to being good for the environment. Thus, campuses focus on the effects of individual lifestyle choices and spending patterns; the impacts of institutional, national, and global economies; and the exploitation of resources for economic growth. Finally, situated at the intersection of environmental and economic concerns is the relationship between human rights, environmental justice, and corporate power, yielding a focus on *equity* or the social impact of sustainability. Educating about this trilogy of sustainability is described by some as EcoJustice Education—an "emerging framework for analyzing the deep cultural roots of and intersections within social and ecological violence …[and] the destructive effects of a worldview organized by a logic of domination" (Lowenstein et al. 2010, p. 101).

2.2 Developing Sustainability Competence

The modern competency movement, referred to by some as a controversial trend, is often attributed to teacher education curriculum development (Zeichner and Liston 1990); and today, is shaping everything from entire academic programs (e.g., College for America) to particular knowledge areas (i.e. multicultural competence). Broadly, competency models emphasize three domains: knowledge, awareness (or attitudes), and skills—or what Sipos et al. (2008) refer to as the head, heart, and hands, respectively. Knowledge competence is viewed as the cognitive domain. Awareness consists of the affective domain inclusive of values, attitudes, dispositions (Savageau 2013; Shephard 2008). The skills domain demonstrates the behaviors that embody the awareness and the application of knowledge. Growing scholarship investigates how EFS might, or does, yield particular learning outcomes or develop sustainability competencies (Filho 2009; Hungerford and Volk 1990; Mochizuki and Fadeeva 2010, 2012; Stubbs and Schapper 2011; Wals 2010; Wiek et al. 2011a, 2011b). However, critics of EFS and students' learning assert that graduates may have a "commitment gap" (Emanuel and Adams 2011, p. 90)—meaning insufficient skills to tackle sustainability problems and upset the status quo (Barry 2006; Kopina and Meijers 2014). Further, as Werner (1999) critiques, psychological studies provide "passive descriptors of how things are" and lack empirical evidence of "how to empower people" to convert knowledge and awareness into skills and behaviors (p. 223).

These gaps or shortcomings in competency development have implications for society as a whole, since EFS may (unintentionally) over-emphasize one dimensional thinking (i.e. environmental concerns) and yields solely individual actions

(i.e. recycling). An EFS approach that falls short in its attention to economic and equity dimensions of sustainability, risks producing superficial enactments of citizenship (Barry 2006). Citizenship education scholars critique that *personally responsible or participatory educational approaches may yield individual responsibility (i.e. picking up trash, recycling) but fail to achieve transformative or justice-oriented potential* (Westheimer and Kahne 2004). Graduates should not have only abstract knowledge of sustainability; or only skills in recycling; or have the misperception that sustainability competence only has utility for "green" jobs. Rather, graduates must have the skills to serve as sustainability change agents in "societies and economies not yet prepared to absorb them" (Wiek et al. 2011a, p. 212; also Svanstrom et al. 2008). To this end, "deep" competence is needed.

2.3 Deep Learning

My use of the word "deep" draws from the social science literature on deep learning. The identification of different approaches to learning is attributed to educational psychologists, Marton and Saljo (1976), who studied students' approaches to learning, and identified that some students sought to comprehend the whole picture, link new ideas to already known concepts, and apply principles to other contexts. Such "deep" learning is differentiated from "surface" learning wherein students typically engage in rote memorization of "unrelated bits of information" (Entwistle 2000, p. 3). With deep learning, students make connections between ideas, examine underlying arguments, explore root causes of problems, and engage in active learning (Entwistle et al. 2000; Warburton 2003; Wiek et al. 2011b). Such a process involves a "metacognitive alertness" that is more likely to translate into "how students act in everyday situations" (Entwistle 2000, p. 3). A third approach, "strategic" learning, "is characterized by competitiveness and attempts to maximize academic achievement with minimum effort" (Warburton, p. 46; Tait and Entwistle 1996). EFS will benefit from an emphasis on deep learning, so that students move beyond surface knowledge yielding only individual level change, to competence for thinking and acting systemically, critical consciousness, and activist skills.

2.4 Experiential Learning and EFS

Experiential learning has become increasingly popular in higher education. Experiential learning, a concept attributed to educational theorist David Kolb (1984), is the process of learning by doing *and* reflecting upon that experience. Examples include internships, service-learning, community action projects; and scholars in the social sciences attest to many benefits including developing students' abilities to think critically about social problems and solutions to those problems (Allan and Iverson 2004; Balliet and Heffernan 2000; Eyler and Giles 1999; Parker 2012). Yet,

experiential learning remains under-utilized in EFS. Domask (2007) describes the benefits of one experiential learning program in international sustainability studies, but also observes the "dearth of research" on experiential learning (p. 65).

Further, studies of EFS have focused largely on classroom-based or curricular contexts, with little attention to the experiential learning that occurs in "informal (e.g., student activities)" spaces (Barth et al. 2007 p. 416). Just has sustainability inquiry has disproportionately focused on natural sciences, resulting in "sustainability being largely disregarded" by the social sciences (Becker et al. 1999), so too EFS has focused namely on "formal" or classroom contexts, failing to recognize the transformative potential for out-of-classroom education (such as residence hall programming) through which students "learn from what we do rather than what we teach" (Cohen 2007, p. 90). Existing literature on co-curricular initiatives has been limited and largely descriptive of sustainable housing trends and residential sustainability programs (e.g., Brewer et al. 2011; Torres-Antonini and Dunkel 2009; Shimm 2001; Shriberg 2000). This chapter describes findings from a study of undergraduate students' thinking about sustainability, and uses these findings for critique and rethinking about sustainability competence.

3 Methods

3.1 Site and Setting

Kent State University (KSU) has sustainability initiatives incorporated into its residence hall program. In addition to renovation projects designed to enhance conservation (e.g., new windows, new HVAC systems), residents have participated, for several years, in two annual competitions. First, the "do it in the dark" energy reduction program is held each fall, putting residence hall versus residence hall in competition to reduce electricity during a two-week period. Second, Recycle Mania, an inter-hall recycling competition, is hosted each spring; this is an international competition where universities promote waste reduction. Over an 8-week period the amount of recycling and trash collected are reported, and colleges are ranked based on who generates the least (About Recycle Mania n.d.). Residence hall staff promote and implement the competitions, and provide incentives for students to be "caught" exhibiting green behaviors.

3.2 Data Collection

In a study of undergraduate students' thinking about sustainability, DuBois and DuBois (2010) administered a survey to 768 undergraduate resident students at KSU to determine students' perceptions of the residence hall sustainability programming, students' understanding and definition of sustainability, and the impact

of perceptions about sustainability on green behaviors.[1] In addition to Likert-scale questions, over 500 respondents provided answers to seven open-ended questions on the survey about sustainability initiatives in the residence halls; what sustainability means to them; their environmental values, attitudes, and behaviors.

3.3 Data Analysis

The data from the open-ended questions were analyzed using summative content analysis. This qualitative approach to data analysis "starts with identifying and quantifying certain words or content in text" (Hsieh and Shannon 2005, p. 1283). However, it moves beyond a quantitative counting of words, to include a process of interpretation of content. Yin (2011) describes several phases of qualitative data analysis, beginning with *compiling* and sorting the data to put them in some sort of order; then *disassembling* the data into smaller pieces and assigning codes; next, *reassembling* the data using substantive themes or code clusters; and finally, *interpreting* "the reassembled material to create a new narrative" (p. 179). Finally, an examination of the coded data for conceptual patterns and linkages enabled me to uncover "underlying meanings of the words or the content" and see broader themes (Hsieh and Shannon 2005, p. 1284).

3.4 Limitations

Findings from studies that employ a summative content analysis are limited by "their inattention to the broader meanings present in the data" (Hsieh and Shannon 2005, p. 1285). This limitation can be mediated by showing that the textual evidence is consistent with the interpretation. Use of a peer debriefer or member checking with participants is a mechanism to demonstrate credibility (Hsieh and Shannon 2005). The latter option (member checking) was not viable, as the survey was anonymous; however, the researcher employed a peer debriefer during analysis, thus contributing to researcher confidence in the coding process and contributing to the trustworthiness of the findings (Onwuegbuzie and Leech 2007).

Another limiting factor of this study is its use of one institution for collection of data. Future study should seek a larger random sample of institutions. Further, respondents may have attempted to provide answers that make themselves appear more socially responsible. While this effect is mitigated by individual anonymity, future survey administration should be coupled with the use of a social desirability scale will help to determine the degree to which this bias exists. Finally, the study is limited by "nonresponse bias" (Groves 1989)—the inability to determine which potential respondents declined to participate. It is not evident the extent to which those who participants were more likely to be stakeholders who are involved in

[1]Findings from the quantitative analysis have been reported elsewhere (see DuBois and Dubois 2010).

sustainability initiatives. However, that some respondents (9 %) knew nothing about sustainability suggests that a cross-section of perspectives were captured.

4 Findings

4.1 Meanings of Sustainability

When respondents were asked "what does sustainability mean to you?" they focused on a "better" world and future. Illustrative data excerpts include, "making the world a better place for the generations to come and making the world last a little longer;" "help the world be a better place by taking care of it;" and "keeping things nice for the future!" This "better" world and future would be realized, according to respondents, through various efforts, ranging from "not doing more harm to the Earth," to "helping to keep the Earth clean;" from "protecting the environment" to "caring about our future and taking precautions now." Largely, however, respondents' understanding of sustainability was dominated by the 3 Rs: recycling, reducing, and reusing. Or really, one and a half Rs—recycling was most evident, with some attention to reducing, and minimal attention to reusing.

4.2 Recycle

Recycling was overwhelmingly the main point of emphasis in the data. Recycling was mentioned over 1000 times in 82 pages of data generated by more than 500 respondents. Many respondents simply wrote the word "recycle" in response to what sustainability means, or what they do—or needed to do—in their daily lives, or what is a "green behavior" that they or others could adopt; however, others elaborated. They described the importance of providing recycling bins[2] in the residence halls (and elsewhere on campus), as this is "motivating students to realize what they can do to help change the path America is on;" the presence of these bins cultivates "the habit of recycling for later in life;" and one respondent connected these habits to her academic discipline: "I am a design major, and a big part of our projects is to use materials in a sustainable way and to come up with new ways to use recycled materials."

4.3 Reduce

Many respondents identified "waste" as a significant problem and delineated ways to reduce consumption and waste. These data excerpts are illustrative:

[2]Residents are provided one trash receptacle and one recycling bin in every residence hall room.

- Take shorter showers, use sun light as desk light, turn off computer screens, and keep the laundry room light out.
- I always take the stairs, turn off lights, and unplug appliances not in use. I don't leave water running, I wash dishes by hand, and at home use a low-pressure shower head (maybe those could be incorporated into the residence halls) and my car gets about 40 mpg highway which isn't too shabby.
- I bring my own grocery bags (not just in grocery stores but all kinds of stores), adopt a vegetarian diet, eat local when available (which is somewhat limited in this part of the country), use energy-saving bulbs, walk when possible, purchase items with minimal or recycled packaging, use the least chemicals as possible.

Intriguingly, several respondents also pointed to the use of posters in the residence hall to promote sustainability initiatives as wasteful. They observed that posters are vandalized and/or eventually discarded, and the environment would be better served by eliminating the use of posters, and replacing it with electronic communication. This observation regarding what an entity (larger than an individual) could, or should, do is a point which is discussed later in this paper.

4.4 Reuse

Less evident in the data were references to reuse. A few respondents described using—or their intent to use—"reusable water bottles;" or "reusable mugs for coffee;" or "reusable bags at the store." One respondent mentioned reading newspapers discarded by others, and another identified shopping at Goodwill.

4.5 Beyond Environmental, Beyond the Individual

As described above, the weight of evidence was on the environmental dimension of sustainability, and it also emphasized individual action. Yet, the literature on sustainability illuminates the intersections of environment with economy and equity/social; and how sustainable actions must extend beyond individuals' efforts to discuss institutional impact and systemic change (Lowenstein et al. 2010; Miller et al. 2011). Knowledge extending beyond environmental understanding and skills beyond individual actions were less evident in the data, but are important to consider, in light of students' developing competence for sustainability.

As noted above, students' definitions of sustainability and examples of how, in their daily lives, they promote sustainability centered on individual actions that benefit the environment. Yet, when asked what was environmentally damaging, on campus and in the world, students named broader, systemic concerns. For instance, in the world, students identified the following issues: global warming, fossil fuels, deforestation, and industry. On campus, they observed the following problems: not having individual controls over temperature; inefficient electrical use, and not only on an individual level, but that the institution failed to do enough to manage when

lights would be on or off. Students also identified pollution as a significant issue, from too many cars on campus, to the "smog" generated by the campus buses. Paper waste was deemed problematic, namely the failure to replace hand towels with hand dryers in the bathrooms. The dining facilities were also cited for troubling choices, such as using Styrofoam "to go" containers.

These examples illuminate that students understand sustainability issues more broadly and deeply than just the 3 Rs. However, they may over-conflate environmental (and individual) dimensions of sustainability, and not have the language to express economic, equity/social, or institutionalized dimensions of sustainability, or the skills to apply such knowledge. Thus, when considering EFS and the development of sustainability competence, educators must consider what do we want students—citizens—to have competence for? Sustainability competence—knowledge, awareness, and skills—could risk being diluted into environmental knowledge, awareness of individual actions that are environmentally damaging, and skills in little more than recycling and reducing.

5 Sustainability Competence for What?

In this section, the sustainability competencies evident in the data are discussed relative to the question: "to what end?" To what degree will students use their sustainability knowledge to question the status quo and seek alternative solutions to age-old problems? How will students deploy their sense of agency and to what ends will they be committed? How will students interpret "the right thing" and how will they endeavor to "help" the environment? How "deep" is their competency for sustainability?

5.1 Expanding Knowledge

Students' knowledge was rooted primarily in environmental dimension of sustainability. They articulated knowledge of environmental problems, including global issues such as deforestation and pollution, and campus issues such as electrical inefficiencies. The majority of respondents defined sustainability as keeping their environment clean; conserving resources; and related efforts that individuals must in initiate to ensure the world is "better for our children." Yet, they also had insight about how organizations contributed to sustainability problems. For instance, citing the Dining Services, one respondent wrote, "Transport and production of foods for campus and on campus is environmentally irresponsible," while others criticized use of Styrofoam and called for "packaging that biodegrades quickly." Other respondents cited concerns related to residence life practices, such as the use of posters described above. Still another respondent expressed cynicism that campus "efforts to 'go green' are motivated by the green money rather than altruistic reasons." Notably, however, this organizational knowledge was limited as

compared with knowledge of individual sustainability behaviors, and the capacity to convert this organizational knowledge into actions was invisible in the data—a point to which this paper returns later in discussion of "skills."

Sustainability knowledge must be expanded to include attention to the historical, social, and political context of sustainability; what Cohen (2007) calls systems thinking. It must include a critique of anthropocentrism—the "pervasive belief that nature is solely a resource for human use," of androcentrism—the belief that men are superior to women (Russell and Bell 1996, p. 173), and of ethnocentrism—"the belief that some 'races' or cultures are morally or intellectually superior to others" (Lowenstein et al. 2010 p. 102), and the impact of these ideas on sustainability. Further, it must demand an examination of the power relationships at work in the environmental, institutional and socio-cultural contexts in which sustainability work occurs (Lowenstein et al. 2010; Russell and Bell 1996).

5.2 Expanding Awareness

It is argued that our knowledge about and relationship with nature is tied to self-awareness. Thus, sustainability competence must involve the development of students' awareness of their own assumptions, biases, and values. Yet, this domain of sustainability competence was less evident in the data. For instance, many respondents indicated that "people should be more aware;" yet, their calls for increased awareness seemed synonymous with (lack of) knowledge rather than with raised personal or social consciousness. Some respondents cited caring for the earth —"it can't save itself," or a "lack of feelings toward the environment" as an important aspect of sustainability. Many believed that the residence life sustainability efforts were evidence that the university "actually cares…not only for their wallet but for the environment." Residents' participation in sustainability initiatives "shows that the young people of this country are caring." Another respondent emphasized "Caring about the present, including all the people in the world that you don't know. Caring about the future generations… I don't want to have as much to be blamed for as other generations."

A raised, and critical, consciousness that might yield a deep shift in perspective (Cohen 2007; Miller et al. 2011), is under-developed in this campus', and likely on most campuses' sustainability efforts. As one respondent astutely observed, sustainability "means changing the way we view the world;" yet, the extent to which EFS teaches us "to suspend our own … assumptions, to avoid using our status or power to dominate others, [and] to develop empathy for [others'] values and positions" seems limited (Cohen 2007 p. 86). We must then identify mechanisms by which students can develop critical consciousness, environmental empathy, and compassion (Cohen 2007), in an effort yield affective learning outcomes (Shepard 2008). This expanded sustainability awareness "provides powerful motivation" for taking action and deepens the commitment to apply knowledge (Eyler and Giles 1999, p. 157; Emanuel and Adams 2011).

5.3 Expanding Skills

Sustainability skills are the "know how" to manifest actions that reflect one's knowledge and awareness. Resonating with Sipos et al.'s (2008) use of the hands metaphor for sustainability skills, one respondent described sustainability as being able "to take the earth into your own hands." Yet, respondents' practical application of their sustainability knowledge (and awareness) was largely evident in descriptions of individual actions. For instance, in response to the question, *what do you do in your daily life?*, respondents focused on how individual actions can 'solve' sustainability problems. While respondents had knowledge of organizational practices that were detrimental to sustainability, as described above, they do not articulate the skills to facilitate structural change. This distinction is most prominent in their responses to the question about what green behaviors they will adopt in the coming year. Most describe individual actions e.g., drive less, walk more, eat local, turn off lights and electronics, use less water, and recycle, among other individual efforts. Some also describe their intentions to educate others, i.e. plans to "get my Mom to recycle at home," or "getting my roommate to turn off lights when not in the room." However, when respondents describe organizational efforts that are needed (e.g., reducing Styrofoam products in the dining hall, designating a "lights out" time in the residence halls, putting hand dryers in the bathrooms), these are described using third person, they or it. Most students appear to have individual efficacy for environmental dimensions of sustainability (i.e. skills for recycling or energy reduction), but have little opportunity to develop the capacity to influence collective action or change on their campuses. Thus, EFS must develop skills that will prepare individuals to effectively intervene at not only individual levels (e.g., my personal decision to reduce, reuse, or recycle), but also the capacity to confront systemic factors and operate as a change agent at institutional levels. Further, skills must address not only environmental concerns, but also equity and economic sustainability.

6 Implications

The findings reported above resonate with others who have described similar results: students demonstrated a dominance of "conserving behaviors," and few report "taking initiative" behaviors (Ones and Dilchert 2012). Further, some have shown that increased awareness and understanding, and even "favorable attitudes toward sustainability" and motivation to act accordingly, "rarely lead to changes in behavior" (Zint and Wolske 2014, p. 190). However, some optimism can be found in the weight of evidence for individual environmental competence as seen through the respondents' stated commitments to recycling and reducing. Further, their knowledge of institutional practices that run counter to sustainability goals calls us to consider how EFS could yield "deep" sustainability competencies. Here, implications for EFS are considered that might hold transformative potential.

6.1 Developing "Deep" Competence

In EFS, such as the co-curricular initiatives implemented by residence life, students are acquiring basic competence—knowledge, awareness, and skills—in sustainability. They articulated knowledge of environmental problems, at an individual, institutional, and global levels; and expressed commitment to individual "green" behaviors (i.e. recycling). Yet, to deepen their knowledge, awareness, and skills, so that students can develop and apply their sustainability competence beyond the immediate context (in this case, the residence halls, but could also be the context of their academic disciplines), students must have iterative learning opportunities. One (or even several) initiative(s) in the residence halls, implemented consistently each year, does not afford students the opportunity to engage more deeply in a subsequent year, or differently depending upon their class standing. Educators need to consider if/how the fourth year student's experience is, or could be, different from the first year student's experience. Similarly, in academic disciplines, educators would be wise to consider how to sequence learning from one class to the next, or one year to the next; for one class may be a powerful starting position, but is insufficient.

The ability to achieve deep learning could be undermined by the competitive nature of the residence hall initiatives (or any incentivized learning); students may be demonstrating *strategic* learning, in which students can maximize achievement with minimal effort, and have no deeper learning that extends beyond the immediate context (Warburton 2003). To facilitate deeper learning, and thus deep competence for sustainability, educators are encouraged to devise more opportunities for EFS to deploy experiential learning, but to adopt a justice-oriented approach that will challenge students beyond personally responsible actions, to challenge existing social and political structures (Westheimer and Kahne 2004). Whether this occurs in curricular contexts (i.e. through use of service-learning), or through more purposeful intersections between curricular and co-curricular learning, such experiential opportunities would enable students to apply what they are learning, not only individual actions, but also skills to challenge institutional practices (Wals and Jickling 2002). Further, it is important to incorporate reflection into the design of these learning opportunities, as the development of reflexivity is essential for cultivating critical consciousness for *deep* sustainability awareness (Miller et al. 2011).

6.2 Politicized Ethic of Care

Approaches to EFS are needed that develops in students the capacity for moving beyond individual level competence (i.e. *I will recycle*), to skills for taking institutional level actions (i.e. *I will advocate for changes in institutional practices*). To achieve "deep" sustainability competence, educators must politicize sustainability; not to preach an ideology, but to illuminate the political issues surrounding sustainability, and prepare students for environmental political participation (Levy and

Zint 2013). Such a capacity emerges from not only political knowledge, but also personally meaningful awareness of sustainability, and the skills to pressure their governments to work for needed environmental change (Levy and Zint 2013). This is what Russell and Bell describe as a "politicized ethic of care" (p. 175).

To this end, EFS efforts would benefit from purposeful intersections with citizenship education. Eyler and Giles (1999) identify five dimensions that are viewed as the "means to the end of citizenship" (p. 156). These are (1) values: students' recognition of what "I ought to do" (p. 157); (2) knowledge: students' "expertise and cognitive capacity" (p. 159); (3) skills: students' "know how" and "confidence in their ability to act" (p. 161); (4) efficacy: students' "personal self-confidence" to "take the risk of involvement" (p. 161); and (5) commitment: the "urgency to do something" (p. 162). Varied conceptions of citizenship exist; yet, a growing body of work illuminates the need for citizenship education to move beyond personally responsibility to include enhanced social consciousness and the skills to take collective action (Iverson and James 2010; Westheimer and Kahne 2004). If our graduates are disengaged in socio-political affairs then they are going to be less-equipped at meeting the challenge of sustainability (Colby et al. 2010; Hamrick 1998). Thus, the efficacy to engage in environmental politics is essential for developing deep sustainability competence.

6.3 Developmental Readiness

Students will be at various levels of learning readiness. To illustrate, 9 % of respondents in this study indicated they knew nothing about sustainability and did not know how to define the term; and 5 % of respondents could not identify anything that they believed was environmentally damaging on campus. At the other end of the knowledge continuum were a handful of respondents whose responses suggested a deeper understanding. For instance, this one respondent acknowledged the three dimensions of sustainability:

> Finding a balance –economically, equitably, and environmentally –so that the earth can sustain the human race forever. Right now it would take 2.4 earths to support our population; that number needs to be less than or equal to 1.

Another respondent indicated her understanding developed before college: "I became 'green' when I was in high school."

Students bring a range of prior knowledge, learning styles, and levels of cognitive complexity to college. Thus, it is important for educators to be cognizant of students' "developmental readiness" (Gayles and Kelly 2007, p. 204) in their design and delivery of EFS. Failure to assess students' readiness can lead to student (and educator) frustration. As Wals and Jickling (2002) observe, educating about sustainability includes "deep debate about normative, ethical and spiritual convictions" and requires the "transformation of mental models" (p. 127). Some students will be resistant to EFS. Some respondents in this study expressed skepticism and criticism about environmental concerns, and the degree to which human impact was the

cause. It is important to carefully design curricular and co-curricular experiences that provide a balance of challenge and support for students as they "sort through the complex mix of feelings triggered when new information collides with unexamined prior knowledge" (Chick et al. 2009, p. 11).

7 Conclusions

In sum, this chapter described findings from a study of undergraduate resident students' understanding and behaviors regarding sustainability. Respondents' understanding of sustainability was overwhelmingly environmental (recycling, and reducing waste), and skills did not extend beyond individual actions. Drawing upon educational theories of deep learning and experiential learning, this chapter argued that sustainability initiatives must not only develop individual-level competencies (i.e. awareness of personal consumption, reduction of personal waste and energy usage), but also equip individuals to act at institutional and structural levels (i.e. advocating for changes in policy and practices). Approaches to EFS are needed that will yield sustainability competencies that not only enable individual-level capacities (i.e. awareness of personal consumption, reduction of personal waste and energy usage), but also to equip individuals to act at institutional and structural levels (i.e. advocating for changes in policy and practices). Such *deep* sustainability competencies will be more likely to develop "innovative change agents that the world needs today and in the future" (Dungy 2011 p. 272). This "politicized ethic of care" will enable students to identify and address issues that are "personally meaningful" but also to examine "the structures that contribute to the problem and our own role in perpetuating these structures" (Russell and Bell 1996 p. 175). This chapter calls for others to build upon the ideas advanced to fuel future scholarship and lively debate for how EFS can develop deep sustainability competencies. These competencies will not be developed in one course in one semester; as Case (2012) notes, engaging in critical self-reflection, dismantling oppressive structures, and taking vigilant action toward social change, is a lifelong process.

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Discourses and Identity: An Educational Sociology Approach to Campus Sustainability Assessment

Ricardo Noyola-Cherpitel, Pedro Medellín-Milán and Luz María Nieto-Caraveo

Abstract

It is widely recognized that integrating sustainability in student professional development is an important contribution of the university to transform students into citizens who are sustainability conscious and who positively impact on university campus and on society in general. Organizations and social groups that promote sustainability introduce different discourses in the university according to their interests and through this process regulate the educational responses to sustainability. Therefore, discourses influence the types of professional identities produced in higher education. The research question was: How are sustainability discourses interpreted and translated by students into their professional development and what are the implications of their identification with one or more sustainability discourses? This question was answered through research focused on graduate students' theses. The analysis was based on Bernstein's educational sociology theory which describes how social discourses are selected and adapted to the pedagogic context. Five different groups of students were identified based on the type of interpretation of sustainability that they favored as a framework for their research. Interpretations

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were constructed based on combinations of sustainability discourses adapted by students in their research and, hence, it was also possible to identify the organizations where discourses originated. This study has implications for advancing campus sustainability by evidencing that discourses that are given priority in higher education, such as curriculum content or teaching activities, could dominate students' professional identities, thus limiting their scope for social contribution.

Keywords
Identity · Sustainability · Agencies · Discourses · Higher education · Recontextualization

1 Introduction

Higher education is genuinely engaged in the process of change and promotion of sustainability on different fronts, as can be seen in the abundance of international declarations and commitments for sustainability in higher education (Disterheft et al. 2013; Tillbury 2013). It is widely recognized that integrating sustainability in student professional development is a key contribution of the university to transform students into citizens who are sustainability conscious (Sterling 2013; Tillbury 2013). Thus, through education, students have a positive impact on social systems, as proposed in chapter 36 of Agenda 21 (ONU 1992).

Campus sustainability is usually considered an integrated institutional endeavor, directed towards campus operations, administration, curriculum, innovation and research; all this revolving around what B. Clark defined as the central functions of the university: production, teaching and distribution of knowledge (Clark 1991). Therefore, sustainability initiatives can be analyzed on two levels: organizational, referring to reconfiguring operatively towards sustainability, and epistemic, referring to changes in knowledge production and teaching to make them conducive to sustainability.

Both types of initiatives for campus sustainability represent opportunities for students to get involved in processes that favor learning and developing identities with a sustainability dimension. The importance of differentiating both types of initiatives is that their assessment requires different approaches. Organizational sustainability in universities has been the subject of previous studies and several sustainability assessment tools have already been developed (EAUC 2015; Caeiro et al. 2013). In the present text we focus on the second type of initiative: construction of sustainability at the epistemic level.

Discourses communicate different interpretations of sustainability. These interpretations can be classified according to the types of goals that organizations and groups prioritize. For example, socio-economic well-being and social equity on one hand and the environment on the other. Interpretations can be classified as

promoters of status quo, reform or transformation (Hopwood et al. 2005) and most of the discourses about sustainability produced by organizations fall in one of these categories. In the context of a university campus it is possible to find adaptations of these discourses in university functions and activities. Other discourses also converge in higher education: the importance of the specialized and differentiated knowledge of the disciplines; the employment's sector demands for specific knowledge and skills to increase productivity; and governmental requirements for more socially relevant academic production and services (Clarke et al. 1984).

Organizations and social groups that promote sustainability introduce their different discourses in the university according to their interests; through this process they regulate educational responses to sustainability. Therefore, they influence the types of professional identities produced in higher education. The purpose of our research was to contribute to a better understanding of the process by which different discourses are introduced in the context of research projects conducted by students and the implications this could have for assessing a sustainability dimension in their professional development and identity.

2 The Production, Relocation and Communication of Discourse

Basil Bernstein proposed a model to describe the existing relations between discourses produced by groups and organizations as a result of their social interaction and how these discourses translate to a pedagogic activity in schools or any knowledge communication-acquiring relation (Bernstein 1998). This process is called recontextualization, where a discourse is selectively removed from its original context of production and relocated in a pedagogic discourse; at the same time it is related to and connected with other discourses (Morais and Neves 2009; Singh 2002). It is possible to observe this process in the production of disciplinary knowledge, such as scientific theories. It is through recontextualization that scientific theories are incorporated into the pedagogic discourse, where they form part of a knowledge package along with other contents for the students to learn.

For Bernstein a discourse is produced when a specific knowledge is relocated from a social context to an educational field (Bernstein 1994). An agency can be an organization, a group of organizations or groups of people that share a specialized discourse. Under this concept, even groups that are not formally constituted become agencies of a discourse. For example, a scientific discipline gains the capacity for action and production of discourse through its community of practitioners. However, specific agencies such as research institutes, private think-tanks and universities specialize in discourse production (Bernstein 1994).

Since discourses originate in social spaces or fields, where the struggle between agencies competing for different forms of power takes place (Singh 2002), the production, recontextualization and communication of discourse translates these struggles to the educational context. This happens because, in order to position their

discourse, agencies promote the insertion of specific codes to try to shape discourses, embedding in them particular power and control attributes (Morais and Neves 2009). The result is that the pedagogic discourse not only transmits the original text produced by the agency, but also passes codes which represent a set of meanings and their relative positioning between each other. This is how recontextualization constructs an ideological base, where ideology is a means to establish and realize relations between contents (Bernstein 1998, p. 48).

Recontextualization is mainly seen in the formulation or modification of curriculum, but is also found in other activities where learning takes place, such as classroom teaching and tutoring. In the case of some higher education institutions, it can be seen in the development of a theoretical framework for a research project by a student, where different types of knowledge (ecology, statistics, sociology, education) are brought together into a discourse.

The recognition of recontextualization as the central mechanism that constrains the exposure that students have to different knowledge and, in consequence, the possibilities to form their own consciousness is an important key to understanding the development of professional or specialized identities. However, as identification is a continuous process, it is possible to change it or invert its ideological underpinnings. This is because even if the subject is positioned by the meanings and the relations she/he acquires from the voice of a discourse, this does not silence other voices that do not correspond to the discourse (Morais and Neves 2009). In other words, the same process of control that defines what is thinkable has the potential to put within reach of the subject also what is unthinkable (Bernstein 1998).

3 Professional Identity and Sustainability

Bernstein's model is relevant for the study of sustainability in higher education for two reasons:

First, Bernstein explicitly recognizes the influence that social agencies have in the educational field, as his theoretical model explains how through the inclusion/exclusion of contents and recontextualization of discourses in pedagogic discourse agencies contribute to maintain an ideological base which students reproduce. This is relevant for organizational change for sustainability as it underscores that a diversity of social interests are at stake (economic, political, cultural), where not all of them are framed by a sustainability concern, even though many of them do have a voice in the pedagogic discourse.

Second, the model highlights the existing social conditions of competition between agencies and their debates, so students' identities are produced by a given social order. These identities are not formed in isolation or by the sole effort of the student. They have their origin in a collective purpose, which is negotiated between the individual identity and other collective identities (Bernstein 1998). Higher education students understanding of sustainability is shaped by both their professional training and the social context where they have developed; therefore, their understanding of

sustainability will not only depend on the discourses that they have been exposed to, but also on how they are articulated and assimilated in their identity.

Campus greening and operative sustainable transformation of the university contributes to build a sustainability dimension in the students' professional identities. This is done by working with sustainability in all substantive functions of the university on practical and theoretical levels through a transversal integration (Nieto and Medellín 2007). Tools for assessing campus sustainability can provide important information on the advances that an institution is making towards its organizational integration. However, an indicator of advances of the construction of sustainability in students' identities (or a change in their consciousness) could be evidenced by the capacity of students to introduce sustainability related issues in their academic work and practice; for example, including sustainability as part of the central arguments in their manuscripts.

Our proposal for assessment of campus sustainability focused on the recontextualization of sustainability discourses and the dialogue that was established with other discourses and knowledge in professional development. In this manner, recontextualization of discourses in their academic work could serve as an indicator of sustainability's realization in students.

In addition to identifying the main discourses recontextualized by students in their research projects and the agencies from which discourses originate, the analysis aimed to recognize if students identified with a particular interpretation of sustainability. Another interest was to understand if other discourses being recontextualized correspond to forms of knowledge production that are conducive to sustainability, such as multidiscipline. For example, Morin (1999, p. 2) has proposed that to transcend disciplinary, fragmented and disconnected knowledge, we must move towards a knowledge that understands objects within their contexts, their complexities and their connections: a vision which many consider essential for a robust understanding of sustainability, and one that is frequently incorporated into theoretical frameworks related to environmental, social and economic challenges.

For the analysis, the framework of Hopwood et al. (2005) was used as a reference for classifying discourses as status quo, reform or transformation, in relation to society's response to sustainability. This interpretation is made on the basis of how social and environmental issues are articulated to face sustainability challenges and correspond to the following combination of factors:

> Status quo: Sustained economic growth is required; technology and information are seen as drivers for change; a change in values is called for; environmental regulation and management techniques are emphasized.
>
> Reform: Technology and information are seen as drivers for change; environmental regulation and management techniques are emphasized; economic growth is coupled with living standards; local action, democratization, and better urban practices are called for.
>
> Transformation: Change in material conditions and structure of society is required; lifestyles, economy and politics are connected; an integrated view of the world is called for; capitalism's division of gender and social class are rejected; social equity, cultural diversity, environmental democracy and organized political power are called for.

The working premise was that the conceptual frameworks and practical adaptations of sustainability in research undertaken by students have two conditions:

1. They are based on discourses that correspond to a particular interpretation of sustainability or, alternatively, include an argumentation where a combination of the factors described above correspond to an interpretation, and
2. Discourses can be associated with agencies that produce the discourses.

In the case of Condition 1, it is considered an indicator of the type of interpretation of sustainability that is being realized in the student. Condition 2 allows for a connection between the discourse producing agency and its reproduction in the individuals that recontextualize the discourse in the context of his/her professional development.

Based on this adaptation of Bernstein's theoretical model to the recontextualization of discourses in students' professional development, the research questions for this study were: How are sustainability discourses interpreted and translated by students into their professional development and what are the implications of their identification with one or more sustainability discourses? Can a sustainability dimension be assessed in students by their capacity to introduce these discourses in their academic work?

4 Case Study

Throughout the last twenty years the Autonomous University of San Luis Potosi (UASLP) has led efforts towards sustainability on several fronts. An important milestone was the creation of an Environmental Agenda in 1998, with the task of helping to transversally integrate environment and sustainability in the university through several programs (Nieto and Medellín 2007).

One area that stands out at the UASLP is the wide range of research around environmental, health and social problems concerned with sustainability at the regional and local level (UASLP 2014a). Although most of the researchers on sustainability are concentrated in programs and research groups dedicated to environmental studies and related areas, research initiatives are emerging from other knowledge areas, such as communications, economic and administrative science, evidenced in the recent creation of academic groups focused on sustainability throughout several faculties (UASLP 2014b). A considerable number of publications and training programs have been organized, as well as participation from professors and students in academic events such as congresses and conferences about environment and sustainability (UASLP 2014b).

In this context, the Postgraduate Multidisciplinary Program on Environmental Science (PMPCA) has been in operation since 2002 with sustainability being one of the pillars of the curriculum, including an introductory course on Sustainable Development (PMPCA 2011). The program has produced a diverse body of research supported by the work of graduate students; the cases selected for our

study were theses for obtaining a master degree and doctoral dissertations produced by this program from the years 2002 to 2014.

5 Methods

Documents were identified in the institutional database of research products, which is prepared for the Rector's annual report (UASLP 2014b). Research papers, book chapters and theses were considered for the analysis. However, an important criterion for selecting the documents was that they had been produced by students as part of their professional development, and therefore the analysis focused on theses of the PMPCA, where a large proportion of the identified documents dealing with sustainability were produced. The theses were available in digital form which facilitated access to the documents (PMPCA 2014).

All documents were reviewed to identify those in which an explicit argumentation about sustainability was included, either as part of the conceptual framework or as a reference for the discussion of results. Based on this review a group of ninety theses was chosen for the study, spanning ten years of operation of the program. After the initial review, thirty-six theses were analyzed in detail with the aid of the Atlas-ti7 tool to facilitate quote retrieving (Scientific Software Development GmbH 2014). This second selection was based on three convenience criteria: Have samples of documents distributed across all years of the graduate program activity, with the purpose of analyzing the different periods of operation of the program; include examples of diverse research contexts where sustainability was introduced; and have as much variability as possible in terms of the professors involved in the research projects. This last condition was selected because some professors were identified as being the core of the committees that directed several of the theses of interest, leading to similar introduction of sustainability in the construction of the theoretical frameworks, argumentation and discussion.

The first phase of the analysis focused on identifying the text passages with an explicit argumentation about sustainability in reference to: its justification for the research, its articulation with the conceptual framework and its inclusion in the discussion and conclusions. A second phase focused on an inductive analysis of the text passages to identify:

- Sustainability discourses, through definition of the concept, historical reconstruction of its evolution or discussion of its conceptual foundation.
- Agencies cited as producers, precursors or originators of the discourses.
- Specific practices to face sustainability challenges, derived or not from the discourses and agencies, incorporated in connection to the student's object of study.

The process of analysis for each document consisted in classifying: Sustainability discourses introduced; agencies of sustainability discourse; methodologies or practices proposed in connection with the discourses; and the relation established

between discourse and the object of study. As a result of the analysis, documents were grouped according to their affinities in terms of the discourses of sustainability introduced and the theoretical frameworks proposed to incorporate sustainability in the research. Finally, groups were associated with a particular sustainability identity taking as reference the classification of sustainability responses proposed by Hopwood et al. (2005) according to the combination of factors which conform to a particular interpretation of sustainability.

6 Results

The documents analyzed showed diversity in the way that PMPCA students introduce sustainability perspectives and justify a methodological approach or the use of a theory according to their object of study. However, after grouping the documents according to similarities and differences in discourse construction, five consistent groups could be distinguished that reflected the main interpretations of sustainability that students favored as framework for their research. Care was taken to have as much internal coherence between the selected theses for each group and the corresponding interpretation. Results are summarized in Table 1. Column A shows the group name and in parentheses the number of theses it includes. Columns B to D show the identified discourses, agencies, theoretical frameworks and practices identified in each group, while column E refers to the identity projected by the students according to the interpretation of sustainability assigned to each group.

The original three categories of interpretations, status quo, reform and transformation, were complemented with two additional categories: reform/transformation, and transformation/revolution that were named to reflect diverging interpretations of the transformation category.

A progression was identified in the level of abstraction required to explain the core problem of sustainability according to the different discourses utilized. This progression ranged from an explanation of the need to separately achieve sustainability in three dimensions–environment, society and economy—(G1), to a call for structural change in society where sustainability is only possible by maintaining integrity and functionality of eco-social systems through a complex systems perspective (G4 and G5).

The theoretical frameworks and practical approach to research varied accordingly from group to group. G1 focused more on planning, management, regulation and technology as the options available to connect their object of study to sustainability. In G2 a combination of resource management and governance principles were at the core of the sustainability proposals in relation to the research. G3, G4 and G5 proposed frameworks to enhance community participation and focused on rural and traditional knowledge and introduced complexity and systemic perspectives in some cases. In addition, G3 and G5 highlighted the need for interdisciplinary and multidiscipline approaches to sustainability.

Table 1 Sustainability discourses, agencies that produce them and type of identification projected by students, classified by group

A	B	C	D	E
Group (No. of theses)	Recontextualized sustainability discourses	Agencies identified as producers of the discourses	Theoretical sustainability frameworks and practices to support research	Sustainability identity dimension projected by student
G1 (14)	– Sustainability conceptualization through the definitions of international organizations and their programs – Technology is available to overcome sustainability limits and produce green economies – Regulative approach to environmental problems – Achieve sustainability in three separate dimensions: social, economic and environmental – Need for conservation of natural capital – Resources management. – Sustainability is related to business opportunities – Call for intra-generational equity: change health and living conditions of communities – Change values and consuming patterns	– International Organizations: UN, UNEP, UNDP, World Bank – Government agencies – Corporations – Education institutions and associations – Communities	– Environmental planning – Process design and efficiency – Green initiatives – Green technologies – Sustainable resource management – Environmental management systems	Status Quo
G2 (6)	– Critique of development model – Recognition of ecological complexity – Call for community participation – Use of technology adapted to local conditions – Stand by the need of regulatory improvement of human activities – Emphasis in natural resources conservation through resource management	– International Organizations: World Bank, UN (critique of) – International Organizations: UNESCO, UN's Agenda 21 (praise of) – Communities – Government agencies – Non-Government Organizations – Universities	– Sustainable resource management – Environmental governance	Reform

(continued)

Table 1 (continued)

A	B	C	D	E
	– Include well-being as measure of sustainability advances – Sustainability seen through three interrelated dimensions: environmental, social and economic			
G3 (6)	– Sustainability seen through three interrelated dimensions: environmental, social and economic – Call for community participation and autonomy – Local technologies as support of community development –Critique of capitalist production system – Include well-being as measure of sustainability advances – Community management of resources – Critique of materialism	– International Organizations: World Bank, UN (critique of) – Government agencies – Non-Government Organizations – Communities (rural, indigenous) – Academics – Media (critique of) – Universities	– Rural sustainable development – Ethno-development – Deep ecotourism – Interdisciplinary – Environmental education – Endogenous development	Reform/ Transformation
G4 (6)	– Critique of capitalist production system and technological solutions – Complexity and systemic vision of human-nature relation, across multiple dimensions – Call for social equity – Improvement of quality of life as indicator of achievement – Social and environmental justice –Emphasis on traditional knowledge for resource management and conservation	– International Organizations: ECLAC, WHO, UN, UNDP, World Bank – Government agencies – Communities (indigenous, rural) – Academics – Non-Government Organizations	– Sustainable rural development – Ethno-development – Ecofeminism – Human community development – Social and ecological vulnerability – Environmental governance	Transformation

(continued)

Table 1 (continued)

A	B	C	D	E
	– Call for community participation and capacities enhancement			
G5 (4)	– Denounces North-South development gap – Socio-economic system failures at the bottom of sustainability debate – Sustainability only possible maintaining integrity and functionality of ecological-social systems – Call for structural change in society – Importance of preserving the historical heritage of traditional production systems – Diversity and variability as key factors for sustainability – Critique of the concept of Sustainable Development	– International organizations: World Bank, UN (critique of) – Academics – Communities (indigenous, rural)	– Social and ecological complex systems – Traditional and alternative knowledge studies – Multidiscipline – Rural sustainable production systems – Empowerment of local communities – Endogenous development	Transformation/Revolution

Some agencies identified as producers of the discourses were consistent between groups. However, several key agencies were an important differentiating factor between groups. The largest group, G1, drew mainly from official discourses produced by international organizations and by the government. Non-government organizations (NGO) were identified as agencies that produce discourses in only a few theses from G2 and G3. In G3, G4 and G5 academics were identified as important producers of discourses. Communities, rural and indigenous in particular, were recognized as being agents of sustainability discourses in at least one document in each group. However, their discourse was given voice through another agency, such as academics, NGO, government or international agencies. Universities were identified as agencies that produce sustainability discourses in one document in each of G1, G2 and G3.

Based on the recontextualization of the discourses, critical positions were identified and these varied from group to group: from an acritical adoption of the mainstream discourse (G1), to a critical perspective of the production system and materialism (G3), to outright criticism of the concept of sustainable development itself and a call to reconfigure the theoretical and practical landscape of sustainability and its discourses (G5). In several cases critiques appeared as an explicit argument in the texts, in particular G4 and G5, while in other cases the critique (or lack thereof) was inferred from the arguments presented by the authors.

7 Discussion

The recontextualization of a broad variety of sustainability discourses suggests that students are exposed to a rich and diverse theoretical landscape of sustainability, either in the postgraduate program, or in other social spaces. The resulting recontextualization in their research reflects recognizable sustainability interpretations that underpin students' theoretical and methodological approaches.

The study helped to identify that discourses produced by agencies play a role in forming the students' sustainability perspectives. At this stage it is only possible to presume that knowledge acquired during graduate studies was the main source of these discourses. In most cases the discourses are introduced to reinforce arguments that appear to be constructed on a pre existing ideological base, a situation observed mainly in theses of G1. However, in other cases the confrontation of mainstream and alternative sustainability discourses served to delineate identities with a broader scope of sustainability, as was observed in theses in G3, G4 and G5.

The absence of complete internal coherence in the adherence to a discourse was observed in several of the documents analyzed, which suggests a disposition in the students to put several discourses into dialogue. This could indicate that the student's ideological base was reconfigured during the graduate formative process and, as a result, is willing to incorporate different points of view to contextualize and put into perspective her/his justification to focus on a particular discourse. Even if this proves to be correct, the interpretations recognized in this study speak only of an

approximation to an identity projected in the documents, and are not evidence of change at the level of consciousness. Notwithstanding these limitations, the analysis proposed in this study could be useful to determine tendencies about the sustainability dimension that students acquire during their formative process and thus, an indicator of the scope of sustainability in professional identities that the university is providing society through its students.

Our results reinforce the importance of continued study of the adaptability of sustainability to different contexts. This diversity has already prompted the analysis in specialized literature of sustainability's many facets (Wals and Jickling 2002): from the multiple definitions, both in content and in their abundance (Glavič and Lukman 2007; Medellín et al. 2011), to the philosophic and ideological underpinnings of different interpretations (Foladori 2001; Gudynas 2011; Hopwood et al. 2005).

Other relevant implication of the results would be for campus sustainability, as the analysis raises the question of how sustainability discourses are being recontextualized in other areas of the university outside the specific graduate program that produced the selected theses. The acquisition of other discourses that respond to priorities of specific agencies, such as economic, may result in a limitation of the possible approaches the students could display under specific professional contexts in relation to sustainability. In this sense, the analysis suggests that discourses which are given more exposure could be better positioned to dominate students' identities. This also highlights the operational challenges to introduce sustainability contents in education, from an integral perspective which also reflects current debates. In other words, the strong educational response that sustainability requires may only be accomplished by an innovative redesign of the curricula (Chambers 2013). However, innovations face difficulties as they represent a major organizational change that touches many areas, especially the disciplinary identities of departments on which campus operations are based (Clark 1991).

Results also coincide with social research about the role that knowledge has in social domination and how it gives an advantage to those who have it (Leff 2002; De Sousa Santos 2012). This is seen in the recontextualization of some students who managed to open to the possibilities of alternative discourses as part of their research and, in doing so, rebel against mainstream discourses; a possibility not available to the students who reproduced these discourses. So, an issue that should not be ignored is that what has been left out may be as important as what has been included (Lukasik 2010). What is left out corresponds to the muted voices that are not part of the legitimate meanings communicated by the recontextualized discourse. Thus, the more discourses that students are exposed to, the more the chances that those muted voices are taken into account. Recognition of the unthinkable raises the possibility for questioning and opposition (Bernstein 1998), and this probably also contributes to a more robust sustainability dimension in the professional identity.

Bernstein's theory proved a useful tool for analyzing the main agencies intervening in the construction of sustainability in the context of the PMPCA. If developed further, it has a pedagogic potential to communicate the affinities

between different types of agencies and their discourses. In addition, it could help to contrast the core debates between sustainability interpretations and with other discourses that converge in higher education. It also could help to explain why some disciplines are closer to particular sustainability discourses, while others seem a long way from embracing them.

The study's main limitation was that it considered the context of only one Mexican public university and focused on documents produced by students already working in the environmental science field, which are generally individuals motivated towards the environment and close to sustainability teaching and learning so they are not representative of the wider student community at the university. Broader research must be conducted at UASLP and other institutions to confirm that our findings apply in other contexts.

The results obtained based on educational sociology theory suggest that social research techniques are useful to capture the full extent of the impact that universities are having on the advancement of sustainability. In this respect, social research, although time consuming, allowed us to approach campus sustainability as a formative dimension acquired from different discourses and projected in the students' professional development. Assessing this could prove difficult using other quantitative and qualitative indicators, for example, those focused on the academic output related to sustainability, or others focused on evaluating the advances of integrating sustainability principles in university functions and policies.

8 Conclusion

The purpose of this study was to test a proposed assessment method of sustainability's realization in students that will be further developed and adapted to different types of information produced at the university. The decision to use social science based methods was made in light of the inherent complexity of assessing sustainability on a cognitive level in the individual, but also to explore the possibility to connect processes occurring in the pedagogic field with interactions with social fields so as to better understand the significance of students' learning and realization of sustainability.

The diversity of discourses presented by students in their research confirms the importance of the university to remain faithful to principles of free discussion and examination of ideas. Only through this process can more diverse interpretations of sustainability emerge, prompting the construction of deliberation mechanisms and increased efforts for convergence of proposals, while contributing to expand the community involved with sustainability in and out of the university.

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Declarations and Commitments: The Cognitive Practice of Sustainability Agreements

Mary K. Whitney

Abstract

This study analyzes six American voluntary agreements for university sustainability, demonstrating that the individual agreement networks intersect to form a larger network for sustainable low-carbon transitions. Drawing on a framework of social and institutional learning, the study uses network and positional analysis methods to map the cognitive practice of universities engaged in voluntary sustainability commitment. These agreements scaffold learning structures for member universities, providing support in the search for solutions to sustainable transitions. Within these structures, universities experiment and learn as they construct new norms for institutions. Through their participation, universities join a network of shared practice and beliefs. By participating in several of these networks, institutions are connected to many new ideas and practices. These overlapping memberships link together, making a network of networks. By choosing to participate in any or all of these agreements, universities have chosen to enter into a dialogue about and practice of sustainable transition, where learning, experience and expertise intersect. The universities participating in these voluntary sustainability agreements are forming a network of committed practitioners supported by policies and an emerging cognitive practice with the ability, capacity and commitment to significantly address the critical problem of climate change.

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Institutional learning · Sustainable transitions · Positional analysis · Network analysis

1 Introduction

Universities are ideal places to uncover and examine the problems we face as a society. Their culture of exploration and knowledge development translates new ideas to be understandable across disciplines, scales and venues. Most importantly, universities incorporate these ideas into the knowledge base of future leaders, generally known as students, through their teaching (Seyfang and Haxeltine 2011; Calder and Smith 2009). In addition to research and teaching, universities have a strong physical presence in any community. Universities may be one of the largest employers in a region, often with extensive property holdings. Many are the size of small cities, with considerable political and economic power (Vezzoli and Penin 2006). Yet the real power of universities is that they are also institutions in the social sense—a persistent societal structure with symbolic significance beyond their material existence. Universities are part of the dominant culture, with the power to transform societal norms far beyond their own boundaries (Bilodeau et al. 2014; Jacobssen and Bergek 2011).

Learning is considered to be an imperative for institutional survival, particularly in uncertain or highly competitive environments (Popper and Lipschitz 2000). Given the magnitude and unknowns of the climate crisis, institutions must be able to learn quickly. Those that share knowledge can learn from the experiences of others, significantly reducing the time required for transforming their own practice. Networks grow institutional capacity to think together and generate new learning for complex problems (Manring 2007).

This study looks at six American agreements that were developed as purely voluntary sustainability transformations, each with a different focus and approach to institutional behaviour change. Through participation in one of these voluntary agreements, a university joins a network of shared practice and belief that provides important guidance and support for sustainable practice. By participating in several of these movement networks, institutions are connected to many new ideas and practices for sustainable transformation (Knight and Pye 2005).

2 Social Learning Framework and Methods

Voluntary agreements are a specialized form of learning, directing members toward a mutual goal, providing support through recommended actions, encouraged behaviors, and feedback mechanisms. They provide an innovation idea, actions, reports, recommendations, and progress ratings that scaffold the necessary learning for their members (Vygotsky 1978; Lafitte 2010). By joining a network, members

can readily learn from the experiences of others, significantly reducing the time required for transforming their own practice while furthering the dispersion of innovative practices (Mariotti 2012; Kilgore 1999; Kraatz 1998).

Discovering and mapping a network of practitioners allows us to discover the commonalities and clusters of interconnection and innovation. Social learning theory suggests that in these interconnected spaces we may find and leverage the development and institutionalization of new ideas as the basis for collective action (Diani and McAdam 2003).

Knowing the 'what,' ''where' and 'who' of the network leads to a deeper look into the practices, products and extensiveness of its new ideas, and lets us see where learning, experience and expertise are located and intersect.

Cognitive practice theory can be used to analyze the collective action and meaning of a network, looking at what a movement believes, how it organizes to get things done, and most importantly, how it constructs and disperses its knowledge (Eyerman and Jamison 1996). It can give us insight into what social learning has occurred within any social movement, even a vast network of networks of cooperating educational institutions across an entire country.

This study used a combination of situational and network analysis methods to more fully understand the institutional space of voluntary sustainability commitments. Situational analysis is helpful in capturing and mapping the complexity of a situation, and network analysis is designed to graph the many inter-relationships between entities in a network, be they people or organizations. The cartographic orientation to situational data analysis includes "maps" or visualizations that allow the researcher to display the connections and interconnections within a situation. Positional maps are axis-based maps that function as a visual analysis of discourse (Clarke 2005). These maps help to make the structure of knowledge within the network of agreements and institutions visible, indicating what knowledge and expectations are articulated by the agreements, and making commonalities or differences apparent.

3 The Agreements

There are many sustainability agreements and compacts around the world. This study investigated six American agreements: the Talloires Declaration, the Association for the Advancement of Sustainability in Higher Education (AASHE), the Sustainability Tracking, Rating and Assessment Systems (STARS), the American College and University Presidents Climate Commitment (ACUPCC), the International Sustainable Campuses Network (ISCN), and the Princeton Review Green Schools (PRGS). There were over 1400 participating organizations within these six agreements at the time of this analysis.

The Talloires Declaration was the first ever university-focused voluntary sustainability agreement, established in 1990 by a group of 22 university leaders convened by Tufts University. As of 2012, there were 430 signatories in forty countries. It offers a ten-point implementation plan, and makes recommendations

for curricular change and establishing operationally-based programs for recycling and water conservation (Adlong 2013; ULSF 1990).

The ACUPCC, a compact for reducing carbon emissions at universities, had 12 founding university signatories, and 400 charter signatories the first year. Its goal is the elimination of greenhouse gas emissions at the member institutions. The ACUPCC requires bi-annual greenhouse gas emissions inventories and 5-year progress reports (ACUPCCa 2013).

The International Sustainable Campuses Network is the newest of the six agreements. Founded in 2007, the charter was completed for adoption in 2009. The charter is based on three principles. Campus sustainability should be addressed through buildings, due to their environmental and societal impacts, campus-wide planning is necessary to guide sustainable transitions, and research, teaching and outreach about and for sustainability are an institutional mandate and responsibility. ISCN requires annual reporting on initiatives undertaken to meet the three principles (Kasemir 2013).

AASHE is a membership network that provides resources and support for sustainability at universities. AASHE functions primarily as a convener, member services and resource provider. It does not recommend a series of specific actions. AASHE also developed the STARS rating system, with its extensive sustainability measuring tools (AASHEa 2012; Second Nature 2012).

STARS is a voluntary benchmarking and rating system, structured as a paid membership, and independent from AASHE participation. The STARS rating is designed to provide metrics and ratification for sustainability practices, policies and education across all aspects of an institution. The system is based on points earned for the sustainability impact of a particular behaviour or process (AASHEb 2012).

The Princeton Review Green Schools program reviews green schools, and releases both a Guide to Green Schools and names a Green School Honor Roll. The Guide to Green Schools grew from a 2007 survey, which indicated that when making their application decisions, students wanted to have information on school environmental accomplishments and behavior. The Review rates schools on their performance against a 28-point criteria list of green practices. Institutions that wish to participate respond with their answers to PR Green Schools administrators. Only schools that wish to participate are included (TPR 2013).

4 Analysis

I began with a content analysis of reports, newsletters, and other publications collected from the organizations. Working with these documents, I identified the themes of mission/vision, roles/role models, and measuring/effectiveness. Within these I developed codes that express a spectrum of discourse positions. I then constructed the positional maps from these codes. Each axis depicts thematic concerns as expressed by codes across a range. The selected discourse of the agreements are then placed onto the map, yielding a visual display of the positions held across the network.

4.1 Mission and Vision

Mission statements sum up institutional purpose and vision statements make clear the desired methods and results of institutional initiatives. There were 4 distinct positions in the mission/vision discourse. "*Protecting*" is about taking direct action to protect the environment and address climate change. Both Talloires and PRGS networks express their missions in ecological terms. The ACUPCC explicitly states that human progress is dependent on stabilizing climatic conditions. "*Advancing*" is about action to advance society's sustainable transformation, and uses human-centric terms, such as "make human progress possible" or "create an equitable and sustainable future for all humankind." AASHE, STARS and the ISCN are human-oriented in their missions, with little direct reference to ecological goals.

"*Surveying*" reflects a concern with laying boundaries and measuring learning. This idea of recording and systematizing measurements is expressed in phrases like "develop and use a standard framework for measuring success," "reporting as self-knowing," and "the need for transparency in measurement." The "*orienteering*" position is similar to surveying, but incorporates the idea of using maps and measurements to travel, as in the sport of orienteering. There is a competitive undertone to some agreements, especially those that use ratings. This position also draws on the idea of a map to the future, with wording such as "create an equitable future in harmony with nature," or "a stable climate will be needed for a stable human future."

In the mission/vision positional map, the *x* axis depicts the mission concerns as expressed in each agreement's discourse, which range from primarily ecological to those using human-centered societal terms. The *y* axis expresses the vision of how this is to be accomplished, with positions that range from the standpoint of surveying uncharted territory to the competitive orienteering approach. The mid-point of this axis combines these modes into an assessment approach, which uses measurement to inform moving forward and learning (Fig. 1).

4.2 Roles and Role Models

Each agreement indicates appropriate roles for itself and its members, their charge and role in sustainability transitions, and what role their members should play. All the agreements evidenced a very strong sense of responsibility and recognition of the unique role of member institutions. This is expressed very clearly in the ACUPCC's statement: "What will society say… if we who have the expertise and the mandate of education and research for a thriving society didn't do everything we could to help society recognize the risks and create solutions?"

The agreements saw their own role as either scaffolding direct action as an immediate solution, or for teaching as a long-term solution.

Fig. 1 Mission and vision. X axis Mission: ecological systems ↔ human systems. Y axis Vision: surveying uncharted territory ↔ orienteering (competitive moving across terrain). Blue AASHE, Aqua ACUPCC, Green PRGS, Purple Talloires, Indigo ISCN, Orange STARS

Acting could have been coded "practice what we preach"—the actual words used in the Talloires Declaration. AASHE has an explicit goal of making sustainable practice the norm in higher education and incorporating low-carbon sustainability into everyday operations. The campus becomes a living lab, demonstrating the possibilities and educating for sustainability while also providing the university with more adaptive capacity for itself (McLaughlin 2011).

The other especially strong code emerged as "*educating* for the future." The Talloires Declaration considers the university to have a "profound responsibility to teach for a sustainable future." The university campus is seen as driver of public education, "where the next generation of our world's leaders are educated," and has a responsibility to "train the next generation of leaders." The idea of mandate also runs strongly in this code. Phrases range from "public mission" to "playing a determinate role". This need is most strongly expressed by the ACUPCC, which claims "America needs us to put the pieces together."

All the agreements have a very strong sense of the university's responsibility to be a sustainable role model for others. I constructed two codes within this theme*:* *driving* or *directing*. Phrases like "drive innovation" and "higher education as a multi-billion dollar economic engine" and "early movers" all gave insight into the university as causing change by action, in the sense of being in the driver's seat, taking everyone along while operating the machinery to get somewhere.

Another way of looking at higher education's role was expressed more in terms of influence or energy. This way of defining the role used words like "critical mass" or "catalyze action" or "playing a determinate role." Universities should be leaders,

Fig. 2 Roles and role models. *X axis* Agreementrole, *Y axis* University role

out in front, encouraging or directing others. How an agreement views its place in making a transformation can be positioned as either pushing or pulling. Although these are opposite approaches, both legitimate university power. Either way, universities see sustainability education as their domain, carving out political space and authority for the university as the provider.

In the positional map, the *x* axis is aligned to the "driving" or "directing" codes, and the *y* axis positions the discourse of the university role as either taking direct action as an immediate solution or teaching as a long-term solution (Fig. 2).

4.3 Effectiveness and Measuring

All the agreements were concerned with understanding the effectiveness of their efforts, and emphasized the importance and purposes of measuring.

Effectiveness can have an internal or external orientation. *Gauging our efforts* is an internal approach to effectiveness. It asks "How are we doing?" Green Schools looks at "how well are we preparing students?" Collecting data is a way to assess past performance and indicate success. STARS sees measurement as a way to gauge where improvement can be made. *Framing progress* has a more future orientation than gauging efforts. Data should be used as a teaching tool and to inform future decisions. STARS and ISCN couch this idea in terms of "experience sharing" or "knowledge sharing." *Being accountable* includes a commitment to accountability and transparency as an integral purpose of measurement. ISCN considers reporting to have two purposes—knowledge-sharing and ensuring accountability to the terms of the agreement. *Committing to action* combines the ideas of PRGS' "environmentally proactive institutions" with both STARS' and

ISCN's conceptions of using data to strengthen commitment, awareness, and buy-in. The ACUPCC states that data collection and reporting is what makes the agreement "not just a symbolic act." This is somewhat different than the Talloires Declaration conception, which considers signing the agreement to be "a symbolic act that guides us to action" and a "framework for steady progress."

Internally, measuring is used as a way to gauge what has been done, and as a tool for planning the next steps. The idea of proving performance is used both internally and externally and is centered on the map. In addition to the idea of proof, measures of past performance are also conceived of as externally-oriented transparency of process and of being accountable to the commitments. The two agreements structured as rating systems, STARS and PRGS, include the idea of being publicly recognized for progress toward sustainability goals.

Pulling together the discourse on measuring and effectiveness into one positional map, the *x* axis maps internal or external orientations to *effectiveness* and the *y* axis is mapped as *the purpose of measurement.* This continuum ranges from past performance to future planning (Fig. 3). The map shows an even coverage of orientations—across continua and agreements both—which gives visual evidence to the very prominent position of the measuring idea in all these agreements. At the very center of the map is the concept of making progress toward solutions to climate problems through formalized structures. This is one of the fundamental purposes of all these agreements.

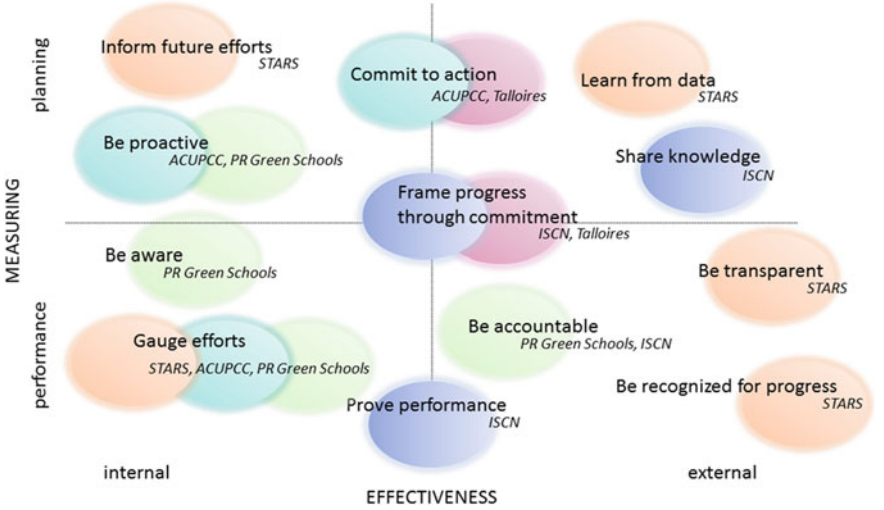

Fig. 3 Effectiveness and measuring. *X axis* using data for effectiveness, *Y axis* purpose of measuring

5 Cognitive Practice Summary

While the six agreements are all very different, the positional analysis reveals certain principles held in common. Although each agreement is relatively informally organized, there is an organization to act as an administrative and logistical home for initiatives. Openness, especially the structures designed to support free sharing of information, is a strong characteristic. Data reported by institutions is publicly available. The networks, conferences, and many publications are all the outgrowth of the idea of sharing information as it is learned through experimentation.

Each agreement provides a formalized structure to support solutions to some aspect of a sustainability problem—one of the fundamental purposes of all the agreements. Within that structure participating universities can experiment and learn together as they construct new norms for institutions of higher education. By choosing to participate in several of these agreements, the universities have chosen to enter into a dialog and practice of working toward a sustainable transition.

This wide network has an extremely strong measurement culture. Measuring is positioned as both a practice and as a way of learning, one of the most important ways to both meet agreement goals and share knowledge. Measurements can be used to set boundaries, make decisions, gauge progress and support teaching.

The agreements are united by their commitment to making sustainable transformation within the university and beyond. Their cognitive practice is based on a strong shared belief in the university as a leader with a responsibility to push or persuade society to meet the goals of practicing sustainability and educating people for the future.

6 Network Analysis

Network analysis relies on principles of graph theory for managing the complexity of data with many overlaps and interconnections. Network diagrams or graphs combine visual and statistical methods in order to trace the flow of ideas and practices and make sense of complex webs of relation and affiliation that might be obscured by the quantity or complexity of these connections (Kadushin 2012). Graphs are useful for discovering patterns of connection, and tracing the flow of information and influence that would be difficult to tease out of a table or other linear format with many data points (Diani and McAdam 2003).

The network analysis began with an affiliation matrix that traced the universities connected to each agreement. The matrix was entered into a network analysis program, and various algorithms run to produce visualizations of the data. These graphs show how the six selected voluntary university agreements are connected through their members. In general, the less the agreements are related to each other by common membership, the farther apart they will be displayed (Bastian et al. 2009) (Fig. 4).

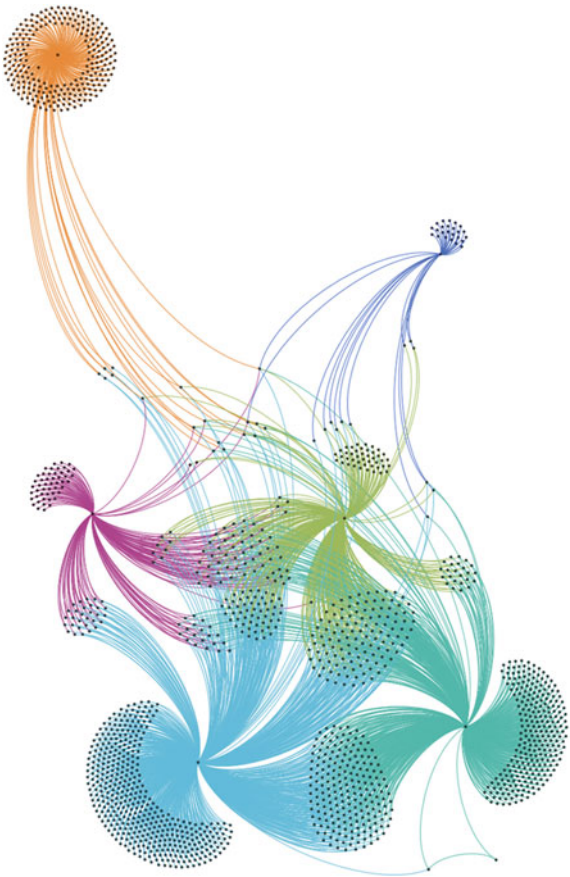

Fig. 4 Network of 6 agreements. *Blue* AASHE, *Aqua* ACUPCC, *Green* PRGS, *Purple* Talloires, *Indigo* ISCN, *Orange* STARS

The analysis used density and centrality to further clarify the structure of the network. *Density* measures the number of ties that actually exist stated as a ratio to the number that could possibly exist, and indicates how cohesive or connected a network is. Larger groups generally have lower densities. This network is quite large, with a theoretically possible 2,510,640 edges or connections, but only 2400 real connections, giving it a fairly low density score of 0.009. Higher densities are considered more effective at transmitting information (Mohrman et al. 2005).

Centrality indicates how embedded in a network a particular entity is, by counting the number of its direct ties across the network. There are several forms of centrality, but they are all essentially measures of some kind of power. *Out-degree centrality* measures how many nodes are connected to a target node, and is used as a measure of influence. Over how many edges does information flow out from the target node? The higher the score, the more influential this node is considered to be (Garson 2012). *In-degree centrality* measures how many edges feed into the target node. How much information flows to it from how many different points? The

higher this score, the more ties or edges that connect to the node, the more important this node is in the network. In network terms, prominence and influence indicate the possession of power and the ability to persuade (Kadushin 2012; Hanneman and Riddle 2005).

Figure 5 shows in-degree centrality with the emphasis placed on the prominence of agreements—how many universities belong to one agreement as compared to the others. The deepest color has the highest membership; colors paleat each level lower. AASHE is the "big fish" in the pond, with the most members. This puts AASHE in the position of being able to make its voice heard to the most people. But as a whole, this network has a centrality degree averaged to 1.514, which means that there is a loose connection among the main nodes. No one organization exercises a central "authority", but again, referring back to density, AASHE cannot require anything outside of its own network, because it is only loosely connected to the others.

Referring back to positional maps, this means that a large number of the members of the wider network will be connected to AASHE's work. AASHE takes an action-oriented view, with a mission to make sustainable practice the norm for higher education. With such low density in the network, AASHE cannot immediately access the wider network through its own members, but it is positioned to

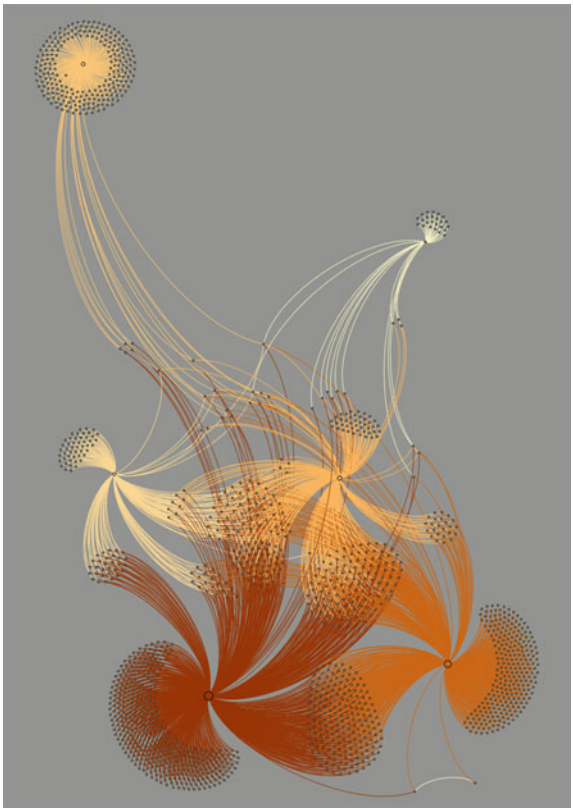

Fig. 5 In-degree centrality. Darkest color = highest degree

reach across the network in only a few "jumps" between institutions. Conversely, ISCN is the least central in this American network, the least connected across institutions. The ACUPCC network has the second-highest centrality scores, so a large number of institutions are committed to a pro-active and highly structured plan for addressing climate change. ACUPCC has an "orienteering" outlook, with the idea of travelling toward a goal—the goal of climate mitigation, and sees its role as "driving society forward."

Figure 6 makes the communities that share more than one agreement stand out. In this visualization it is easy to see three levels of out-degree centrality. The nodes in the darkest blue participate in five of the six agreements, nodes shaded in darker

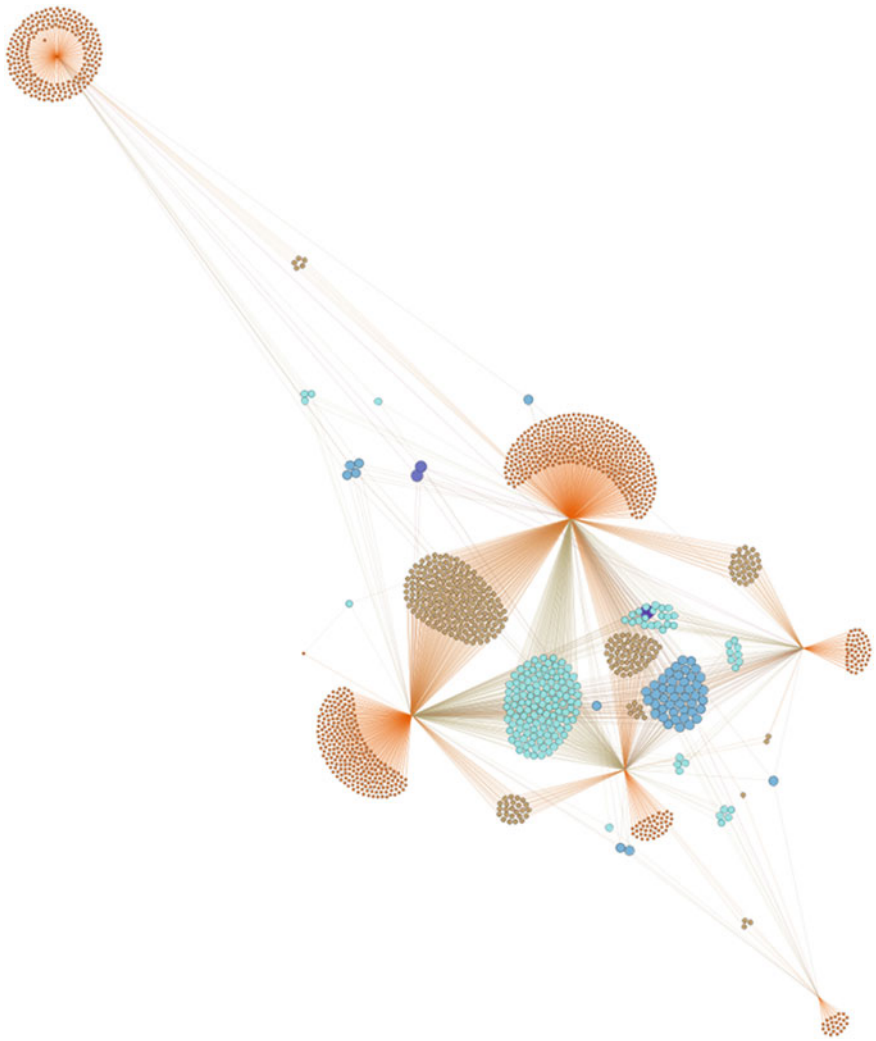

Fig. 6 Out-degree centrality. *Dark blue* = 5, *medium blue* = 4, *aqua* = 3, tan = 2, *orange* = 1

blue in at least four, and the lightest shade of aqua indicates participation in at least three of the agreements.

The network depicted in Figs. 5 and 6 is a wide network with a low density of ties between organizations. It has a low local centrality score, with loose connections between agreements and a lack of central authority. The network of networks exists more as an artifact of overlapping memberships than of any coordinated interactions and intentions. This may actually favour continued exploration and development. First, the intersection of multiply-connected institutions can be seen as an innovation cluster. Scholz et al. (2008) study of organizational networks working on water pollution found that those organizations most concerned about the problem tended to participate in multiple collaborations. It is in this overlapping, multiply-connected core of practitioners that new ideas can diffuse most rapidly and where institutional learning and transition occurs. Second, because high density can act as a network constraint, by making the communication of ideas or practices opposed by the dominant organization more difficult, the low density of this network assists its ability to innovate and get attention for new practices (Borgatti et al. 2013).

7 Discussion

Is there any evidence that the members of these networks are transforming their policies and practices for sustainability? Policies are an indication of institutional "transformation of intentions," and help make clear how these new intentions will be accomplished. The style of these policies also reveal much about new institutional practice, conventions and learning, or the transformation of institutional culture (Hall and McGinty 2002).

An important example of the institutionalization of sustainability is the growth of sustainability officers and offices within higher education. In 2010, 23 % of AASHE member institutions had such positions; by 2012—just two years later—67 % of member institutions reported having sustainability offices/officers (Walton 2013). Having an office dedicated to sustainability initiatives gives legitimacy from a finance and administration vantage point. Having sustainability as an institutional responsibility area helps ensure ongoing progress toward goals.

By adding sustainability offices, schools are making structural changes to their internal processes. Sustainability offices ensure that change begins at the basic levels of the business and planning offices, and continues as a program of sustainability expectations and requirements for university functions. By adopting agreement goals as institutional goals, they are reinforced through repetition, stabilizing sustainable practices over time (Barth 2013).

Some agreements have enforcement mechanisms to guide action, others have only suggested ways to think about sustainability problems and guidelines for institutional praxis. They all are committed to transparency in the process and evaluation of results. When compared against each other, it is hard to say if any one of these agreements is more "important" or more "effective" than another.

We can get a sense of the extent of practices and their effectiveness through institutional reports. Data from the ACUPCC (2012) Annual Report provides a useful snapshot of the power of a voluntary agreement: its 664 members had submitted 1648 greenhouse gas emissions inventories, and 482 had Climate Action Plans to address those emissions. ACUPCC signatories that purchase renewable energy credits are the third-largest purchaser of renewable energy credits in the United States (ACUPCCb 2013). In addition, the 298 signatories that produce green power themselves, produce 186 megawatt hours of solar power, 67 megawatt hours of wind power, and 41 megawatts of geothermal, fuel cell and biomass renewable power—over 295 MW hours of renewable, low-to no-carbon energy (Second Nature 2012). This is a significant investment in low-carbon technology. It would have been impossible to accomplish without a committed program with strong policy support. By purchasing green power or by installing solar panels, wind turbines or fuel cells on their campuses, universities support the longer-term goal of a decentralized and diversified renewable energy system.

Universities across these networks are also investing considerable money in the construction of green buildings. Construction and operational decisions will affect the emissions footprint for many years. A focus on green building also supports long-term change by providing financial support for new architectural practices to be accepted into standard construction practice.

7.1 Limitations

This study looked at only six American sustainability agreements. The ISCN network extends beyond the United States, although only the American members are shown in this analysis. There are many other voluntary agreements that could be analyzed, including a number of programs in Asia, Africa and Europe. GUPES and EAUC together have over 350 member institutions, some of which are quite large (UNEP 2014; EAUC 2014). A study of the structure and impact of those agreements could add to our understanding of the global potential for change. In order to deepen our understanding of how these agreements foster institutional change, future research could also map the many NGO partners and intermediaries that support and interact with networks, and include the ever-growing cluster of businesses that provide services to the institutions working on these agreements.

7.2 Implications for Institutional Practice

Each agreement provides a structure to support some aspect of the sustainability transition problem. Within that structure, participating universities can experiment and learn together as they construct new norms for institutions of higher education. By choosing to participate in any or all of these agreements, universities have chosen to enter into both the dialogue and practice of sustainable transition. An institution joining this wider network could expect change in several key areas.

Joining any of these networks means joining a measurement culture, where measuring is positioned as both a practice and as a way of learning. Reporting institutional performance becomes a form of sharing experience, a way to learn from the practices of other institutions. There is a strong concern for developing the structures and frameworks that can support more meaningful comparisons across member institutions, echoing Michael Shriberg's call for systematic and informed decision-making (2002). Institutions will find that procedures and practices will need to be quantified in ways they may not have been before, in order to support that decision-making.

Perhaps the most important part of the cognitive practice of this network is the transformation of the curriculum. Education and research are the reasons for the existence of universities, and the curriculum is the intersection of those practices. The agreements all seek the transformation of the curriculum, fully integrating it into everything at an institution. Member universities are working to infuse the entire curriculum with sustainability, linking the concepts of ecosystem capacity, the impacts of economic systems, and the importance of social justice. By providing students, faculty and staff with opportunities for sustainable practice, these concepts are reinforced with visible practical applications. The long-term impact of this deep institutional change, especially in the normative sense, will be immense. Through curriculum, norms and common practices are diffused through society, increasing society's capacity to innovate and respond to the challenges before us.

8 Conclusion

This study looked at how universities that participate in six voluntary sustainability agreements have become part of a wider network of cognitive practice working to transform institutional structures and practices, actively engaging in action for climate remediation and adaptation, seeing measurement as both a tool for analysis and as a form of change in itself. These networks believe that they have a special role to play in advancing societal change, a commitment to the open sharing of knowledge, and a deep sense of responsibility to fulfill a social mandate for teaching.

These guiding principles, knowledge, and meanings are the foundation of new institutional practice. Universities have an unparalleled ability to make transformative social change. As institutions in both the organizational and the normative sense, they are well-positioned to combine practice and structure for effecting change. Through a commitment to practice what they teach and the implementation of many measures to meet concrete institutional sustainability goals, universities are directly addressing the challenges of sustainability. Universities are responding to the most urgent need we have before us—transformation to sustainable systems.

These universities are a deeply committed network of practitioners, connected to many institutional agreements, all working to construct sustainable institutional practices for our future. By doing so, they will fulfill their highest calling, providing society with a skill set for sustainable decision-making for the challenge of climate change.

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Place Consciousness as a Pathway Towards Campus Sustainability

Christine Moseley, Deepti Kharod and Wayne Sheldon

Abstract

How do college students develop personal connections to their college campuses, which they view as temporary habitats? Sense of place is critical in the development of an environmentally conscious and responsive citizenry for the sustainability of our natural resources. This chapter discusses the significance that the multidimensional concept of place consciousness, within the theoretical framework of sociocultural constructivism, has towards college students' involvement in campus sustainability efforts. In doing so, it summarizes the findings from a collaborative inquiry study, an example of educational research involving two graduate students and their instructor as co-researchers, and describes their personal journeys in defining sense of place, leading towards their understanding of personal and campus sustainability as states of mind.

Keywords

Sense of place · Campus sustainability · Collaborative inquiry · Sociocultural constructivism

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1 Introduction

Research in Environmental Education (EE) links environmentally responsible behaviorto an individual's personal connection with the environment (Ardoin 2006; Burley et al. 2007; Devine-Wright and Howes 2010; Gosling and Williams 2010; Hernández et al. 2010; Walker and Ryan 2008). That is, individuals will be more aware of, and willing to protect the environment if they are emotionally attached to a biophysical place. It has also been argued in the literature that a connection to nature is necessary in developing a sense of place and that sense of place contributes to pro-environmental behaviors (Halpenny 2010; Ryan 2005; Scannell and Gifford 2010; Stedman 2003; Walker and Chapman 2003). However, our previous research with college students suggests that psychological and sociocultural rather than biophysical elements are central to an individual's construction of sense of place. If so, how do they develop a personal connection to their college communities, which are temporary habitats? More importantly, how does their sense of place or lack thereof, affect their attitudes and actions towards the sustainability of the natural resources in their college environments and beyond?

Published in 1991, the document *Caring for the Earth: A Strategy for Sustainable Living* called for EE to focus on the appreciation, understanding, and implementation of sustainable practices (Munroe and Holdgate 1991). This document established the ideas of sustainability as new underlying principles for EE and introduced an ethic of sustainability, based on an individual's responsibility to care for nature (ecological sustainability) and for others (social justice). Similarly, in 1990, the Association of University Leaders for a Sustainable Future published the *Talloires Declaration*, the first global statement made by university administrators addressing a commitment to sustainability in higher education. It stated that:

> Universities educate most of the people who develop and manage society's institutions. For this reason, universities bear profound responsibilities to increase the awareness, knowledge, technologies, and tools to create an environmentally sustainable future. (p. 2)

This document declared the importance of higher education institutions in establishing strong campus sustainability efforts. Globally, campus sustainability has become a priority on many campuses and consequently, institutions of higher education have become leaders in promoting sustainability research, practices, and community outreach (Adomssent et al. 2007; Alsuwaikhat and Abubakar 2008; Calder and Clugston 2003; De Ciurana and Leal Filho 2006; Emanuel and Adams 2011; Kevany et al. 2007; McMillin and Dyball 2009; Noor et al. 2015; Savelyeva and McKenna 2011; Walton 2009). Indeed, Nejati and Nejati (2013) stated that, "given the growing global interest on the university's role towards promoting sustainability, an increasing number of universities are committing themselves to sustainability" (p. 101) and are emphasizing the acquisition of knowledge as fundamental to the establishment of sustainable practices (Eagan and Orr 1992; Earl et al. 2003; Emanuel and Adams 2011). However, despite sustainability becoming a priority on many campuses since the *Talloires Declaration*, a gap remains between

students' knowledge about sustainability and their actual engagement in sustainability efforts during and after their time on campus (Emanuel and Adams 2011 Velazquez et al. 2005).

We propose the creation of an institutional culture of sustainability, interdisciplinary and transformative in nature that promotes behaviors that minimize human impact on the environment (Ferrer-Balas et al. 2008; Friedman 2008; Lozano 2006). An institutional culture of sustainability should not just talk about sustainability, but rather establish an environment on campus where students reflect on, learn about, and participate in sustainability practices that they take with them wherever they relocate (Bezbatchenko 2010). To do so, college campuses need to "address more explicitly the interconnectedness of different aspects of sustainability, by linking the environmental (natural environment, in particular) aspect of sustainability with economic, social, cultural, inter/intra generational aspects of sustainability in order to help students understand the complexity of sustainability-oriented concepts, understandings and challenges" (Kagawa 2007, p. 335).

Bezbatchenko (2010) states that "fully comprehending humans' tendencies pertaining to sustainability is warranted given the tremendous influence of other human beings on students' attitudes and behaviors related to sustainability" (p. 2). As such, this chapter discusses the significance that the multidimensional concept of place consciousness, within the theoretical framework of sociocultural constructivism, has towards college students' involvement in campus sustainability efforts. In doing so, it summarizes the findings from an interdisciplinary collaborative inquiry study, an example of educational research involving two graduate students and their instructor as co-researchers, and describes their transformative journeys in defining sense of place, leading towards their understanding of sustainability as a state of mind.

2 Theoretical Framework

According to Dovros and Makrakis (2012), "achieving a sustainability mindset is essentially a process of learning" (p. 75), which sociocultural constructivism theory describes as a constant interaction between an individual and the social, cultural, and historical contexts in which he/she lives (Bruner 1990; Resnick 1987; Vygotsky 1978; Wertsch 1998). Learners develop their own understandings about the world around them through social interactions, and these perspectives are shared and eventually internalized (Richardson 1997; Stauffacher et al. 2006). De Miranda (2004) states that "ways of knowing are strongly connected to the social, cultural and physical situations students experience in learning" (p. 69). Furthermore, just as the learner and society are inseparable, learning is tied to the tools that support it. From this perspective, all learning is mediated through socially embedded tools, whether physical (e.g., pencil or computer) or non-material (e.g., language or an instructional strategy) and "language, literacy, and discourse are both tools and

products of cognitive, social, and cultural practice" (Moje et al. 2001, p. 471). Thus, sociocultural constructivism, as a theory about the nature of learning and the learner, also informs the nature of sustainable practices in higher education (Simpson 2002).

2.1 Sense of Place Concept

The literature in EE suggests that individuals become motivated to live sustainably through developing a relationship to their 'place' (Lewicka 2011). But what is 'place?' Place has been defined as a geographic location that has meaning and value, where an individual feels connected to the physical, cultural, and social environment (Halpenny 2010; Rogers and Bragg 2012). However, Gruenewald (2003) suggests that "no single, axiomatic theory of place exists that might inform educational studies, although most scholars who study place would agree that an understanding of it is key to understanding the nature of our relationships with each other and the world" (p. 622).

Likewise, past ecologists (Berry 1997; Bowers 1999; Gould 1995; Leopold 1949; Orr 1994) have argued that a connection to nature is essential in fostering sustainable behavior. Leopold (1949) wrote: "We abuse land because we regard it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect" (p. 201), and he argued that people need to feel a sense of belonging and connection to the natural world to effectively address environmental issues (Mayer and Franz 2004). Expanding on this idea, Kudryavtsev et al. (2012) state that, "Leopold's (1949) suggestion that landscapes include multiple aspects such as ethical, esthetic, economic, and ecological resembles the current idea of multiple dimensions of place meanings" (p. 2).

Our explorations of sustainability are rooted in the ideas from Leopold that cut across many disciplines including anthropology, architecture, environmental science and psychology, geography, political science, and sociology (Ardoin 2006; Uzzell et al. 2002). The concept of place is central to the development of an environmentally conscious and responsive citizenry for the sustainability of our natural resources. Our research also suggests that an individual's connectedness to place does not necessarily have to be rooted in a physical, naturalistic place. If so, then how does one make connections to the physical environment and recognize the importance of the sustainability of its natural resources? This question becomes even more important when considering the emphasis o sustainability efforts on college campuses. Thus, the purpose of this study was to investigate how college students connect with their temporary environments within the context of sociocultural constructivism and how this connection leads toward sustainable habits and ways of thinking that travel with them.

3 Methodology

The educational research study described in this chapter utilized a combination of qualitative methods, including small focus group meetings, written and oral discussions, and collaborative inquiry to engage the participants in critical reflection about their experiences and changing perspectives. The research was conducted from an interpretivist paradigm (Eisenhart 1988), which assumes that "human behavior and human learning are responsive to a context that is interpreted by participants" (p. 101). This approach is congruous with the sociocultural constructivism theory of learning (Staples 2007) and consisted primarily of ethnographic methods of data collection, "a holistic approach to the study of cultural systems" (Whitehead 2005, p. 4). Convenience sampling was used to select the participants, based on student availability and interest (Merriam 1998).

Collaborative Inquiry (CI), a type of participatory action research where participants in a study are also involved throughout the research process (Kasl and York 2002), was used as the research design for this study. It is a qualitative method of educational research that includes "a process of repeated episodes of reflection and action through which a group of peers strives to answer a question of importance to them" (Bray et al. 2000, p. 50) and allows for deeper investigations into personal changes in ideas. It is a research strategy for recognizing and understanding the disequilibrium that an individual experiences when exposed to new knowledge which "may be inwardly centered on a not fully formulated need for exploration into one's private sense of being. This disquiet can be around an intellectual question or rooted in the problems of life" (Bray et al. 2000, p. 52). In this study, the 'disquiet' was to explore collectively changing perceptions about sense of place. The three participants were interested in gaining a deeper understanding of how their life experiences have influenced their perceptions about the relationship between their personal understandings of sense of place and sustainability.

3.1 Participants

The three participants in this research study were two graduate students enrolled in a graduate level EE course and their instructor, all who currently reside in a large city located in the southwestern United States. Throughout this paper, the pseudonyms Mary, Lee and Aruna are used. Mary, age 63 and Caucasian, has been teaching in higher education (Ph.D. in Environmental Science), specifically in environmental and science education, for 25 years. She previously taught middle and high school science for seven years. Lee, a Caucasian male, age 46, is pursuing the Master of Arts in Education (MAED) degree with a concentration in Curriculum and Instruction. With a Bachelor of Arts (BA) degree in Business, he currently works in energy demand response for an international energy company. Lee has had no teaching experience in formal preK-12 education. Aruna, an Indian American

female, age 47, is a full-time doctoral student at the research university, pursuing a Ph.D. in Interdisciplinary Learning and Teaching with a concentration in Early Childhood Education. With a Bachelor of Arts (BA) degree in International Studies and a Masterof Arts (MA) degree in Journalism, she has ten years of past experience teaching elementary school. When asked about previous EE experience, both Lee and Aruna stated they had had no formal background training.

3.2 Data Collection

Data collection for this study occurred across four phases within an 18 month time period. During Phases I and II, the instructor of the course (Mary) collected data from course participants (including Lee and Aruna) in the form of assignments and class discussions. Data collected in Phase III included the collaborative development of several presentations for national and state conferences. In Phase IV, the participants met for discussion sessions to analyze the data previously collected in the other phases and share their personal stories with each other. A cycle between reflection and action was repeated several times that enhanced the validity of the findings. Our research team became more cohesive, self-critical, and reflective as we progressed through each phase.

3.2.1 Phase 1

Phase 1 involved twelve graduate students enrolled in a graduate level course, *Environmental Education in the Curriculum*, exploring the central idea of this scenario: "You are embarking on a journey to tell a story about your personal place that leads to your development of your personal definition for a sense of place." This idea for exploration is adapted from the activity "Personal Places" in the Project Learning Tree (PLT) secondary module *Places We Live* (American Forest Foundation 2006). Purposefully, no references to an environmentally situated, physical place were made throughout the assignment.

The EE course was designed for the students to: (1) expand their awareness of the elements that constitute a personal sense of place; (2) gain an understanding of the meaning of a bioregional perspective and its relationship to sense of place; (3) consider the benefits of developing an intimate relationship with a place; and, (4) explore how to protect their place. Using local, accessible outdoor locations, students explored the factors that came together to create their personal sense of place. The course was focused on assisting students in interpreting the natural history and critical environmental issues of their local community. The students and instructor agreed on a set of data to be derived from assignments throughout the semester that included weekly online discussions and journal entries, creation of digital stories, field trip reflections, critical review of readings, and a final course portfolio.

3.2.2 Phase 2

In Phase 2, the students participated in the exploration through experiences and discussions with their peers in and outside of class. Individualized immersion occurred throughout the course where the students became fully engaged with the course materials, assignments, and experiences, especially those outside the boundaries of the classroom. Facilitated by the instructor, the initial discussions evolved into deeper dialogues centered on their individual journeys. The watershed and its surrounding bioregion in which the university is located were chosen as the situational context for the students to investigate as the basis of their journeys. Through multiple field trips, the students explored the watershed from the headwaters to the bay. Collectively, they developed a Bioregion Discovery Journal and accompanying eModule of resources for dissemination to teachers and environmental educators.

3.2.3 Phase 3

After the course ended, the students were invited to join the instructor in presenting their ideas and products derived from the course to others at state and national conferences. The two students who responded and the instructor presented at three state conferences and one national meeting. Resulting from the dialogue that occurred during the preparations, presentations and reflections from these conference experiences, they began to reframe their original ideas and pose new questions.

3.2.4 Phase 4

Phase 4 of data collection occurred a year after participants had been engaged in the course. During this phase, the three participants became active co-researchers as they reviewed all the data collected in the three previous phases for accuracy and to engage in reflective discourse. Over the course of four months, they met five times for collaborative inquiry sessions where they self-reported a shift in thinking about their personal sense of place and its relationship to their beliefs about sustainability. The participants engaged in reflective discussions and writings to capture and share the transformative changes in their mindsets across the research time frame.

3.3 Data Analysis

Using the constant comparative method of grounded theory (Strauss and Corbin 1988), the instructor simultaneously analyzed the course materials (reflections, assignments, and discussions) during Phase I and II while the students analyzed their assignments and their peers in comparison to their own. In Phase III, the students and instructor synthesized, analyzed, and disseminated the data drawn from Phases I and II. It was during Phase IV that the two students and instructor came together as a research team that engaged in further readings, data analysis and reflective discourse. The team explored data collected in all four phases for key

ideas in order to develop descriptions of their insights and changing perceptions. Analysis was ongoing and continually informed the data collection process. The process of analytic induction was followed, reviewing the entire set of data multiple times. Internal validity was established through triangulation of multiple sets of data (Merriam 1998).

The depth of analysis, including the amount of time and effort in collecting and analyzing data necessary in collaborative inquiry research, limits the use of a larger sample size. Despite this limitation, the use of extensive data sources collected over a long term, triangulation of multiple data sets, validation of data from respondents, and the depth of the researchers' involvement throughout this research study ensure validity.

4 Results

Through the reflective process of examining our personal journeys in defining sense of place, we have identified two broad implications of this work:

- Sense of place when viewed through the lens of place consciousness becomes a state of mind.
- A personal, holistic, and transformative journey is required for the individual to develop a sustainability mindset.

The results and discussion of this study are organized around the participants' personal stories and presented as excerpts from the original data sets.

4.1 Aruna's Story

As a military child and a daughter of immigrants, my sense of place is rooted in nine school campuses, 15 homes, and three continents. In class we pondered questions about attachment to a physical place, yet my inner landscape revealed a kaleidoscope of backyards, parks, and playgrounds. Both as a child and adult, the connection to and among these places came not through their physical locations and features, but because they were places I had shared with my family. A poetry assignment entitled "Where I'm From" brought my sense of place into sharper focus:

I am from a backyard butterfly garden
From towering chinquapin oaks and hurrying hummingbirds
I am from air force bases and suburban sprawl…
I'm from an uprooted, re-rooted, family-is your-first friend bunch…

For class I read about Leopold's land ethic, Carson's coastal connections, and studies that said feeling attached to a particular place is a critical prerequisite for caring about the environment. How could a person with no such connection to a place develop a sense of place? I wondered, glancing not only within, but around at

the many college students whose lives embody high rates of mobility. I had no one place, yet as a classroom teacher, my classroom culture was woven around nurturing dispositions of respect and caring, for each other and for nature. So, how did the EE course and this collaborative inquiry study add to my journey, what I now think of as a journey towards a sustainable living disposition? More importantly, why was it effective in cultivating a disposition, rather than simply pushing me to engage in certain short-lived behaviors?

By the end of the semester-long EE course, our combination of field experiences, readings, discussions, reflections, and volunteerism reshaped me. First, the course addressed the knowledge components that I lacked…facts about local land use, watersheds, aquifers, conservation issues, and a little history in terms of geography, geology, archaeology, and anthropology. Next, our field trips took me to places I had not been and issues I was not aware of, which followed the flow of our local river from rain to drain, from creek to estuary to the Gulf of Mexico, from the politics of ground water to the pollutants that infiltrate it, from the first inhabitants who relied on the river to modern conflicts between the rights of salamanders and summertime swimmers. These field trips left deep impressions upon me, situating the factual knowledge in a larger social, cultural, economic, and political framework. Instead of reading about these places and problems, I learned about them on location.

As I reflect on the past year since I enrolled in the EE course, I see my personal evolution from a land-based, information-oriented understanding of EE to a broader, more holistic approach encompassing sustainable living. A critical stance now informs my professional and personal decision-making as an emerging educational researcher and teacher educator. Although my own history is evidence that an attitude of sustainability can take root without a person feeling attached to one particular physical place, I also realize that both unstructured and guided opportunities for active engagement in nature are critical to developing and sustaining such a disposition.

4.2 Lee's Journey

I am from a place between ocean and desert
From rocky shores to sandy plains.
I am from the place where the suburban meets the rugged
paved, ground, both feel the hot Santa Ana winds.
I am from the scrub brush of the hills
The boulders laid about them.
Hot in the summer sun, cool on a summer night.

My life has been very migratory. Perhaps that is why I do not really feel tied to any one physical place, but rather to the memories of people and events in places. I believe being rooted, having something that I feel connected to, is most important and enduring during childhood. It gives stability that helps children feel safe. This can hold true for adults as well. However, it can be a feeling that ebbs and flows with time.

I grew up in the eastern part of San Diego County, California. We changed houses every few years but mostly stayed within the community of Lakeside. My cousins and I would build forts behind my grandma's house out of the wild bamboo that grew there among the boulders and rock formations. When I think of childhood, it isan image of a brown landscape of rocksand hills that comes to mind. I have not been back to San Diego County since moving in 1991. I looked up Lakeside on Google Earth a few years ago. The hills of my childhood have been replaced by tract houses, and there is nothing of the town that I could recognize. I often think about going back and spending time at the beach but my grandma's house is only a memory now.

What we learn in childhood seems to be what sticks with us. Time and place are intertwined. Places are changed by time, and time is only relevant by what happens in a place. Because I know that the places of my childhood are gone, I do not feel that location is the primary aspect in thoughts of my place anymore. My thoughts now tend to be more temporal than spatial. While some may think of where they are on a map, I think of where I am in a timeline. Having lived in four states and seven cities, and traveled to 19 countries, I have seen the similarities of people that transcend where they may live. We share this time and are more connected by when we are than by where we are.

I have always thought of myself as environmentally minded, aware of environmental issues, thought of in terms of facts and logic. However, I have felt little emotional connection between the environmental issues and the environment itself. For me, there has been a sense of right and wrong for the environment, but the ideas were of issues like climate change and the condition of the oceans. The EE class changed my focus on the environment from large and generalized global issues to more localized concerns and made me realize the divergence. By realizing the relevance of the issues on a personal level, I began to take ownership in these issues and my behavior towards them.

4.3 Mary's Thoughts

My childhood has memories of trees…trees I climbed, hid behind, read books in, and took naps on the ground beneath. To this day, I point out a good climbing tree to my husband when I see one. But alas, the one big, perfect climbing tree from my childhood is gone.As I get older, I sometimes grieve and lament about change. However, I have come to realize that despite change to a community overtime, which is inevitable, it is up to me to find new connections to the environment to replace the connections lost. It is really the memories of past places that linger and shape my connections to the environment—the memories of that tree from so long ago, of hours reading alone or time chasing my brother up and down the limbs, that I treasure and not just the tree.

I am finding that the idea of rootedness can also be linked to our age and life experiences. After my father died a few years ago, I experienced for months a sense

of 'unrootedness'…my old ideas and concepts of family were gone. I have since been on a journey to find a new meaning of identity. What I am discovering is the inner need to treasure the memories that I have of family and recognize that who I am today is in part a reflection of my connections to them. Inevitably, those memories are also connected to a physical place in time. As a toddler, I learned to fish with a cane pole next to my dad. Today, going fishing is not only one of my closest connections to a physical place but also to a place of memories, family, and past experiences.

I find this idea of rootedness thought provoking on a personal level. Do I have to be attached to an actual physical place? And if I am not, does that mean I will not have a connectionnor value the environment? If land stewardship is based on individuals being connected to the land, then how do I, as an educator, get college students connected to a physical place in this migratory society? And if they are not connected, does that mean they will not value the environment and practice sustainability for its natural resources? Maybe it is a sense of rootedness within us that is important and that is what we should seek to be ultimately connected to the environment.

5 Discussion

Our understandings of sense of place evolved in the context of a scholarly community and interactions made possible by the graduate course. At the beginning of this inquiry journey, all three ofus considered ourselves transient, having lived in multiple locations over the course of our lives and each being in the current location less than ten years. Our journeys mirrored the process for establishing a new sense of place after relocation as recommended by Mueller-Worster (2006): (1) acknowledge that living in our new place will be for a while; (2) let go of the past and embrace the present (allow for impermanence); and, (3) maintain conscious and critical thinking about our new place. It was during the course that we found ourselves being truthful to ourselves as we came to realize that we needed to embrace our new places where we resided, let go of past place connections, and develop new place identities. Despite resistance, each of us came to the point that we had to allow for the discomfort necessary for transformation and accept impermanence, not only in change in location but change in personal identities. We began to acknowledge the importance of building new relationships with our new place which is a spiritual, cognitive, and affective process critical to establishing a sense of belonging to our new community and necessary for the development of a new social and ecological place identity.

During Phase 3, and more explicitly in Phase 4, the continuous cycles of reflective discourse and dissemination of key ideas resulted in reshaping our thinking from a sense of place perspective to a mindset of sustainability. Thus, we realized the central role of language as a tool for our own learning through internalizing and externalizing our emerging understandings. It was during Phase 4 that

we truly began to consciously and critically analyze the social and cultural norms of our new place. We found ourselves not just existing but also observing, listening, and ultimately, learning about our new place and how to shape our changing identities in it. The sociocultural constructivism lens of our research approach provided a useful frame of reference for us to understand our changing perspectives. Initially, there was some resistance and tension—some 'disquiet'—surrounding the attempts in identifying and defining personal sense of place. It was these feelings of disequilibrium that led us to changing perspectives and ideas.

At the outset of the course, our understanding of place was grounded in the belief that a connection to a biophysical place was essential in developing a sense of place (Stedman 2003), which in turn was required to foster a caring and responsible attitude toward the environment (Gruenewald 2003). However, as we explored our personal journeys, we discovered that our sense of place was not centered on a physical location (natural or built), but rather on feelings of rootedness and relationships. Many EE efforts in the past focused on only one dimension of place (the biophysical) and emphasized only one avenue in developing a sense of place (rootedness) (Ardoin 2006). More recent research in EE supports the idea of sense of place as multidimensional, going beyond the biophysical to include the psychological, political, and sociocultural dimensions, often simultaneously (Ardoin 2006; Avriel-Avni et al. 2010). Results from this study suggest that the broader concept of place consciousness develops primarily from a psychological connection in a sociocultural context that may or may not be related to a naturalistic environment. As one participant in the course wrote:

> I wonder if we can find rootedness in spiritual, social, emotional, as well as environmental, spaces. For instance, lacking roots connecting me directly to different locations I've lived in, I struggled to feel rooted physically. However, the social connections through my family, emotional connections that arose through experience, and spiritual grounding contribute to my general sense of rootedness to the earth and life as a whole, without limitation to a specific location.

In previous research, undergraduate college students cited psychological elements such as emotions, feelings, and attitudes as the underlying reasons for their place attachment. Many even rejected the idea of feeling attached to a physical location, and instead described connectedness based solely on personal relationships with family members, spouses, children, or friends (Moseley et al. 2015). They described elements of the biophysical, sociocultural, and political domains of place consciousness, filtered through the psychological domain (see Fig. 1).

Our own explorations towards understanding personal sense of place support the experiences of these undergraduate students as members of a highly mobile, transient, and diverse society. Feelings of impermanence due to multiple relocations are common features of today's lifestyles (Avriel-Avni et al. 2010) that can lead to a sense of alienation from the environment and the local community (Buchecker 2009). Our research journeys support the need to shift the focus from an individual's connection to the physical environment to include psychological, social, and political connections with the society at large (Bonnett 2002). This shift was evident

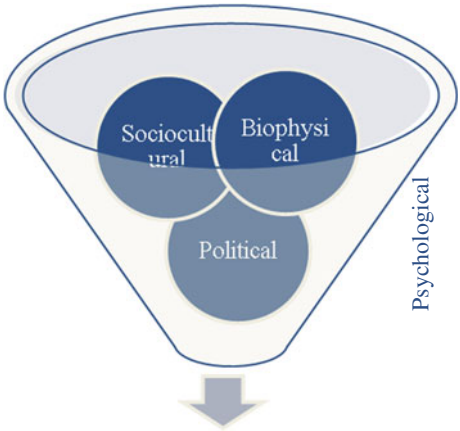

Fig. 1 Place consciousness

in the writings of one member of the class who had fled his country of origin and is now a United States citizen:

> Once upon the time I was rooted to my former land, the land that I was born, but not anymore. I don't even have a fraction of feeling toward it. I made a daring escape from home due to religious conflict and unexpected circumstances that happened in my former country. Ever since I was 19, I have been roaming (nomadic) from one place to another place, hoping to find a new home (not a house). Every place I discovered, I had to make an extreme effort to adapt to the culture and environment in order to survive. I can't see myself ever being rooted in any place. On the other hand, I have to say that for the last several years I started to feel strongly connected to this country, "United States." I believe this feeling comes from completing my education, becoming familiar with the culture, and being accepted by those around me. Now, I feel, not only I am part of this society, I also belong to the group who are involved in cultivating and developing this country.

Place consciousness supports the idea of a multidimensional connection between humans and the environment. Sense of place as seen through the lens of place consciousness then becomes a state of mind. Bonnett (2002) suggests that sustainability is also a state of mind; not just a connection to some place but a "transformative paradigm which values, sustains and realises human potential *in relation to* the need to attain and sustain social, economic and ecological well-being, recognising that they must be part of the same dynamic" (Sterling, as cited in Bonnett 2002, p. 22). Therefore, we propose that by understanding and embracing place consciousness and sustainability as states of mind, or ways of knowing, college students would be able to take these ideas with them wherever they go, and extend them from specific places to the entire globe. Our research situated within the context of place consciousness supports the idea of sustainability as a human value, related to the multiple and complex social, political, and cultural domains of human behavior that differ over time and space (Emanuel and Adams 2011; Wals and Jickling 2002).

6 Conclusions

Within the context of sociocultural constructivism and through critical reflections, we ultimately altered our frames of reference and changed our perspectives about our personal understandings of place and its connection to sustainability. We interpret the transformative learning that took place within our selves as a situation where "learning is understood as the process of using a prior interpretation to construe a new or revised interpretation of the meaning of one's experience in order to guide future action" (Mezirow 1996, p. 162). As collaborative researchers, we experienced the three common themes characterized by Mezirow's theory of transformational learning—experience, critical reflection, and rational discourse. Our life experiences provided the framework for critical self-reflection of our world views. Rational discourse, identified by Mezirow (1991) as a catalyst for transformation, occurred throughout the study as we explored the depth and meanings of our various world-views and articulated those ideas to each other. The sociocultural perspective that we used as researchers allowed us to focus on trying to understand new ways of thinking derived from our discourse.

Our personal journeys support the need for individuals to understand the concept of place consciousness as a pathway towards sustainability. The development of students' attitudes and behaviors related to sustainability is mostly influenced by their social connections, especially with their peers (Gudjonson 2012; McKenzie-Mohr and Smith 1999). Bezbatchenko's (2010) research indicates that college students care more for their peers and their social connections than environmental issues. Thus, we advocate the need to assist college students in developing social connections collaboratively with the local cultural life and the environment where higher education institutions are located. Sustainability efforts on college campuses should be situated within the theoretical framework of sociocultural constructivism that includes the "centrality of the learner in defining meaning; the importance of situated, authentic contexts; the negotiation and interpretation of personal beliefs and multiple perspectives; and the importance of prior learner experiences in meaning construction" (Stauffacher et al. 2006, p. 259). According to Tynjala (1999), "universities are communities for producing knowledge and, as a matter of fact, scientific activity in its very nature is a constructive learning process. Therefore, creating constructive learning environments for university students is in harmony with universities' other mission, conducting scientific research" (p. 366).

In addition, campus sustainability efforts should include not only experiential learning within the biophysical domain, but also a multidisciplinary knowledge base about the social and political domains of the local community. Walker and Chapman (2003) suggest that knowledge about where one resides can generate a greater sense of commitment and responsibility and lead towards more sustainable behaviors. Through the processes of acquisition of knowledge about a place, college students, regardless of where they find future jobs and more permanent residences, will better understand the importance of the ecological, social, political, and

cultural values of local places related to sustainability issues that can transfer to any place. Zimmerman and Halfacre-Hitchcock (2006) note that, "a sense of place and a sense of comfort in an empowered community setting are important for mobilizing change" (p. 6). Thus, university sustainable efforts tied to the surrounding community can have a long-term impact on the future sustainable practices of its students.

However, research indicates that increasing knowledge by itself will not directly cause long-term behavioral change (Kollmuss and Agyeman 2002; Darnton 2004) nor does increasing awareness of environmental issues lead to action (Sadusky 2014). In fact, Steg and Vlek (2009) propose several major influences on pro-environmental behaviors that include "rational cost-benefit choices (economic), moral obligations (psychological), affect of symbolism (social status), contextual factors, and habitual behavior" (p. 317). However, regardless of the importance of the political, sociocultural, and biophysical domains of place consciousness, acting sustainably is a personal choice. This relates back to the psychological domain of place consciousness as being the necessary situational context through which the other three domains filter. College students have to ultimately want to participate in sustainable practices.

There are multiple factors which influence the process of behavioral change, and further investigations between students' perceptions of sustainability and their individual actions need to be explored. The processes which facilitate behaviour change are very complex, as Folke (2003) states: "Directing human behaviour towards improved environmental performance and sustainability is not just a simple matter of providing information and policy prescriptions. It will require understanding of the contexts that form, shape and reshape habits of thought and action" (p. 227). According to McMillin and Dyball (2009), it is essential "to encourage students to reflect on the broader social and economic processes that influence their behaviour and then to give them the opportunity to engage in action-oriented environmental initiatives" (p. 58). As stated in Umholtz (2013), "Kolb (1984) likens the process to Paulo Freire's (1968) *conscientizacao*, the deepening of awareness that occurs when people merge reflection and action to transform their realities" (p. 3).

Our research centered on our personal journeys shared within a social context in developing a new sense of place. It supports the idea that universities need to assist students in becoming conscious and critical thinkers about their local place and community through field-based and reflective experiences (affective and spiritual domains) that support academic learning (cognitive domain). Our research was a study of personal and social transformation that informed our learning, and we recommend that process for others in similar situations. Our research into place consciousness and its relationship to campus sustainability supports the ideas of Uzzell et al. (2002) who state:

> While one can address the problem of sustainability at an individual level, it would seem that any long-term environmental behaviour strategy has to be located in the relationships which exist between people in the community, and the relationship between those people—individually and collectively—and their environment. If we are to argue that change can

only come about through social and collective action that is grounded, at least in part, in identity processes and people's identification with place, then we need to devise social and political strategies that recognise these processes. (p. 40)

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Gauging Universities for Sustainability: Action Research as a Tool for Assessing and Influencing Organisational Transformation

Alex Baker-Shelley

A sustainable university is "A higher educational institution, as a whole or as a part, that addresses, involves, and promotes, on a regional or global level, the minimisation of negative environmental, economic, societal, and health effects generated in the use of their resources in order to fulfil its functions of teaching, research, outreach and partnership, and stewardship in ways to help society make the transition to sustainable life-styles"

Velazquez et al. (2006).

Abstract

This contribution presents how the novel social scientific methodology of Action Research (AR) can assess campus-driven initiatives to see how to enhance governance for sustainability at Higher Education Institutions (HEI's). Maastricht University (UM) in particular has a unique form of maintaining the student-driven, bottom-up component, and has pioneered in recent years in student activism for sustainability. Its Green Office's (GO) mandate is to manage the sustainability portfolio of UM in the areas of research, education, operations, governance and community engagement, in a student-driven staff-supported manner. The drive was to see how AR can be used as a tool to assess and influence organisational transformation towards sustainability at an HEI. Other theories and lenses used included an organisational change management approach to embedding sustainability, assessment strategies from CSR, and insights from behavioural change. AR provides a moment for reflection after a full cycle—diagnose, plan, act, and evaluate action—has taken place. This paper represents the outcome of the reflection of this continuous process of transformation after one year of engagement by the researcher, with the focus on the internal causal mechanisms from which an organisational transformation

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gains traction and propagates. It was chosen as the approach best-suited for answering the primary research question of "how do universities manage their organisational transformation towards sustainability and how can this be effectively achieved", especially against the backdrop of university's unsustainability so as to enable the co-production and design of solutions at the organisational level. AR also requires a lot of 'conventional' research—such as the construction of an analytical framework, interviews with key stakeholders and a content analysis of documents produced by the GO and UM—before any meaningful reflection on interventions, the core of AR, can take place. In the context of organisational transformation towards embedding sustainability at UM, AR has enabled the researcher to come closer to seeing how operational, social, and governance processes take place up close, which conventional 'desk' research might not have otherwise gained access to. The researcher and the participants/co-researchers of the study have been able to learn from each other and from the initial findings of interventions and conceptual framework used to analyse organisational transformations towards sustainability. The AR 'team' therefore functions at the interface of the internal properties of the university and its external environment at the societal or regime level, using this approach to forge collaborative partnerships within organisations and with local stakeholders. It is hoped valuable lessons can be gleaned for others seeking to use the AR approach to study transformational processes that enhance the role of universities for sustainable development against the global imperative created by UNESCO's Global Action Programme of Education for Sustainable Development and the UNSDG's.

Keywords
Sustainability in higher education · Action research · Organisational transformation · Behavioural change · CSR

1 Introduction

This chapter presents contemporary, state-of-the-art applications of how social science theories, particularly action research (AR), might help overcome campus sustainability challenges. It illustrates the diversity, reliability and adaptability of social sciences in an interdisciplinary research project being undertaken here at Maastricht University (UM) in close collaboration with its Green Office (GO). GO is mandated to manage the sustainability portfolio of UM in the areas of research, education, operations and community engagement, in a student-driven staff-supported manner.

The aim is to show how AR can be used as a tool to assess and influence organisational transformation towards sustainability at an HEI. It brings to the fore

the role of researchers in AR projects, potential downfalls and challenges outlined by the author, so that others might learn from this experience (and those of other examples of using AR in studying transformational processes). It takes a methodological stance so that future projects of similar calibre can utilise this social science approach to overcome sustainability challenges on campus.

With respect to the case of UM, AR is being used to investigate its organisational transformation towards embedding sustainability. This is a running application of a novel methodology of the social sciences that seeks to overcome such campus challenges as institutional inertia, decentralisation, a lack of effective communication, missing 'nodes' of liaison in a bottom-up and top-down participatory governance structure, and practices associated with commercial logic and management at universities.

The theoretical perspectives taken in this research project draw from the interdisciplinary approach of sustainability science, and more specifically behavioural science, organisational change management, socio-ecological systems, corporate governance and CSR, and sustainability in higher education. Going into more depth of each of these is beyond the scope of this chapter, however it is considered relevant to look at how action research is useful for solving complex campus sustainability challenges, and therefore on the emerging 'discipline' of sustainability science.

2 Why Do Universities Need to Become More Sustainable?

Universities have been lagging behind other sectors in terms of embedding sustainability into their organisational structures (Lozano 2011). Much research has been undertaken into the 'what' of corporate responsibility, sustainability reporting and accounting, and organisational transformation (Aras and Crowther 2008, 2009; Clark and Master 2012; Eccles et al. 2012; Lozano 2006; Zadek 2006), yet relatively little has been performed on the 'how' (Shelley 2013), and fewer still for a specifically operationalised integration of sustainability into the core business of higher education institutions (HEI's).

Progress has been slower than expected across the departments, faculties, facilities and operations at HEI's and there is a definite lack or "clear orientation on exactly what a sustainable university should be" (Velazquez et al. 2005). Considering their unique position and legacy in society, as well as their significant capacity for innovation and the honest brokerage of knowledge at the boundaries of science, policy and politics (Pielke 2007), universities have a unique role and responsibility towards society and environment. Global trends nonetheless encourage a new trajectory for HE post Rio+20, especially with the Higher Education Sustainability Initiative (HESI) commitments playing an enabling role in mobilising HEI's to ensure a sustainable future (Simon and Haertle 2014).

To integrate principles and practices associated with sustainability into the whole portfolio of activities at HEI's is a tremendous opportunity to prepare the entire campus community to be better equipped to make decisions for a future that rapidly becomes more complex, dynamic and uncertain (Yarime and Tanaka 2012, Glasser et al. 2005). With respect to education (as part of the core-business of an HEI that also comprises research), it should prepare students for the transformational challenges the world will face in the near future. These are in response to what the International Geosphere Biosphere Programme calls the great acceleration (Steffen et al. 2004): the collection of exponential trends of human development that shift our planetary influence to that of a geological force in its own right.

This plays against the backdrop of a plethora of charters and declarations signed by global networks of HEI's to cement their commitment to the global transition toward a more sustainable society, such as the Talloires Declaration (1990), the Copernicus Charter (1994), the Handvest Duurzaamheid HBO1 (1999), Agenda 21 (1992), and the most recent UN Decade for Education for Sustainable Development (2005–2014) (Boer 2013; Sylvestre et al. 2013; Lozano and Young 2013). HEI's need to become more sustainable yet they claim to find it difficult to meet their social and environmental responsibilities. Many institutional barriers exist: such as decentralisation, a lack of environmental literacy, and missing participatory democracy. The boundaries between public and private have become increasingly blurred; managerial logics have predominated leading to a 'marketization' of HE (Howells et al. 2014). Hence universities must justify how they contribute to solve ecological, social and economic challenges of unsustainability with the knowledge that they produce and implement in research and education.

Transformation towards sustainable development requires a vision and goals (Zeijl-Rozema Van 2011). Since 2008, UM has fulfilled this teleological requirement through its mission, roadmap and sustainability goal-setting. However, according to Jenssen (2012), not only the management of a HEI should be committed to sustainability, but the whole university community should be involved and mobilised in a participatory approach, in a manner which embodies a balance between top-down and bottom-up approaches for organisational change that multiplies benefits (Fraser et al. 2006). Participatory processes have shown a particular appropriateness for application from theory to practice in the higher education sector because of their benefits to the academic community, towards fostering sustainable development, raising awareness about sustainability between varied actors at universities, as well as increasing the standard and quality of the dialogue between them. However there still remains a significant challenge that the institutional governance structure would have to change to accommodate these changes (Disterheft et al. 2014).

The dynamics of how this change in institutional governance, or in other words how the process of transformation takes place, are not yet well understood (Hoover and Harder 2014). This calls for greater focus on processes and departments that aim to embed sustainability at HEI's (Stephens and Graham 2010). According to Yarime et al. (2012), this means taking into account the deep structure and inter-personality of a university, all its sub-systems, facilities and departments,

including their interdependencies in a systemic and dynamic understanding. This represents an emerging paradigm in institutional governance, that goes beyond the traditional 'third-mission' (Trencher et al. 2013) of an entrepreneurial, knowledge producing, and technology-innovating institution.

Accordingly, AR was chosen as the approach best suited for this research project against the backdrop and problem of unsustainability identified in universities, so as to enable the co-production and design of solutions at the organisational level. At the macro-level, networks of universities that are transforming themselves to be more sustainable might then augment societal transformations that grow as global trends, complemented by the launch of the Future Earth initiative, and the renewal of the UNDP's Millennium Development Goals after 2015 into Sustainable Development Goals in Paris 2015.

3 Being the Insider in Sustainability Transformations

Reflecting on the theories and models that support the choice of AR in the case of insider academic research, it is apt to mention the paradigms that have influenced its evolution. One of these is Sustainability Science, which implies that complex concepts requires equally complex framings, bringing temporal and spatial dimensions into account as well as the stakeholders involved (Martens 2006). It refers to a societal process of changes towards a desired quality-of-life now and in the future; a pluralistic approach that deals with diverse actors at multiple levels, creating an integrated vision built on shared concern towards a shared solution that resolves trade-offs along the way (Zeijl-Rozema Van et al. 2008; Zeijl-Rozema Van 2011). It demonstrates a variety of "new" approaches or lenses for understanding complex sustainability problems: post-normal science, mode-2 science, sustainability science, action research, and integrated assessment amongst others (Funtowicz and Ravetz 1993; Waterman et al. 2001; Rotmans 2006). A description of some challenges of Sustainability Science is made by Zeijl-Rozema (2011) in Table 1.

The growth of sustainability science as a fully-fledged approach operating at the borders of science, policy and politics (Trencher et al. 2014) hence sees AR as a legitimate manner of solving challenges characterised below.

Table 1 A typology, problem-handling process and description of some challenges of sustainability science

Type of problem	Complex, societal, decision stakes high, disputed values, systemic uncertainty high
Knowledge production	Inter-, trans-disciplinary
Goal	Contribute to decision-making by improved problem understanding, structuring complexity and bringing about societal change
Challenges	Dealing with: long-term developments and short term actions, spatial scale levels, uncertainty and risk, co-production of knowledge, combining qualitative and quantitative approaches, integrating knowledge, perspectives and interests, structuring complexity, quality assurance of results

Daly (2006) sees sustainability "as a way of asserting the value of longevity and intergenerational justice, while recognising morality and finitude" illustrating the imperative that the youth of today have a stake in the future state of the world that is left to them. Against the backdrop of globalisation, climate change, infectious diseases, biodiversity loss, water scarcity, social immobility, inequality, ecological deterioration, and a void of trans-boundary governance on a global-level, the potential universities possess to prepare the youth for such a future is inimitable. This mission embodies the principles of intergenerational justice, socio-ecological equilibrium, and ensures that social and environmental externalities are accounted for so that no one human group has to bear the costs of production and consumption of another without compensation. Paradigmatic changes in and of science change as a result of external perturbation and crisis in response to the aforementioned challenges (Kuhn 1996).

Another appropriate lens is adaptive management, a part of the paradigm of reflexive governance and systemic change expressed by Voß and Kemp (2006). The central assumption is that surprise is inevitable in a complex evolving system, such as a university that is transitioning towards greater equilibrium of its associated social and ecological systems. It advocates modelling techniques across multiple scales and dimensions (economic, environmental and social), integrating multiple perspectives from each, and moreover, "embraces uncertainty through a cycle that links hypothesis with policy with implementation with monitoring" (Sendzimir et al. 2006, p. 132). This can be considered appropriate in a research process that consists of multiple researches and learning cycles of different terms that have to be managed in the AR process.

Sarewitz and Pielke (2007) argue that it is rarely considered in science-policy discourse or decision processes that "alternative research portfolios might better achieve stipulated societal outcomes". The AR approach is just such an alternative. It enables the researcher to operate with the supply and demand of science to realise a dynamic role in society by ideally matching the needs of end-users of scientific knowledge produced (Sarewitz and Pielke 2007).

It also operates at the science-policy interface, defined by van den Hove (2007) as a social process that encompasses "relations between scientists [students, practitioners and decision-makers] in the policy process…" allowing "for exchanges, co-evolution, and the joint-construction of knowledge" enhancing social impact. The ideal goal of all this is social and organisational learning: a change in understanding occurring in the individuals populating and influencing the university's transformation—stakeholders, co-researchers, policy-makers and management—at the surface level and at a deeper level "demonstrated by a change in attitudes, world-views or epistemological beliefs" (Reed et al. 2010) towards a sustainable development of and by their institute in its urban, regional and international settings. Central to this cause at UM are just such a group of individuals, the GO, whose mandate is to manage the sustainability portfolio of UM in the areas of research, education, operations, governance and community engagement. This project also looks at how it is fulfilling its role towards the overall sustainability transformation of this university.

This research project can be boiled down to providing and brokering scientific knowledge in the AR approach so that university management and 'Green Offices' (student-driven, staff-supported sustainability departments: http://greenofficemaastricht.nl/) have a balanced account of how to gear up their institutes as trans-sectoral actors and facilitators of transformational change in the 21st century. This aims to bolster the usual indicators of successful performance of HEI's (student numbers, research project acquisitions, rankings etc.) as well as emphasising governance for sustainable development and corporate responsibility using findings that might only be gleaned using AR in participation with the 'doers', stakeholders in the university's overall transformation to become more sustainable.

4 The Action Research Approach

> Action research is a period of inquiry, which describes, interprets and explains social situations while executing a change intervention aimed at improvement and involvement. It is problem-focused, context-specific and future-oriented (Waterman et al. 2001).

Action Research (AR) builds on the philosophical tradition of Pragmatism; that is to say, the notion that knowledge (whether obtaining it or sharing it) is based on observing the consequences of intentional action. Moreover, its participatory mode follows a democratic approach to knowledge production, with the researcher being actively involved in intentional change. Policy and management advice is developed iteratively using an active collaboration of researchers and practitioners where those studied are also deemed as 'co-researchers' (Heiskanen and Rask 2008).

It aims to facilitate social learning and the development of novel, scientifically sound yet practicable knowledge by involving relevant stakeholders, including the researcher, in multiple cycles of planning, action, observation and reflection (Waterman et al. 2001). The objective is be aware of where the researcher places herself on the spectrum between the 'objective' observer and the active team member: balancing the role between acting as a 'critical insider or friendly outsider'. According to Brannick and Coghlan (2007), AR is one of three major research paradigms where one can do 'insider-research': defined as "research by complete members of organizational systems in and on their own organizations".

The challenges subsequently arise from access, pre-understanding, role duality, and managing organisational politics and chicanery (Brannick and Coghlan 2007). The last is considered of particular relevance for any study approaching the often thorny issue of integrating sustainability into an organisation.

Despite such challenges, there is growing appreciation for AR in the social scientific community (in light of initial scepticism from naturalists) apropos 'insider academic research' (Brannick and Coghlan 2007). Furthermore, it is strengthened when combined with other statistical and comparative approaches. It assumes that in order to understand the nature of complex systems, we must dismantle them into units to examine the underlying complex relationships and mechanisms internal to

the case under study [Wallerstein (1974) in Moses and Knutsen (2012)]. As an 'insider' in organisational research one must untangle the complex knot of interactions and internal causal mechanisms from which an organisational transformation takes hold and propagates.

Positive evidence that supports AR as an overarching methodology to undertake and motivate best practice in the management of sustainability at organisations is found in the findings of Hind et al. (2013). Their study focusses on the "developmental methodology" designed to assist organisational learning in a leader-driven exploration of structures and processes. Despite the top-down nature of their "action learning and action research" project specific to businesses, their conclusions point towards progress made after several iterations (or cycles) of AR in terms of awareness and implementation of sustainability strategies and responsible internal leadership (Hind et al. 2013). On the other hand, the method of employing AR is very difficult to place in one methodological camp or the other and could therefore succumb to criticism in its salience and credibility.

5 Challenges of Action Research for studying transformational processes

AR holds transformation as both the ends and the means of getting there for the organisational research of UM. As well as knowledge creation, the researcher is concerned with the transformation (hence learning) of himself, in addition to participants, subjects, co-researchers and the university as a whole, whilst also diagnosing whether this is actually happening (McCormack and Dewing 2012). Titchen and McCormack's approach to transformational AR synthesises the paradigms of critical social science and critical social theory to arrive at what they term Critical Creativity (Titchen and McCormack 2010). The criticality deconstructs and diagnoses a problem situation "to develop new understanding for the purposes of transformation of practice and generation of new knowledge"; the creativity uses imagination and expression in order to apply meaning to a holism of transformation. The fusion of the two is a "way of being, knowing, doing and becoming" that enables us as researchers "to understand and facilitate the transformation of practice and, simultaneously, create new knowledge about that transformation" (McCormack and Dewing 2012; Titchen and McCormack 2010).

To explain the hermeneutic tradition of organisational research is to see the researcher going in, or entering the site with a clean slate; that is, few or no theoretical preconceptions. This is a target which although can never be attained, allows the subject's (a university sustainability department for example) empirical evidence to guide the emergence of key themes and concepts (Brannick and Coghlan 2007). Taking the decision to actively involve stakeholders in research is an arguable necessity given the AR approach. It is ultimately both an essential opportunity and a risk in any research that requires an inside-out perspective: where you as the researcher are deeply embedded in the organisation that is both funding

you and that you are required to investigate. It does not therefore take too much of a leap to imagine that there is a political context which projects such as this come up against (Brannick and Coghlan 2007; Hoover and Harder 2014).

Another challenge when looking at the role of the researcher in studying and participating in transformational change processes, is the tension between the role of 'honest broker' and 'issue advocate' (of policy alternatives) as proposed by Pielke (2007) in his analytical reflection of the idealised roles of science in policy and politics. In light of the role of an action researcher to provide advice based on insights gained from performing conventional research in collaboration with counterparts and subjects, there is the potential pitfall of advocating one decision or choice informed by research over another because it complies to the researcher's own views, or brings a sustainability transformation to fruition. Indeed as Pielke states: "the issue advocate seeks to compel a particular decision, while the honest broker of policy alternatives seeks to enable the freedom of choice by a decision-maker" (Pielke Jr. 2007).

6 A Case-Study Employing Transformational Action Research

The Living Laboratory piloted in this research concerns the transformation of UM towards a sustainable HEI and follows three large cycles of an AR approach (see Fig. 1). It uses the information collected by performing interventional social,

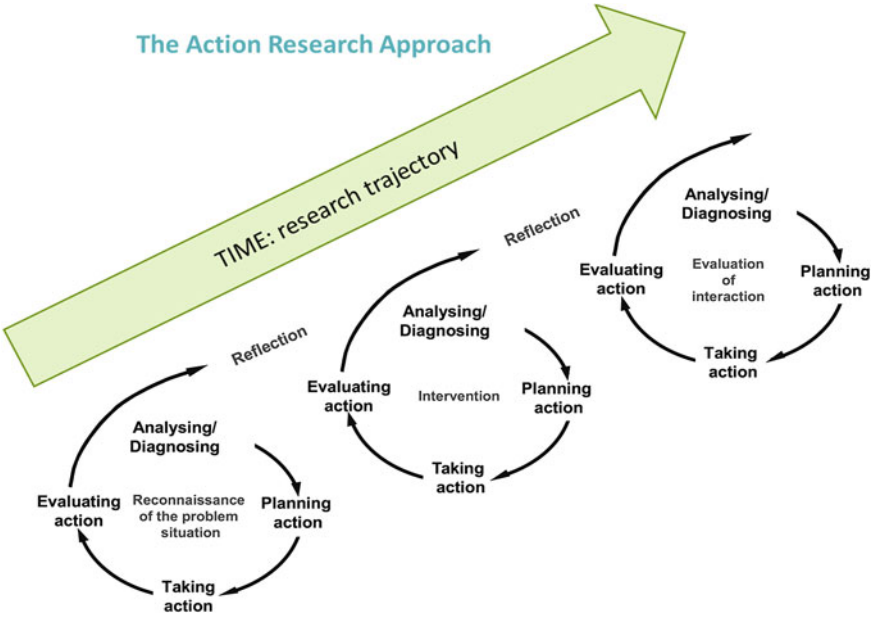

Fig. 1 Adapted from Coghlan and Brannick (2014)

organisational and behavioural experiments at UM. Thus, the generic knowledge gained in the different case studies is immediately tested and made relevant for structural organisational change. Several case studies at other universities will be performed, from which the aim is to draw a hypothesised causal mechanism buried in the experience of each of them. The first will use a 'plausibility probe' to inform the approach to the others [Eckstein (1975) in Moses and Knutsen (2012)]. This study benefits then from seeing case-studies as "histories with a point" in that they encapsulate the process (or lack thereof) of sustainability transformation at HEI's, where they are situated along this pathway, their trajectory and how they aim to reach their goals. The Living Lab is viewed as a 'within-case-study' (Moses and Knutsen 2012) since the first iteration of AR has taken place where the researcher is a complete member. UM and its Green Office are embedded in this research process as a living laboratory for organisational change. Effective pathways in sustainable transformations at other HEI's enable the researcher to integrate knowledge from other sectors with findings at UM in order to set up experiments and pilots that test the results of several AR cycles. In sum, for this research the AR approach always provides a moment for reflection after a full cycle has taken place: diagnose, plan, act, and evaluate action.

Action research must also include a lot of conventional types of research before any meaningful reflection on interventions can take place. In this grounded case, the development of a conceptual paper and analytical framework, GO assessment, UM community surveys, and interviews of key stakeholders. After this conventional research, a critical reflection evaluates then analyses the action of applying the analytical framework to a university and performing an intervention (as is the case at Maastricht University in 2015). The aim then being to diagnose the system to see what the effects have been and whether this is successful in terms of establishing a good trajectory towards a sustainability transformation or not.

Case studies abroad would also follow the same process in order to utilise and refine the analytical framework each time it is used before one cycle is complete. The difference being that during the evaluation phase lessons would need to be learnt that are generalizable and able to be applied back in Maastricht within its specific organisational culture. After an intervention based on these lessons, the system (university) would be assessed in order to diagnose the effects as above.

Upon reflection of the author's own role as an action researcher investigating the organisational transformation and systemic change in and of universities towards greater sustainability, other methodological insights become clear. After one complete iteration of AR at UM the case for it being an appropriate methodology has become increasingly self-evident, however this has not been without the need for the researcher himself to learn! As Hind et al. (2013) point out, action learning was also important for the academic team, facilitating their own learning and that of the participants in order to generate useful knowledge. As with the author's experiences in UM and its Green Office, it was absolutely necessary to see what has been learnt, how these perspectives might indeed affect conventional research such as holding interviews, and reflexively what meaning could be built from this. The

purpose of all is to "expose the constraints of organisational realities and uncover alternative solutions to sustainability challenges" on campus (Hind et al. 2013).

Occasionally one finds that in AR, one of the major challenges is the demand for an impromptu disclosure of results from the conventional body of research by the subjects and co-researchers (Heiskanen and Rask 2008) at key moments of analysis. This occurred in the UMGO case. Being in the midst of analysis of interview transcripts and documents of the organisational structure surrounding the GO, there was the demand to provide insights from provisional results in order to determine criteria for how best to select a new member of its Supervisory Board. After one year of reconnaissance of the problem situation at UM, it was decided that to disclose recommendations could be done coherently, in order to maintain the essential working relationship, trust and legitimacy of the researcher with co-researchers, subjects and participants. It was also necessary in this case to remain objective and systematic in the choice in order to fulfil the role of honest broker rather than issue advocate.

7 Discussion and Conclusions

The limitations of this chapter so far begin with the temporal challenge of AR: because it will last the four-year duration of the research project, the work represented in this chapter is concurrent and cumulative; it represents a snapshot after one year of analysis and does not represent policy recommendations eventually produced for UM. It has instead aimed to illustrate a specific social scientific research method that contributes to knowledge of a structural transformation of public institutions towards sustainability, shedding light on the extent to which sustainability initiatives and activities add value to university governance and beyond. This is exemplified in spill-over effects—such as knowledge exchange and industrial student placements—on society, corporations, and other public institutions.

In the studied projects, the researcher provides advice based on the results of the evaluation and reflection stages of the AR iteration, as well as the case study research on how to improve the transformation towards a sustainable HEI. The impossibility of the accurate prediction of factors and aspects of socio-ecological transformation is accepted despite the ingrained role of the researcher in the system under transformation. Values and therefore solutions to the sustainable development predicament cannot be defined *ex ante* (Voß and Kemp 2006), only in practice, in an iterative process of action and reflection. Subsequently, the approach to this study has met obstacles and drawbacks largely as part of the very reflexive nature of the AR process, and especially when case-study results are implemented in pilot schemes. However, in this process, failure is considered just as valuable an experience and result to learn from as success.

This chapter has aimed to illustrate how campus sustainability challenges are addressed from one researcher's embedded view in order to help build a better understanding of them. In essence, and in the context of organisational transformation towards embedding sustainability at UM, AR has enabled the researcher to come closer to seeing how operational, social, and governance processes take place up close, which conventional 'desk' research might not have otherwise gained access to. As practitioner, friendly outsider and critical insider at different moments of the AR cycle, the researcher must adopt many different roles and articulate them to colleagues, subjects, co-researchers and not least herself. Being this ingrained into the organisation, insights from the academic literature can be corroborated in practice. Insights gleaned from observations that corroborate findings from the behavioural change literature include recommendations for interventions that could stimulate 'pro-environmental behaviour in terms of appropriate physical facilities, tailored persuasive communications, and the active engagement of middle management' (Lo et al. 2012). This exemplifies the boundary worker component present in the function of the action researcher, at the policy, practice, science border, translating and brokering knowledge to and fro with a diversity of stakeholders (Pielke Jr. 2007). The action researcher can furthermore function at the interface of the internal properties of the university and its external environment at the societal or regime level, with the purpose to fill the void between top-down and bottom-up governance structures (Fraser et al. 2006) and stimulate "students, educators, researchers, and academic practitioners" using findings after each iterative cycle in transformational AR (McCormack and Dewing 2012).

Ultimately, this approach can forge collaborative partnerships within organisations (from the observed experiences of the author in this case with the GO and other faculties) and with local stakeholders in building and maintaining resilience and encouraging innovation and transformability in achieving sustainability (Manring 2014). The university is then more able enter into partnership with external actors in a form of collaborative governance (Zadek 2006) that proves its extrinsic motivations for policy-driven organisational change. It is hoped that this short chapter's contents can provide valuable lessons for enhancing the role of universities for sustainable development against the global imperative created by the fledgling UNESCO Global Action Programme of Education for Sustainable Development and the UNSDG's.

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Part II
Case Studies and Examples of Implementation

Food Production as a Niche Innovation in Higher Education

Thomas D. Eatmon, Hillary E. Krill and James J. Rynes

Abstract

Institutions of higher education, which have historically responded to the cultural, economic, and technological needs of society, possess great potential for influencing societal transitions towards sustainability. Today, colleges and universities are experimenting with campus-based social innovations that integrate infrastructure, operations, curriculum, research, and funding while communicating new ways of thinking within and outside of the campus community. Food production, for example, has created an integrating context for sustainability on campuses throughout the country and has been praised for its impact. This exploratory study examines the role of colleges and universities in facilitating the diffusion of campus-based food production. Considering food production as a niche level innovation in higher education, we measure the success of this niche as determined by its potential to grow and facilitate the diffusion of innovative practices that influence larger transitions towards sustainability. The transition management (TM) framework is utilized to examine 281 examples of social innovation on college campuses collected from the Association for the Advancement of Sustainability in Higher Education's (AASHE) Database of Campus Sustainability Case Studies and the Sustainability Tracking, Assessment & Rating System (STARS). We find that while necessary processes for successful niche growth are present, the data provides less evidence of the conditions necessary for innovation diffusion.

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Campus food production · Sustainability innovation · Social innovation · Innovation diffusion · Transition management · Multi-level perspective · Strategic niche management

1 Introduction

From establishing long term visions through national commitments to implementing real-world solutions to context specific problems of sustainability, institutions of higher education function at multiple levels of engagement. At one level, these institutions influence broader social commitments to the increasingly complex challenges of accelerating environmental, social, and technological change (Stephens et al. 2008). For example, International declarations such as Agenda 21, the Kyoto Declaration, and the Talloires Declaration have established long term goals that guide higher education's role in shaping a sustainable future (United Nations 1992; UNESCO 1990; ULSF 1999). At another level of engagement, campuses have integrated sustainability into their practices and policy. In the United States, 685 campuses have signed the American College and University President's Climate Commitment (ACUPCC) since 2007, demonstrating environmental leadership through the integration of sustainability into the institutional infrastructure, operations, curriculum, research and funding. At a third level of engagement, faculty, staff, and students are actively involved in experimenting with sustainable alternatives as a means to facilitate learning while also responding to societal challenges. As a result, campuses around the world are creating local innovations, in some cases unifying infrastructure, operations, curriculum, research, and funding through projects that serve as integrating contexts for sustainability (Eatmon et al. 2015). These campus innovations contribute to sustainable transitions by modeling practices and problem solving, facilitating research focused on real-world issues, and forming relationships between institutions of higher education and other societal actors (Stephens et al. 2008).

Campus based food production is one innovation that has proliferated in recent years and become a new focal point of sustainability efforts within higher education (Barlett 2011). These initiatives have largely developed in reaction to the negative social and environmental impacts of conventional agricultural food systems (Hamm 2008; Kloppenburg et al. 1996). Producing food locally reduces reliance on carbon-based fossil fuels and addresses problems of urban food insecurity. Food initiatives also result in the reduction of poorly maintained and vacant lots, improvements in the image and identity of neighborhoods, and cultivation of a stronger sense of community (Kaufman and Bailkey 2000; Glover 2004; Macias 2008). Most initiatives are characterized by interrelated components that include environmental education, sustainability research, food service operations, marketing opportunities, and community outreach programs that have the potential to

impact the surrounding food system (Barlett 2011; Hassanein 2008; Lyson 2004). These efforts advance community objectives of public health, social justice, economic development, and environmental protection while enhancing analytical skills, creativity, social networks, and commitment to service within the community (Pothukuchi 2012).

To what extent are campus-based food production initiatives facilitating the diffusion of innovative practices? Social science research provides useful tools for understanding how the activities of higher education institutions, involving multiple actor interactions at various organizational levels over time, promote change in broader socio-technical systems. For example transitions studies and socio-technical system theory have made contributions to the transition management (TM) framework. This framework has been used to consider higher education institutions as subsystems of socio-technical systems that co-evolve as a result of changing economic, cultural, technological and organizational forces (Stephens and Graham 2010). A multilevel perspective (MLP) of these institutions, taken from innovation studies, views their activities as occurring across macro, meso, and micro scales, which can be useful for understanding how innovation processes lead to change in socio-technical systems (Smith et al. 2010). Strategic Niche Management (SNM) theory goes beyond the TM framework to examine the internal dynamics at the micro (niche) organizational level, the level at which we consider campus food production.

In this chapter we utilize these social science tools in order to examine the success of campus food production in facilitating innovation diffusion and influencing broader change. We do so by analyzing data collected from two databases maintained by the American Association of Sustainability in Higher Education (AASHE). Our analysis targets the communication of niche scale campus innovation initiatives among association members in order to measure the presence of replication (growth of similar projects within the niche that brings about aggregative change) and scaling (growth that draws more participation in the niche) (Seyfang and Haxeltine 2012). Following from SNM theory, both measures are used in this study as indicators of niche success. In the next section we discuss sustainability innovations in more detail before presenting the TM framework and SNM theory as useful analytical tools.

2 Food Production as a Social Innovation

Innovation has been a critical means of addressing the challenges of human survival and progress throughout history. According to Rogers (1983), an innovation is “an idea, practice, or object that is perceived as new by an individual or other unit of adoption.” Innovations differ from inventions in that they do not have to be original but rather they must be new to the adopter and an improvement on the status quo (Phills et al. 2008). As a result, invention often requires attention to technology while innovation requires attention to people (Denning 2004). Academic research on

innovation began in the field of economics and has been applied to the study of urban and regional development, public policy, and management (Cajaiba-Santana 2014).

More recently innovation theory has been applied to the study of social change. There is no agreed upon definition of social innovation, but it can be thought of as "new ideas, institutions, or ways of working that meet social needs more effectively than existing approaches" (Reeder et al. 2012). In the case of environmental challenges such as climate change, social innovations address "wicked" problems that do not have clear solutions but rather require the development of shared understanding across stakeholders with varied perspectives and competing interests (Davies et al. 2012). Social innovation in environmental sustainability, or sustainability innovation, can take on many forms such as recycling businesses, sustainable housing cooperatives, and farmers markets (Seyfang and Smith 2007). Activities often go beyond greening business to take into consideration bottom-up solutions designed to address the needs and interests of the local communities being served (Seyfang and Smith 2007).

For example after purchasing land in 1993, former professional basketball player Will Allen started Growing Power in 1999 to provide fresh food and education to communities in Milwaukee. The main facility's location was once known as "greenhouse alley" for the ornamental greenhouses that were present as far back as the 1920s. Today Growing Power is one of the last functional farms within Milwaukee city limits. The main site is one of twenty farms owned by Growing Power dispersed throughout the city. The farm collects 80,000 pounds of food waste each week from 22 Wal-Mart stores in southeastern Wisconsin to compost and create rich soil for growing produce. Growing Power has over 3000 volunteers as well as partnerships with universities and k-12 schools to maintain their production. The permaculture farm practices beekeeping, aquaponics, and animal husbandry while producing its own soil through vermiculture composting. The organization has been established as a 501(c)(3) not-for-profit organization and takes advantage of incentives such as zero tax liability and access to grant funding, donations, and volunteer services (Goodman 2011). Growing Power's major sources of funding are grants, fee-for-service programs, product sales, and contributions. All revenue that exceeds the organization's costs are reinvested into the activities of the organization, furthering the organization's goals.

The "social" nature of this innovation can be viewed in several ways. One way in which the term "social" has been used is to describe the social motivations of enterprising individuals like Will Allen (Phills et al. 2008). Social entrepreneurship has been the focus of research efforts that examine the characteristics of innovators. These entrepreneurs are distinguished from business entrepreneurs in that they measure value as more than revenue generation alone. Social entrepreneurs play a key role in the development of social innovations as their missions are often driven by the creation of social value, which becomes essential to every aspect of decision-making. Characteristics of social entrepreneurs include pursuit of new opportunities, engagement in innovation processes, actions taken independent of current resource availability, and accountability to stakeholders and outcomes (Dees 1998). In addition, social entrepreneurs are able to identify injustices, develop

social value propositions, and alleviate suffering through "inspiration, creativity, direct action, courage, and fortitude" (Martin and Osberg 2007).

The term "social" has also been used to describe the legal status of social organizations like Growing Power (Phills et al. 2008). If the examination of social entrepreneurs answers questions of who does social innovation, the examination of social enterprises answers questions of how. According to Dart (2004), "the term social enterprise is considered synonymous with organizations becoming more market driven, client driven, self-sufficient, commercial, or businesslike." Such factors as legal status and financial success of organizations have been the focus of this area of research (Schoning 2013). Activities such as revenue source diversification, fee-for service programs, private sector partnerships, and social purpose business are characteristic of these organizations (Dart 2004). One advantage of businesses-minded social enterprise is the potential to reduce reliance on external funding, however at the risk of succumbing to the pressures of prioritizing economic value over social value.

A third lens by which the term "social" may be viewed refers to the nature of the innovation's impact, such as Growing Power's provision of education and fresh food to local communities. While the study of social entrepreneurship and social enterprise focuses on the qualities of people and organizations that lead to the fulfillment of social goals, innovation itself is what creates social value (Phills et al. 2008). Some researchers argue that the concept of social innovation is a more useful construct than the concepts of social entrepreneurship and social enterprise. According to Phills et al. (2008) social innovations break down the barriers between the traditional activities of public, private, and non-profit sectors through the exchange of principles, resources, and responsibilities. Focusing on the process of creating social impacts allows for examination of value creation in public, private, and non-profit sectors by entrepreneurs and non-entrepreneurs alike.

Campus food production initiatives mimic social innovations like Growing Power in a campus microcosm that creates safe spaces for experimentation. As a result, students learn how to integrate various values, perspectives, and knowledge bases into critical thinking and problem-solving (Lourdel et al. 2005; Alshuwaikhat and Abubakar 2008; Yarime et al. 2012). They do this by capitalizing on distinct and often opposing perspectives, combining skills and knowledge from multiple sources and experiences, demanding that issues and positions are framed contextually, and applying theory to practice (Alshuwaikhat and Abubakar 2008; Lieberman and Hoody 1998; Cortese 2003; Schneider 2003; Sterling 2004; Huber and Hutchings 2004). These initiatives can often lead to collaborative efforts that create a mutually beneficial relationship between institutions and their surrounding communities (Alshuwaikhat and Abubakar 2008; Cortese 2003). As a result, students are given the opportunity to experiment with a variety of "real-world" solutions, thus utilizing campuses and surrounding communities as problem-solving laboratories (Barlett 2011; Huber and Hutchings 2004; Herrmann 2007; Lieberman and Hoody 1998; Orr 1992; McMillin and Dyball 2009). The protected space allows alternative ideas to develop in the absence of regime selection pressures, or factors at the meso level that prevent path-breaking

innovations at the micro level from outcompeting mainstream alternatives that are more aligned to existing values and practices (Smith and Raven 2012). These micro level protected spaces are also referred to as "niches" (Seyfang and Haxeltine 2012).

3 Socio-Technical Transitions and Strategic Niche Management

Transition Management is an analytical framework for understanding and promoting change in social systems that can be used as a prescriptive tool for management intervention or as a descriptive tool for understanding historical transitions (Stephens and Graham 2010). The multi-level perspective (MLP) of the TM framework recognizes interactions at three levels and organizes them into a nested hierarchy (Smith et al. 2010). At the highest scale of landscape processes, higher education institutions respond to societal forces that may be economic, cultural, environmental, or technological in nature. These may include external influences such as "costs and accessibility of higher education, the politics of education funding, society-wide economic conditions, climate change impacts, increasing costs of energy and food, and other global or macro-level factors that clearly influence decisions in higher education" (Stephens and Graham 2010, p. 613). These forces can place external pressure on regimes while creating opportunities for niches to create path-breaking solutions (Smith et al. 2010).

Regimes, nested within landscape processes, are the accepted norms and dominant practices of higher education institutions with respect to divisional structures, tenure and promotion practices, degree requirements, etc. (Stephens and Graham 2010). They place selective pressure on niche activities by reinforcing "mainstream, and highly institutionalized, way[s] of currently realizing social functions" (Smith et al. 2010, p. 6) perpetuating unsustainable practices as a result. Selective pressures may include established industry structures, technical standards, established research practices, market rules, public policies, and cultural values (Smith and Raven 2012). These structures create barriers for the diffusion of novel innovations that challenge the regime. For this reason regimes tend to follow incremental innovation patterns while non-incremental change that challenges the regime are developed in niche spaces (Smith et al. 2010).

Niche level activities are nested within the regime and facilitate opportunities for innovation through experimentation and learning. Unlike regimes, niche level activities rapidly change and evolve to answer new questions or to demonstrate new ideas. Niches provide "protective space" for innovations that would not otherwise survive the selection pressures of existing regimes. According Strategic Niche Management (SNM) theory, which addresses internal niche dynamics, successful niche growth requires managing expectations, building social networks, and learning (Seyfang and Haxeltine 2012). Managing expectations requires that niches communicate and attain clear goals. Building social networks leverages resources

that support the activities of the niche. Learning can be both shallow and deep; providing surface level information about the niche activity with respect to economic performance, adoption barriers, and user experience (first order learning) or provoking reflection on deeply held assumptions and beliefs about current practices (second order learning) (Smith 2007). Niches that are successful in facilitating diffusion and influencing regime change do so through (1) the replication of niche activities, (2) scaling projects to involve more actors, and (3) by translation of niche ideas beyond the niche to the mainstream (Seyfang and Haxeltine 2012).

In order to evaluate the success of campus food production as a niche in facilitating innovation diffusion, the authors examined two databases maintained by the North American Association for Sustainability in Higher Education (AASHE). The North American Association for Sustainability in Higher Education is a professional association that supports the development of new practices, knowledge dissemination, and policy change for the campus sustainability community. This is achieved through annual conferences and online communications. These activities create conditions for successful niche growth by providing communications channels for expectation management, social networking, and learning. What is less clear is whether sustainable innovation niches in higher education are facilitating diffusion and influencing regime change. In the next section we present data on innovative campus sustainability projects representing hundreds of US higher education institutions. We focus our attention on campus food production as a niche level innovation and consider whether there is evidence of replication and scaling that would, at least partially, indicate the successful growth of the niche and facilitation of innovation diffusion within the niche.

4 Methods

The "Campus Sustainability Case Studies" database is one of many resources that the AASHE provides to member organizations. The database contains case entries voluntarily submitted by project leaders at U.S. colleges and universities as part of AASHE's annual Campus Sustainability Awards program. The awards recognize projects that promote sustainability in any sector (operations, education, administration, community engagement) and places preference on projects that invest diverse stakeholders in addressing multiple components of sustainability.

The authors reviewed all 188 database entries submitted between June of 2010 and June of 2014. Each database entry contained information on project leadership and institutional affiliation and was divided into sections that included project overview, background, project goals, project implementation, timeline, financing, project results, lessons learned, and supplemental material. The authors used content analysis to systematically categorize each entry according to the language used to describe the goals of serving the campus and community through the provision of environmental services. Each project was coded and placed into one of the following eight categories: climate and energy, water, food and agriculture, health,

sustainable communities, waste reduction, and other. These categories are not mutually exclusive, and oftentimes overlap. For example, green building innovations can address issues of climate, energy, water conservation, and waste reduction simultaneously. For accounting purposes, each case entry was assigned to the category that best matched the project description. The authors also noted the enterprise orientation (the presence of a profitable business model) for each project to account for social enterprise as a type of sustainability innovation. The analysis therefore examines campus innovation from the perspective of social impact (creation of social value) as well organizational structure (market-driven or business minded orientation). As the data provides little information on leadership, we do not examine innovation from the perspective of social entrepreneurship here.

Institution type was noted in order to characterize representation across varying institutions. Of all degree granting institutions in the U.S. (excluding 2-year colleges), Doctorate level institutions account for 10 %, Masters and Baccalaureate institutions account for 24 % (each), and Special Focus institutions account for 42 % (United States Department of Education 2006). Table 1 shows that most cases examined were submitted by Doctorate granting institutions (71 %) with Baccalaureate institutions as the next highest proportion of cases (13 %) followed closely by Associate (8 %), Masters (6 %), and Special Focus (2 %) degree granting institutions respectively. Although Doctorate granting institutions account for only 10 % of all institutions, they compose the large majority of the social innovation cases reviewed. This may be due to the level of resources available for campus sustainability efforts or the communication of those efforts. Doctorate granting institutions generally have higher levels of research activity and expenditures than other institution types. They also rank highest in sustainability efforts as rated by AASHE's Sustainability Tracking, Assessment & Rating System (STARS), followed (in order) by Masters, Baccalaureate, Special focus, and Associate degree granting institutions (AASHE 2015).

Data was also collected from the description of each entry identifying the source of leadership for campus sustainability efforts. This data is not only important for identifying leaders who may be the impetus for sustainability efforts on campuses (the social entrepreneurs), but also for understanding the extent to which innovation efforts are occurring in isolation or as collaborations across conventional boundaries that divide students, faculty, and staff. Table 1 shows that projects were mostly led by a combination of students, faculty, and staff (43 %), followed by staff led projects (42 %) which are mostly the efforts of sustainability coordinators and administrators.

Table 1 Campus sustainability case studies database entries by institution type and project leadership

Degree level	# Cases	Leadership	# Cases
Doctorate	134	Mixed (students, faculty, and staff)	81
Masters	12	Staff	78
Baccalaureate	24	Students	15
Associate	15	Faculty	5
Special focus	3	Other	9

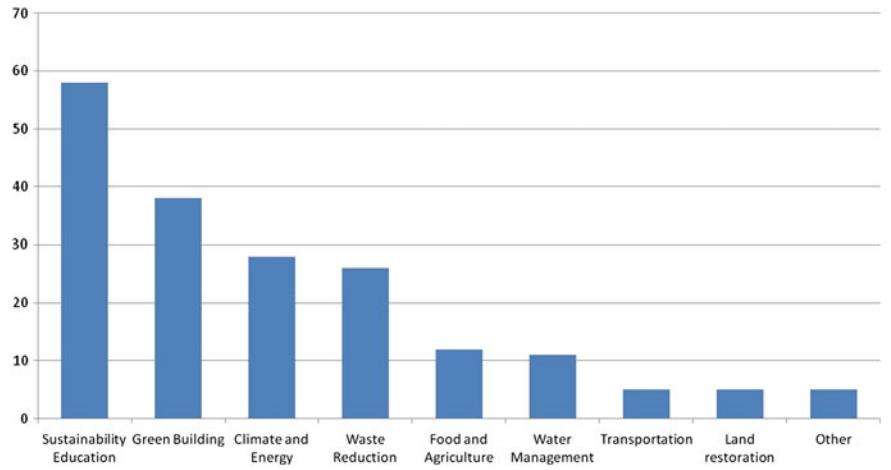

Fig. 1 Bar graph showing campus sustainability innovations by mission type

Figure 1 shows that almost 80 % of the innovations examined belong to the four categories of sustainability education, green building, climate and energy, and waste reduction. Sustainability education projects accounted for the largest proportion of projects (31 %) and can be described as activities designed to develop knowledge, skills, attitudes, and values regarding sustainability. Most sustainability education activities took the form of programs and events, which accounted for 79 % of the cases in this category. Green building, which accounted for 20 % of cases, included projects aimed at improving campus infrastructure and operations, the majority of which involved Leadership in Energy & Environmental Design (LEED) certification.

Climate and energy projects accounted for 15 % of all cases, most of which were energy and carbon offset projects. Waste reduction projects such as recycling, composting, and waste diversion, represented 14 % of all cases.

Although social innovations can occur within any type of organization, many perceive social innovation as the work of non-profit organizations (Dees 2003). This may be a result of conventional views of the roles of business entities. However many campus projects generate revenue that is often used for financing project activities. For example, the Food for Sustainability project at Allegheny College utilizes aquaponic systems for indoor, year round tilapia and lettuce production. The products are sold to Parkhurst Dining Services and are incorporated into the campus dining menu. The integration of food production into campus operations, faculty-student research, and civic engagement experiences has created a whole-systems approach to achieving campus sustainability that has increased the number of partnerships and interactions across the campus and community while creating space to explore new ideas (Eatmon et al. 2015). The authors found that only 9 % of cases utilized profit-driven business models in order to achieve a social mission, most of which were waste reduction and food and agriculture projects.

As the sample of profit driven business models was very small, the authors examined an additional 93 cases of sustainability enterprises from a separate database; AASHE's Sustainability Tracking, Assessment & Rating System (STARS). The rating system is used for tracking the performance of colleges and universities with respect to sustainability. Version 1.2 was used, which measures progress in education and research, operations and planning, administration, and engagement. According to AASHE (2015), 317 US Institutions have a STARS rating. The authors limited the search to AASHE member institutions using the "Type of Characteristic" and "Specific Characteristic" filters and used the reporting fields Category = "Education and Research", Subcategory = "Co-Curricular Education", Credit = "ER-T2–5: Sustainable Enterprise", Reporting Field = "A brief description of the enterprise". The authors used content analysis to systematically categorize each entry according to the language used to describe the goals of serving the campus and community through the provision of environmental services. Each project was coded and placed into one of the following six categories: climate and energy, water, food and agriculture, sustainable communities, waste reduction, transportation, and other. Figure 2 summarizes the results.

Food and agriculture projects accounted for 55 % of all sustainable enterprises. Projects in this category include farmers markets, food production systems, and café's. Forty-three percent of the database entries were classified as sustainable community, transportation, or waste reduction projects. Sustainable community projects accounted for 28 % of all STARS entries and included fair trade stores, thrift stores, and cooperative stores among others. Transportation, all entries of which were bike share or voucher programs, accounted for 9 % of all cases. Profit generating waste reduction programs such as recycling and composting represented 6 % of all entries.

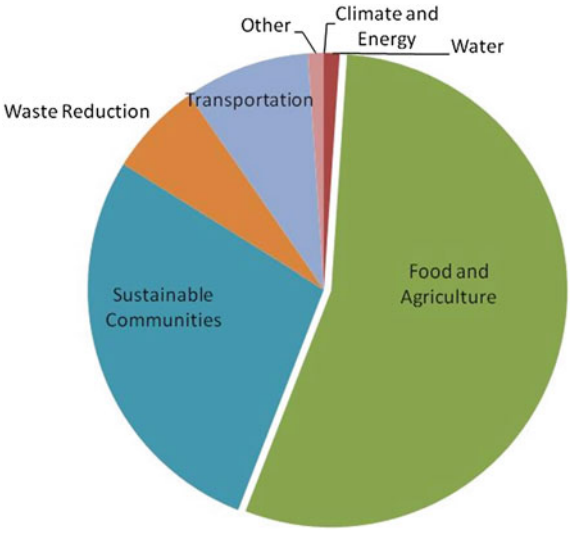

Fig. 2 Pie graph showing campus sustainability enterprises by mission type

5 Discussion

Many institutions of higher education provide protective spaces, or niches, for campus-based social innovations such as food initiatives that are alternative means for meeting societal needs in a sustainable way. In this chapter, we presented the transition management (TM) framework and strategic niche management (SNM) theory to consider the success of campus food production as a niche in facilitating innovation diffusion and influencing regime change. A review of 188 case studies from an AASHE hosted database revealed that most of the sustainability innovation cases reviewed were either green building, climate and energy, or waste reduction activities while food and agriculture, transportation, and land restoration accounted for a much smaller proportion of cases. However food and agriculture, sustainable communities, and transportation represented the majority of the 93 sustainability enterprise cases examined in AASHE's STARS database.

The North American Association for Sustainability in Higher Education creates strong conditions for successful niche growth by providing communications channels for expectation management, social networking, and learning. However according to SNM theory, the facilitation of innovation diffusion and pressure towards regime change are dependent on replication (growth in number of initiatives), scaling (growth in participation), and translation of ideas from the niche to the mainstream (Seyfang and Haxeltine 2012). The data does not provide sufficient information to adequately grasp the extent to which translation of ideas from the niche to the mainstream is occurring, but several insights can be drawn regarding the extent to which replication and scaling are present.

The majority of the "Campus Sustainability Case Studies" database entries described projects in the categories of green building, climate and energy, and waste reduction, while only 11 of 188 entries described food and agriculture projects. In order for replication and scaling to be present, we would expect to see a larger proportion of projects involving larger numbers of participants. According to SNM theory, green building, climate and energy, and waste reduction projects may face less selection pressure than those exerted on food production activities. These selection pressures may come in the form of existing industry structures, dominant technologies and infrastructures, the established knowledge base, market practices, policy, and cultural factors and favor innovations that are aligned with the incumbent, dominant, and often mainstream values (Smith and Raven 2012).

For example, green buildings are viewed as long term investments as well as admissions marketing tools for a new generation of environmentally minded students. With more than 900 buildings certified and over 3000 registered with LEED, this standard is becoming increasingly popular on campuses nationwide (EfS Blueprint Network 2011). Similarly, campus commitments to reducing carbon footprints are becoming an increasingly common standard nationwide. According to the American College and University Presidents' Climate Commitment ACUPCC (2015), 697 colleges and universities are signatories to, 2151 have greenhouse gas inventories, and 533 have submitted climate action plans. Recycling

rates continue to increase each year in the United States and more Americans are becoming conscious of waste disposal behaviors. These landscape forces create regimes that are economically, technologically, politically, and culturally amenable to these types of niche activities.

Food production initiatives on the other hand face stronger selection pressure from incumbent regimes. For example with respect to market rules, small scale food production often requires that consumers are willing to pay higher prices in order to sustain the business model. Existing policies may stifle the use of available land, or hiring of full-time staff that can coordinate projects. Even the academic calendar, a policy established at the regime level, creates barriers for food production projects as many students are away during the summer when food production is at its peak. These factors might allow other niches to outcompete food production projects for resources and attention.

Although food production projects were not well represented in the first dataset, the STARS database of social enterprise projects revealed that food and agriculture projects represented more than half of the entries in the database. This contrast may be significant in that it signals that food and agriculture projects may be the most suitable niche for experimenting with ideas surrounding social enterprise. Food production easily lends itself to business principles and creates an excellent space testing ideas. Although our study shows that food production projects have not been heavily replicated or scaled, they may be a breeding ground new ideas surrounding social enterprise.

These results suggest that higher education institution regimes may be placing excessive pressure on food production activities occurring at the niche level. Changes in regime norms and practices might allow for more replication and scaling of these activities. For example, our data shows that very few faculty were independent leaders of food production projects. The affect of tenure and promotion policies on the work that faculty choose to engage in may be important for strengthening the niche. Policies that support campus food production with funding and resources are also important considerations for the growth of the niche.

6 Limitations

Our findings face several limitations due to the nature of the data utilized in this study. Self-selection bias can be attributed to the "Campus Sustainability Case Studies" data. The database contains case entries voluntarily submitted by project leaders as part of AASHE's annual Campus Sustainability Awards program, which recognizes projects that promote sustainability and places preference on projects that invest diverse stakeholders in addressing multiple components of sustainability. Database entries may reflect well established or noteworthy projects more so than projects in the earlier stages of development or those that lack adequate staffing to dedicate to communication activities. In addition, Doctorate granting institutions account for 71 % of all cases but only represent 10 % of colleges and universities in

the United States. Although it could be argued that these institutions have adequate resources for establishing, standards, best practices, and institutionalized learning necessary for creating strong niches, the sample is not representative of the entire population of US colleges and universities. More data should be collected in order to determine whether the patterns identified in this study hold true for the larger population of higher education institutions. Finally, this study relies heavily on SNM theory in evaluating niche governance, which takes into consideration the internal dynamics of the niche only. Factors beyond niche dynamics, such as pressure on regimes to become more sustainable, could ease the diffusion of food production initiatives into the mainstream (Smith 2007).

7 Conclusion

The TM framework and SNM theory offer useful analytical tools for understanding the role of niche level campus innovations in creating sustainable sociotechnical transitions. Few studies have applied TM and SNM to considerations of sustainability in higher education, and to the authors' knowledge no studies have specifically examined campus food production as a niche level activity. Although the results of this study are not generalizable, analysis of the data highlights important considerations. If institutions of higher education are to demonstrate leadership in creating pathways to sustainable sociotechnical transitions, selection pressures at the regime level must be carefully considered in order to facilitate the growth and diffusion of niche scale activities.

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Student Interest in Campus Community Gardens: Sowing the Seeds for Direct Engagement with Sustainability

Raymond De Young, Kif Scheuer, James Roush and Kate Kozeleski

Abstract

At a time when environmental problems are growing and biophysical limits-to-growth are apparent, encouraging sustainable behavior is a critical societal objective. Within the college campus sustainability movement this is expressed as the need to broaden student involvement in environmental stewardship initiatives. This chapter proposes that campus community gardens are particularly well-suited to the task of increasing student engagement across the entire campus population, not just among those with a prior interest in sustainability or gardening. To explore this proposition, a survey of undergraduate attitudes about motivations for and interest in gardening at a large, non-land-grant, research university was conducted. Results show that student interest is strongly related to how the campus gardening experience is structured. In particular, interest in gardening is related to clearly defined personal and community benefits. What is most fascinating is that the level of interest is not related to prior gardening experience or to strong pro-environmental attitudes, suggesting that campus gardens and farms may be made to appeal to a wide range of students.

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1 Introduction

In the years since the Talloires' declaration challenged universities to pursue on-campus sustainability initiatives[1] (ULSF 1990), such efforts have grown dramatically, becoming a centerpiece of some university agendas (Egan 2006; Eilperin 2006; Friedman 2006; Smith 2013; Weeks 2006). There are now more than 300 international colleges and universities in the Sustainability Tracking, Assessment and Rating System, which measures campus sustainability performance (Urbanski 2014). Furthermore, over 63 % of college applicants place a strong emphasis in their decision to attend a particular college on the institution's commitment to the environment (Zernicke 2008).

Campus sustainability programs are often outgrowths of the environmental research and teaching already in existence on campus (Shriberg 2000). Initially, such programs focused on large-scale infrastructural and administrative changes, such as energy use efficiencies and water conservation in campus buildings, regulating greenhouse gas emissions, and land preservation (Graedel 2002; Pike et al. 2003). In some cases, campus sustainability efforts were integrated into university mission statements or other frameworks, such as using sustainability principles to guide decision-making and purchasing (Shriberg 2000). In other cases, efforts focused on specific projects, such as decreasing the amount of chemicals used in laboratories (Shriberg 2003).

While these achievements are important, the modest level of student day-to-day behavioral engagement in campus sustainability efforts remains an issue. From the beginning, getting students involved with campus environmental stewardship initiatives has been a prime objective (The Heinz Family Foundation 1995; ULSF 1990) and even a guiding principle (Clugston and Calder 1999; Nixon 2002). Unfortunately, campuses lag in achieving this goal (Calder and Clugston 2003; Wright 2003), placing emphasis on technological, purchasing, and physical-plant interventions while underemphasizing the behavioral and cultural aspects of campus environmental sustainability (Levy and Marans 2012). The National Wildlife Federation's Report Card on Environmental Performance and Sustainability in Higher Education found the biggest missed opportunity was involving students, faculty, and staff in campus sustainability efforts (McIntosh et al. 2011).

[1]Composed in 1990 at an international conference in Talloires, France, this is the first official statement made by university administrators of a commitment to environmental stewardship in higher education. The Talloires Declaration is a ten-point action plan for incorporating sustainability and environmental literacy in teaching, research, operations and outreach at colleges and universities.

Where there is student engagement, there is a related issue of self-selection; the active participants are often those with a well-established commitment to environmental issues. Sharp points out that campus environmental groups are generally composed of "passionate, committed students" (Sharp 2002, p. 137), while Zimmerman and Halfacre-Hitchcock note that environmentalism is often viewed as a fringe activity, negatively stereotyped by other students (Zimmerman and Halfacre-Hitchcock 2006). There is clearly a need to provide more opportunities for the broader student population to engage in campus sustainability efforts. But to reach this broader group, efforts to motivate environmental sustainability behaviors will need to be better integrated into everyday educational activities (Lidgren et al. 2006). This is a challenge best addressed by the social sciences. While the natural and physical sciences can present the details and context of the environmental problems being faced, it is the behavioral and educational models of social change that will help to craft the needed societal responses.

1.1 The Importance of Everyday Involvement

DeLind and Link (2004) argue that sustainability cannot be taught effectively in the abstract, needing instead to be experienced and practiced. This echoes the thinking of many campus sustainability scholars who argue that place-based instruction and daily hands-on experience are essential to teaching sustainability. Barlett (2002) writes about the role of a walking tour in building environmental awareness and sense of place. In his recommendations for creating sustainability education, Moore (2005, p. 331) counsels that "pedagogical transformation" is accomplished through "participatory" and "experiential" opportunities. Zimmerman and Halfacre-Htichcock (2006) highlight the role of connectedness as a key component of student engagement. Alvarez and Rogers (2006) suggest students' understanding of sustainability is positively transformed by their being embedded in the campus community and by connecting sustainability to place in their educational process. Thus, place-based and engaged learning, coupled with tangible and directly perceivable outcomes, are essential to the task of promoting long-term sustainability behaviors.

The transition from a growth-oriented, consumer focused industrial society to one that operates within biophysical limits will require resourcefulness and behavioral entrepreneurship (De Young 2014). It will be a long-term, evolving process (De Young and Princen 2012) where the more appropriate responses to environmental dilemmas will emerge from on-the-ground, place-based adaptations (Tonn and MacGregor 1998). For this reason, providing students with chances to experiment with sustainability while they are still in the supportive environment of a school setting gives them the opportunity to slowly develop personal environmental proficiency (Kaplan and Basu 2015; Princen 2005, 2009) and to learn to craft solutions that are appropriate for their own communities and cultures (Kaplan 1996; Irvine and Kaplan 2001).

1.2 Creating Fertile Ground for Student Engagement with Sustainability

One example of a campus sustainability initiative that is aimed at engaging the broader student population is a community garden or farm (Barlett 2011). A campus community garden or campus farm is a public space created and maintained by the campus community where participants can plant and harvest vegetables, herbs, and fruit (Dengate et al. 2013). The material and logistical commitment can be modest—a small piece of land, fencing, a source of water, simple tools and some maintenance oversight—but the benefits to environmental awareness and engagement in sustainability initiatives may be significant.

Campus farms and gardens lend themselves well to experiential learning programs. Combining classroom lectures with hands-on agricultural experience is a strategy favored by students (Parr and Trexler 2011) and a documented means of fostering cognitive engagement and interdisciplinary learning (Francis et al. 2011; Mazurkewicz et al. 2012).

Campus gardens are being used in a wide variety of settings to advance environmental education, foster community ties, and improve psychological well-being (Borgman et al. 2014). Community-based gardening and farming initiatives develop social capital and resilience on multiple levels. They create a positive, empowering social atmosphere, help to develop social networks among participants, and encourage community activism (Okvat and Zautra 2011). Such initiatives also have been shown to enhance the psychological well-being and physical health of participants (Johnson 2013). Tending a garden or small campus farm provides a potent counterpoint to the abstract relationship many people have with nature. With just a little time and effort, students can literally taste the fruits of their labors, building a positive and visceral relationship with the natural environment. Research studying the effects of contact with the natural environment has consistently found exposure to nature to be positively correlated with important well-being outcomes such as attentional functioning (De Young 2010; Irvine and Warber 2002; Kaplan and Kaplan 1983, 2003) and stress reduction (Ulrich 1984; Van Den Berg and Custers 2011; Wells and Evans 2003). Other research has found that frequent experience with a natural environment, such as a garden, is linked to an increase in positive environmental attitudes and behaviors (Bradley 1995; Moore 1995; Stewart and Craig 2001).

From an academic perspective, campus gardens can serve as a tool for exploring sustainability topics such as food systems, and global energy and resource use. The research on campus gardens suggest they are a low-threshold way to provide opportunities for student engagement in sustainability efforts while literally getting their hands dirty. On a number of levels—personal, academic and community—a campus community garden can be used to build and reinforce positive connections with sustainability principles and practices, serving as a gateway to broader environmental stewardship concepts and behaviors. Additionally, within contexts in which the primary focus is not environmental sustainability, a campus garden might

facilitate introducing environmental literacy discussions into fields such as public health, planning, engineering, art and business. Environmental educators increasingly recognize that natural environments, such as campus farms, are an excellent context for integrated learning, connecting environmental awareness with other topics.

There are many student garden and farm projects at colleges and universities in the United States. An informal review done ten years ago identified 52 student farm and/or gardening projects (New Farm Program 2005). More recently, Valluri (2010) identified over 100 institutions of higher education that have community gardens on campus. However, most of those programs were not targeting the general student population and were not explicitly part of a campus sustainability program. Many of the existing campus gardens and farms are geared towards specialized training in areas such as industrial agriculture, horticulture or organic farm production. Although the presence of these garden and farm programs provides evidence that such efforts can be easily integrated with existing campuses initiatives, there appears to be room for these programs to involve the wider campus population.

Campus community gardens provide the opportunity for place-based sustainability education that researchers are calling for (Alvarez and Rogers 2006; DeLind and Link 2004; Gruenwald 2003). Place identity and environmental responsibility have been shown to increase with visitation to natural areas on campus and this relationship may also be stronger when the outdoor experience is tied to coursework (Lawrence 2012). Students who become involved in gardening activities that are integrated with campus sustainability initiatives may come to understand the meaning of sustainability in ways that will endure far beyond their college years.

1.3 Measuring Student Interest in Campus Community Gardening

This study is part of a larger initiative aimed at integrating small gardens and a larger campus farm into both a campus-wide sustainability program and an undergraduate curriculum. This study's specific goal is to explore the potential for engaging a broad segment of the campus population in the study and practice of sustainable food systems, especially those students who are not predisposed to environmental issues. Furthermore, while US land-grant universities are actively engaged in promoting sustainable agriculture (Jacobsen et al. 2012) this study was conducted at a large Midwestern research university that is not the state's land-grant school.

The study was designed to measure what motivations exist for becoming involved in campus gardening and to develop guidance on how to set up campus garden and farm programs to appeal to the general student population. At the time this survey was conducted, the campus had a number of sustainability programs (e.g., green building renovations, environmental purchasing guidelines) but had yet to establish either a campus community garden or a campus farm.

2 Methods

2.1 Sample

An email was sent to undergraduate students living in residence halls at a large, non-land-grant, research university in the U.S., seeking participants for an online survey on gardening and environmental attitudes. Younger college students were intentionally targeted since their interest was not likely to be compromised by approaching graduation. A single invitation email was sent to approximately 3700 students. There were 256 respondents (7 % response rate) including 166 freshmen, 58 sophomores, 16 juniors, 13 seniors and three in their fifth year or beyond. Respondents were 40 % male and 56 % female (12 respondents provided no demographic information).

2.2 Measures

The survey instrument included a measure of prior gardening experience, a bank of items assessing both attitudes toward gardening and the environment and interest in gardening behavior, a bank of items measuring motivations for gardening, and several demographic measures (i.e., gender, year in school, campus residence area).

Prior gardening experience was measured with one item. Respondents were asked to rate their agreement with the statement "I know how to start and maintain a garden." Responses were on a five-point Likert scale from strongly disagree to strongly agree. In all measures reported here, higher mean values indicate higher endorsement for the construct being discussed.

Attitudes towards gardening and the environment were measured with ten items. Respondents were asked to rate their agreement with gardening-related statements such as "I would be willing to start and maintain a garden" and environment-related statements such as "protecting the environment is important to me." The respondents' interest in gardening behavior, the dependent variable in this study, was measured by four items, including "I would be interested in starting a garden." Again, responses were on a five-point Likert scale from strongly disagree to strongly agree.

Motivation for gardening was measured with 18 items designed to assess a spectrum of motivations related to how the garden would align with students' lives and campus routines. Items asked students to rate their motivation for gardening depending on what would happen to the products of the garden (e.g., donating the produce to a homeless shelter, selling the produce), where the garden was located on campus, how students might access it, and in what ways the garden might be tied into their coursework. The stem question for each motivation item was "Please indicate how interested you would be in gardening if…" This was followed by items such as, "You could eat the vegetables you grew." Responses were on a five-point Likert scale from not interested at all to very interested.

Separate factor analyses were conducted for the bank of attitude and bank of motivation items in order to reduce the data and identify latent constructs in the responses. These analyses involved principle axis factoring using varimax rotation. Acceptable and reliable factor structure consisted of eigenvalues ≥1.0, item loadings ≥0.5, no double loading ≥0.5 and Cronbach's coefficient of reliability (alpha) ≥0.7. The resulting categories of items were averaged into the new composite categories discussed below.

3 Results

The respondents reported a moderate level of prior ***Gardening experience*** (mean 3.0), suggesting a range of gardening knowledge and skills among the students.

The factor analysis identified two categories in the first bank of survey items (Table 1). The ***Pro-environmental attitude*** category is composed of four items measuring how important the environment is, whether gardening is beneficial to the environment, and how often participants are engaging in the pro-environmental behaviors of recycling and energy conservation. Respondents rated the *Pro-environmental attitude* category the highest among all the study measures (mean 3.9). This same factor analysis extracted the study's dependent variable labeled ***Interest in gardening***. This category is composed of four items that indicate a willingness to start a garden and the potential intrinsic enjoyment experienced from gardening. The item "gardening is a boring and tedious activity" negatively loaded on this factor and was reverse coded for the composite measure. On average, respondents were modestly positive about their willingness to garden (mean 3.4).

Table 1 Interest in gardening and Pro-environmental attitude categories

Category names and items included	Mean	S.D.	Alpha and loadings
Interest in gardening	***3.4***	***0.9***	***0.84***
Growing plants would be enjoyable			0.92
I would be interested in starting a garden			0.90
Gardening is a boring and tedious activity[a]			−0.80
I would be more likely to compost food scraps if I had a garden			0.50
Pro-environmental attitude	***3.9***	***0.6***	***0.71***
On average, I think I recycle more than other people I know			0.75
Protecting the environment is important to me			0.75
I make a conscious effort to turn off electrical appliances when not using them			0.70
Gardening benefits the environment			0.60

[a]item reversed

Pairwise comparison of means is significantly different at $p < 0.001$

The second factor analysis identified three categories in the bank of items measuring motivations (Table 2). The ***Personal benefits*** category is composed of items regarding how participation in gardening might affect the students themselves. This category of items measures the respondents' desire to have the gardens give something back to them in terms of money, dining points, competition or personal space improvements. Overall this category was endorsed at a low to moderate level (mean 2.8). The ***Learning opportunities*** category is composed of items reflecting students' motivation to garden based on the whether the garden is tied to coursework or other formal educational opportunities. This category had a low to moderate level of endorsement (mean 2.7). The third category extracted in the factor analysis, ***Community benefits***, is composed of items that relate to making a positive contribution to society through helping other students, hospital patients or homeless people. While the item "The garden was somewhere on central campus, but not next to your dorm" is not as clearly about community benefits, having the garden on central campus would put it in an easy-to-reach location for most students, perhaps reflecting the desire to make the benefits of the garden available to

Table 2 Motivation categories

Category names and items included	Mean	S.D.	Alpha and loadings
Personal benefits	***2.8***	***1.2***	***0.90***
Could sell your vegetables on campus			0.87
Could sell your vegetables at a local farmer's market			0.85
Received dining points for donating vegetables to residential hall			0.67
Your dorm floor gardened competitively against other floors			0.66
Could grow plants in your own dorm room			0.56
Learning opportunities	***2.7***	***1.2***	***0.89***
Take a class for credit which just taught you how to garden			0.85
Take a class for credit which included growing a garden			0.81
Participate in a one-day workshop in your dorm to learn to garden			0.70
Learn to garden from an elementary age or high school age student			0.61
Mentor a child in a gardening program			0.61
Community benefits	***3.1***	***1.1***	***0.86***
Vegetables were given to homeless shelters			0.86
Flowers were grown for patients at university hospital			0.84
Vegetables were donated to residence hall dining services			0.64
Garden was somewhere on central campus, but not at your dorm			0.54

All pairwise comparisons of means are significantly different at $p < 0.05$

the entire campus community. This category received a moderate level of endorsement (mean 3.1). All pairwise comparisons of motivation category means were significantly different at $p \leq 0.05$.

3.1 Hierarchical Regression

To examine how respondents' motivations relate to the study's dependent variable, *Interest in gardening*, after accounting for the variance predicted by the other measures, a hierarchical regression was performed. The demographic variables were entered first. Then the measure of *Gardening experience* and the *Pro-environmental attitude* category were entered to account for respondents' pre-disposition toward general environmental sustainability and gardening in particular. Finally the three motivation categories were entered to explore their ability to predict the remaining variance in the *Interest in gardening* category (Table 3).

This hierarchical regression model accounted for a significant percentage of the variance in the *Interest in gardening* category (r-squared = 0.62). The demographic measures had no significant contribution. *Gardening experience* and *Pro-environmental attitude* had a significant positive influence (r-squared = 0.21) on the respondents' *Interest in gardening*. Finally, in combination, the three motivation categories significantly predicted the remaining variance in the *Interest in gardening* dependent variable (r-squared = 0.39). Of the motivational measures, *Personal benefits* and *Learning opportunities* had the strongest relationship ($B = 0.34$, $p < 0.001$ and $B = 0.31$, $p < 0.001$, respectively) with *Interest in gardening*.

Table 3 Hierarchical regression of Interest in gardening category

Predictors	*B*	Sig. *B*	Δr^2	FΔ	sig. FΔ
Year in school	0.03				
Gender	−0.08				
Campus residence area	0.00				
			0.02	1.8	
Gardening experience	0.14	***			
Pro-environmental attitude	0.12	**			
			0.21	32.5	***
Motivation categories:					
Personal benefits	0.34	***			
Learning opportunities	0.31	***			
Community benefits	0.14	*			
			0.39	83.1	***
Total R-squared			0.62		

Dependent variable: ***Interest in gardening*** category
*$p < 0.05$
**$p < 0.01$
***$p < 0.001$

4 Discussion

The survey findings suggest that a wide range of students may be interested in participating in a campus community garden, depending on how the garden program is structured. Approximately 40 % of the variance in students' interest in gardening was predicted by their motivations. Thus, a campus garden or farm program that aligns with student motivations is more likely to engage students.

While the students did report an interest in gardening, that interest depended on whether they could see tangible personal benefits from their participation, or if the gardening experience was tied to coursework or other formal learning opportunities. Benefits that accrued to the community was another, although much less powerful, motivator of student interest in campus gardening. Although prior gardening experience and a pro-environmental attitude were significantly related to an interest in gardening, together these two measures were a much weaker predictor than the motivational measures.

4.1 The Influence of Familiarity

The effect of perceived personal benefits and learning opportunities on the students' interest in gardening suggests that they are concerned about how well a campus garden fits into the normal educational experience. Students were more likely to be interested in gardening if the campus garden was physically and programmatically integrated into familiar campus elements or environments, such as residence halls, dining halls, and coursework. Many existing campus garden and farm programs, however, are distant from the main campus or are geared towards specialized training rather than general sustainability education (New Farm Program 2005). The findings reported here suggest that students may be more responsive to a new program if it is designed to provide clearly defined personal benefits and fits the established academic routine.

4.2 The Importance of Community Benefits

Clearly, the built and social environments characteristic of college campuses are extremely slow to change, some of it quite literally set in stone. This may present a barrier to participation for those students who wish to make a visible impact on the campus environment. Since students' interest in gardening was motivated in part by the community benefits provided by the garden, a campus garden may be of more interest to students if it is portrayed as an opportunity to make tangible and noticeable changes to the campus setting (Eatmon et al. 2015; Ralph and Stubbs 2014). In addition, a campus garden or farm program might be advised to highlight the service provided to the campus and/or local community (Barlett 2011), rather than to emphasize, for instance, specific crops produced or their yield.

4.3 The Broad Appeal of on-Campus Agriculture

Higher levels of a pro-environmental attitude was not a powerful predictor of higher levels of interest in campus gardening. This result supports the notion that a campus community garden or farm may appeal to a wide range of students, even to those without pre-existing, high levels of environmental awareness or concern. There is also a possibility that involvement with a campus community garden might serve as a gateway behavior, possibly leading to the development of higher pro-environmental attitudes and/or an interest in other sustainability behaviors (Barlett 2011).

5 Conclusion

This study was small with only a modest response rate. Furthermore, it was conducted early in the development of on-campus gardening and farming initiatives. Since these programs are developing very rapidly the findings reported here should be used cautiously.

Nonetheless, at a time when environmental problems are growing and biophysical limits-to-growth are apparent, teaching and facilitating sustainable behavior is a critical societal objective. Although a community garden or campus farm may not seem to be the loftiest of sustainability endeavors, they create opportunities for young people to experience the environment in direct and everyday ways. Thus, such opportunities may serve as stepping stones to more dramatic and durable sustainability behavior.

Furthermore, developing campus gardens and farms has the potential to broaden the scope of existing campus sustainability programs beyond common, and often unexciting, infrastructural goals. This would help to address the important goal mentioned earlier, that of preparing students to be environmentally aware, concerned citizens prepared to impact their community.

Finally, the findings reported here suggest that a campus community garden may be an effective way to reach a broad student population, including those individuals who might not otherwise get involved in environmental initiatives. This is perhaps the most important finding being reported. Environmental sustainability will not be possible unless and until it engages individuals from across the entire social spectrum. This would seem to be a daunting challenge yet an initiative as commonplace and easy to develop as an on-campus garden proved capable of appealing to a broad range of individuals. This is a most hopeful outcome.

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Implementation of Education for Sustainable Development in Universities of Applied Sciences

Ulrich Holzbaur and Ariane Kropp

Abstract

Universities of Applied Sciences have emerged from the former German "Ingenieurschule" and "Fachhochschule" and from this tradition they have a strong focus on engineering and industrial application. This poses a particular challenge on the implementation process for Education for Sustainable Development (ESD) at these universities. We look at these implementation processes from a managerial and organisational point of view. We have a twofold focus:

- The processes and methods to implement ESD at a university
- The pedagogical methods for ESD

The basis for all activities is a sustainability portfolio, which combines sustainable development (SD) in education, research, operation and transfer (EROT) with a holistic approach of SD. Working on the implementation process for ten years conducting action research, various methods have emerged like the prepared projects method for students' projects on sustainability or the development and use of educational games.

Keywords

Education · Sustainable development · Project method · Research education

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1 Introduction

Education for Sustainable Development has been identified by the UN as the most important measures to reach Sustainable Development (SD), since it "allows every human being to acquire the knowledge, skills, attitudes and values necessary to shape a sustainable future" (UNESCO 2014). In the basic Brundtland-Report, SD is defined as a "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED 1987).

The UNESCO defines Education for Sustainable Development in the following way: "Education for Sustainable Development means including key sustainable development issues into teaching and learning; for example, climate change, disaster risk reduction, biodiversity, poverty reduction, and sustainable consumption. It also requires participatory teaching and learning methods that motivate and empower learners to change their behaviour and take action for sustainable development. Education for Sustainable Development consequently promotes competencies like critical thinking, imagining future scenarios and making decisions in a collaborative way" (UNESCO 2014).

The competences that are needed for shaping a sustainable future can be summarized by the term "Gestaltungskompetenz" (shaping competence), that has been coined by de Haan (2008). Throughout the years, there have been a lot of definitions, listing between eight and twelve elements of shaping competence. Holzbaur et al. (2013) identified five core areas of shaping competence:

- ethics: competency to deal with own and other people's and group's values
- knowledge: competency to acquire and integrate new knowledge
- planning: competency to plan
- action: competency to implement plans and to participate in decision processes
- reflection: competency to analyse and reflect processes.

The precondition for ESD is responsibility. Thus universities need to dispute with this topic and their own specific responsibility too. Leal Filho (2015) points out that especially higher education institutions are playing a key role in making a major contribution to a sustainable development. Due to their "formidable body of knowledge and expertise", higher education institutions "are uniquely placed to help society to identify and implement the social and technical solutions to the environmental challenges they have helped to identify" (Leal Filho 2015, p. 5). Subsequently he identifies three main approaches of implementing sustainability in higher education institutions: an individual one, a sectorial one and an institutional one. Nevertheless there are many problems that are preventing universities from the implementation processes, like a lack of strategic goals or a reduced willingness to promote structural changes (Leal Filho 2015). These problems need to be identified and solved, since an implementation of sustainable development is unavoidable.

Our contribution to the fostering of these implementation processes, especially at Universities of Applied Sciences (UoAS) is given from an organisational point of view.

The focus is on two aspects. At first we describe general processes to implement SD at a university, like the compilation of a sustainability portfolio (Chap. "Looking Beyond Fossil Fuel Divestment: Combating Climate Change in Higher Education"). Second we present successful pedagogical methods to foster ESD, like project learning and simulation games (Chap. "Beyond Recycling: Developing "Deep" Sustainability Competence". The processes and methods presented are easily replicable for other universities.

2 General Remarks on Implementing SD at Universities

2.1 Universities of Applied Sciences

Universities of Applied Sciences have the triple mission of education, research and transfer. These Universities of Applied Sciences (UoAS) have emerged from the former German "Ingenieurschule" and "Fachhochschule" and from this tradition they have a strong focus on engineering and industrial application. This poses a particular challenge on the implementation process for sustainable development at these universities. Research is strongly focussed on applications which in fact supports transdisciplinary research. Moreover, their research focus is strongly influenced by third party funding.

2.2 Universities and Responsibility

A contribution to sustainable development requires the awareness and acceptance of responsibility. Fortunately it can be seen, that universities are getting more and more aware of their responsibility. At first they have responsibility to the students, who are the decision makers of tomorrow and thus shaping future' society. This results second in responsibility towards society. Third especially UoAS have responsibility to the industries, which need qualified employees. And fourth, a university needs to be responsible in their management of funds, which they receive by the government.

We start with short overview on responsibility and sustainability. Responsibility refers to the consequences of human action. One can only be responsible for the things that depend on him or that can be influenced by himself (Zimmerli 2014, p. 21). Being responsible does have three dimensions minimum: *Someone* (subject of responsibility) is responsible *for* somebody/something (object of responsibility) *towards* someone/institution (instance of responsibility) (Zimmerli 2014, p. 22).

The philosopher Hans Jonas was one of the first, who pointed out the correlation of technical progress and the concomitant growing responsibility.

The basic thesis of his work "The Imperative of Responsibility" is that the promise of latest technology, like genetic manipulation, has turned into a threat, due to unpredictable consequences of action. In addition in many cases it is very hard to tell, which person is responsible for undesirable outcomes of action, like global warming or the loss of biodiversity. For that reason Jonas recommends an "Ethic of Responsibility" and an orientation along impending threat instead of possible promises. The uncertainty needs to be integrated into the ethical theory. "It is the rule, stated primitively, that the prophecy of doom is to be given greater heed than the prophecy of bliss" (Jonas 1984, p. 31). In addition inspired by Immanuel Kant, Jonas formulates a categorical imperative for responsible action: "Act so that the effects of your action are compatible with the permanence of genuine human life" […] "Do not compromise the conditions for an indefinite continuation of humanity on earth" (Jonas 1984, p. 11).

Thirty years later Vogt defines responsibility as a basic willingness to account for one's own action (Vogt 2009, p. 384). Shouldering responsibility is an act of freedom. Man can choose between several options for action, provided that he considers himself being free and not determined. As a consequence accountability can be demanded, especially if the chosen action has negative consequences for third parties. The challenge of the 21st century is that due to an increase of new technologies and the thereby increased options of action, the attribution of individual responsibility is not possible anymore. Since it is unclear who or which (technical) invention caused a specific unwanted consequence like global warming, it is not possible to hold the causer liable. Nowadays one needs to accept responsibility for consequences that have not been caused by him (alone) (Zimmerli 2014, p. 23).

Therefore it is essential to overthink the borders of technical progress. Just that things can be done, does not mean that they should be done, since they might not be good for society. In this context Jonas Imperative is very useful, when trying to find the "responsible" border of technical progress.

Due to these unpredictable effects of technical achievements engineers are highly responsible for common welfare (Hieber 2014, p. 11). It is important that right from the beginning of the developing process of technical inventions possible applications, risks and consequences are discussed—like the example of nuclear fission has shown impressively. For this reason, higher education institutions, who qualify future engineers, are asked to train future engineers not only with expertise but with "estimation competence" and competence to assume responsibility. The estimation of possible consequences of action is essential for shouldering responsibility and definitely challenging. This "estimation-competence" requires networked thinking to understand complex global relationships. Measuring instruments like the Ecological Footprint that accounts "whether the planet is large enough to keep up the demands of humanity" (Global Footprint Network 2003–2015). Can help to identify some of these unwanted consequences. "The Ecological Footprint represents the productive area required to provide the renewable resources humanity is using and to absorb its waste" (Global Footprint Network 2003–2015).

Table 1 Stakeholders of a university and main requirements

Stakeholders	Demands
Students	Education
Society	Social responsibility/transdisciplinarity
Economy	Development/training
Scientific community	Science/research

Universities that want to assume responsibility need to consider the main requirements of all stakeholders. Thus the responsible university is also a responsive one. Lategan and Holzbaur (2010) have developed a model for a responsible university, that responds to the claims of the various stakeholders. The stakeholders are represented in the supervising body of the university and hence deciding about the university strategy. Every stakeholder of the university has his own requirements and demands. The responsible university responds to the needs of all relevant stakeholders, as long as their demands are legitimate. The difficulty is to balance, which needs are essential ones and which are not. Table 1 presents the demands of the four most relevant university stakeholders.

2.3 The Baden-Württemberg Way: Network of Universities for SD

For a better understanding of the implementation process, the special environment in Baden-Württemberg is outlined.

In Baden-Württemberg, a Center for the Enhancement of Ethics in Science and Engineering (rtwe—Referat für Technik—und Wissenschaftsethik) was established in 1991 as a central service unit for all Universities of Applied Sciences (UoAS) in Baden-Württemberg. The rtwe was established to support UoAS in implementing science and technology ethics and technology assessment in their teaching, research, projects and curricula. Most of the 21 UoAS have implemented the position of a senates delegate for science and technology ethics who is responsible for implementing the program at his university and is also part of the Baden-Württemberg network for Ethics in Science and Engineering meeting twice a year in one of the participating universities and organizing seminars and workshops.

From the early days, there was a strong focus on the application of ethics and on environmental issues leading to a strong interest in all aspects of sustainable development. Based on these activities, the Baden-Württemberg Network of Universities for Sustainable Development (HNE = Hochschulen für Nachhaltige Entwicklung) evolved and was formally established in 2005. It is managed by the rtwe and has a similar structure with senate's delegates for Sustainable Development as representatives of their university, with regular meetings and workshops. Several universities have also established positions for a coordinator for sustainable

development who is planning and implementing education for sustainable development at his/her university.

The HNE is an open network with intensive communication via email lists and with more than 200 members in 21 UoAS. From this network, a Federal network evolved which allows professors from other universities all over Germany to participate in the network activities. The HNE is also part (as an organization and via several shared memberships) of the Baden-Württemberg network for Education in Sustainable Development (BNE = Bildung für Nachhaltige Entwicklung) focusing on teacher´s education in ESD but also considering question of methods and curricula for implementing ESD in all areas of education.

HNE and several of its members have been rewarded several times as a project of the UN Decade Education for Sustainable Development 2005–2014.

3 Implementing ESD at UoAS

3.1 Stepwise

Especially at universities with a technical focus, it is helpful to use technical topics, like energy and resource saving as an entry point for the implementation of SD. Later on it is essential to communicate, that SD is much more than that and indispensable for our future. To foster a systematic implementation process it is useful to compile a sustainability portfolio for the university. This portfolio visualizes the SD aims and strategies in the four fields of action education, research, operation and transfer. Table 2 summarizes the use of the sustainability portfolio.

In the preparation of the first sustainability report of the university, seven interviews with members of the university outlined the focus and importance of their activities:

Table 2 Use of the sustainability portfolio

Target group	Use
Sustainability team	Strategic plan, focus
University top management	Communicate the strategy
Faculty/department management	Plan their role within the portfolio
University top management	Communicate the strategy
Research focus: professors and staff	Stepwise approach communicate the role of individual research
Educational focus: professors and staff	Stepwise approach communicate the role of subjects and lectures
Public	Stepwise approach communicate the role of individual research
City administration	Focus for cooperation

- Three professors within the study course "industrial Management" have outlined their activities in education including sustainable development, leadership and sustainable management,
- Three researchers have outlined their activities including renewable energy, materials science and sustainable event management.
- The manager of the career centre, outlined the extracurricular activities to support the social skills and competences of the students.

3.2 Portfolio for the Implementation of Sustainable Development

The implementation of sustainable development at a University of Applied Sciences needs a structured approach. This paper presents two portfolios: Table 2 shows the one of Aalen University (HS Aalen) and Table 3 the one of the cooperation partner Central University of Technology (CUT) Bloemfontein, South Africa. For more than ten years CUT and HTW Aalen cooperate to implement education for sustainable development in both universities.

3.2.1 HS Aalen

The areas of activity of a university can be divided into education, research, transfer and operation. The following portfolio (Table 3) visualizes these areas differentiated according to the dimensions of sustainable development—ecology, economy and social issues—and an overall view for cross-cutting issues.

Table 3 Portfolio of sustainable development at the university of applied sciences Aalen 2014

	Education		Research	Transfer	Operation
Holistic	Integration of SD into teaching	Extra-curricular studies	(E) SD as a research topic	Real world lab Aalen	Governance framework conditions and organisation
Economic	Courses		Institute for applied research (IAF): Projects	"Explorhino" (workshop for young scientists) career-centre	Transparent and future-oriented management
Ecological				Company network transfer centres of the Steinbeis Foundation	Environmental management
Social					Future orientation for members of the university

Table 4 Portfolio of sustainable development at the CUT 2010

	Overall holistic intergenerational	Environment resources	Economics management	Social political intragenerational
Site level campus	Sustainability@CUT	Green campus	Economic sustainability	Blue campus
Local/regional community development	Cooperation programs	Climate protection program	Entrepreneurship sustainable economy	Community engagement
Regional/national education cooperation	ESD in curricula	Energy engineering for sustainability	Entrepreneurship	ESD in teachers education
National/global research cooperation	Cooperation programs SD in research	Energy water	Corporate social responsibility	Research in socioeconomic aspects of sustainability

3.2.2 CUT Bloemfontein

The aim of the project "Sustainability@CUT", which started in February 2011 is the implementation of SD into education, research, operation (campus), transfer and community development, leading to an autonomous sustainability management system. The HTW Aalen is supporting the project by an exchange of teaching staff, cooperation in management and students' projects as well as exchange students. Table 4 presents the SD portfolio of the CUT Bloemfontein.

4 Educational Methods

In the process of implementing ESD, we found it difficult to give the students the relevant competences for SD only by traditional lecturing. From this and from the need to influence society, we developed, adapted and tested several methods for teaching and learning.

4.1 Projects as Part of the Real World Lab Aalen/Students Projects/Project Learning

The transition to sustainable development is a challenging task for states, organizations and individuals. The "great transformation to sustainability" (WBGU 2011) will require the contribution of all groups in society. Science and consequently universities can make their contribution by expanding transdisciplinary research. This is the reason why universities are getting more and more engaged in the "real world lab".

Real world labs are places of transdisciplinary research, where social challenges and transdisciplinary research are connected (MWFK 2013). Real social contexts like cities, neighbourhoods or industries and issues like the strategy of sufficiency or

efficiency are supported scientifically to foster a transformation process. Basically a real world lab is initiating changes towards a sustainable development supported by science. These changing processes can be observed in the lab to achieve a better understanding of its causes and consequences. This is a new conjunction of research and transfer of knowledge in a network of science, economy and civil society for the implementation of a sustainable development (MWFK 2013).

Aalen University has a longstanding cooperation with the City Administration and with the Aalen Local Agenda 21 group of which was founded due to an initiative by the University, the City Dept. of Environment, and the Adult Education Centre. During 15 years, cooperation has grown and had a lot results beneficiary for the University and the City (Holzbaur and Kaufmann 2011). Thus Aalen has been a "real world lab" for sustainable development for more than 10 years. Schneidewind has emphasized the importance of "real world labs" for transdisciplinary research projects. According to him especially cities are an important space for experiments (Schneidewind 2013, p. 85). Lately Schneidewind (2014) shaped the term "True University Sustainability" referring to the "True Business Sustainability", speaking up for the necessity of universities to become transformative. Transformative research and teaching is the next step towards a true sustainable university, since transformative science requires an "outside-in-perspective", from the society (outside) to the university (inside), concerning two aspects (Schneidewind 2014). First the Grand Challenges of Society should be the topic of investigation and second social players should be involved in the development of research issues (Schneidewind 2014).

Education for sustainable development is one example of a real world lab. It is a highly topical challenge to convince society to engage for a sustainable development. This concerns all generations, disciplines, and industries anywhere and anytime. Thereby not only practical problems are emerging, but topics for research as well:

- How can these processes be influenced?
- Which methods are necessary to influence these processes?
- How to increase essential motivation for the implementation of sustainable development?

To answer these questions, it is important, that all participating actors come together, develop concepts and experiment with them. This example shows how real world labs serve as test rooms for transformation.

4.1.1 Project Learning

Project learning is more than just doing a project in the course of or instead of some lecture. Project learning needs to be planned in two aspects:

- Project success with regard to the project outcome of the students' project
- Learning outcome as a result of the didactical project including preparation and evaluation.

A more concise description that also introduces the two project triangles of students' project and learning project is given in (Holzbaur et al. 2013).

Projects are separately identified tasks that are handled by a dedicated team within a well-defined time and with limited resources. In brief: projects are anything that is non-routine. Projects are mostly seen as a means of achieving some goals. In education and training they can also be used to acquire knowledge and skills in an action oriented setting. To apply projects successfully, there must be a good preparation and a balance between theory and practice.

General competences gained via projects comprise the competence to:

- Plan in a result-oriented way considering the requirements with respect to quality, resources and timelines and their interactions.
- Structure the aims and the tasks to be accomplished in order to achieve these aims and to organize the work.
- Argue and preview argumentations and counter-argumentation in advance making sure that the result can be argued in a written documentation and defended in an oral presentation.
- Document the results and processes leading to these results.

Inquiry based learning is similar to PPM, but concentrates more on the increase of knowledge than on real world project outcomes and effects.

The systematic implementation of students' projects as a method of learning and communicating sustainable development and to contribute to regional sustainable development has been implemented in several projects of the ESD decade. The Baden-Württemberg state department within the framework of their program "welcome to science" has funded a project for systematically involving first semester students into projects. The method has been further developed at Aalen University and is implemented within the ESPRESSO team to support educators and students. ESPRESSO stands for "Experience science and practical relevance and learn sustainably via sustainability projects".

This is an example for transdisciplinary research in a real world lab (Schneidewind 2013) and also contributes to (education for) sustainable development outside the university.

4.1.2 Projects for ESD

After explaining the use of project learning, short summaries of several examples of students' projects that integrate learning for ESD and impact on society are given here.

Green Eel

The "Green Eel" is an environmental management system for schools developed by the Aalen Local Agenda 21 and Aalen University. It is based on two pillars: (1) environmental management without many formalities but high quality due to peer audits; (2) Environmental pedagogics and environmental protection. This makes the implementation of the environmental management system "green eel" very comfortable and easy. The certificate is awarded, if certain measures are performed and an environmental statement about the single activities, projects,

consumptions and targets is created. Students of Aalen University are supporting participating schools with the implementation of the green eel. They are helping with the actual condition analysis, the introduction into the environmental management system and the creation of the environmental statement. Employees of the Green Spaces and Environmental Office as well as the Agenda Office are available for technical information.

Beside Primary and General Secondary School, institutions of the youth, a gymnasium and a day care centre for children have been distinguished. By now a neighbouring municipality is in the process of adapting the system for a primary school; moreover two secondary schools are interested too. In addition multilingual information flyers have been made to improve the attraction and integration of migrants.

The "green eel" has been distinguished for five times by the UNESCO commission, being project of the UN-decade "education for sustainable development".

KARN

KARN is a virtual sustainability learning trail that runs along the rivers **K**ocher, **A**al, **R**ombach and **N**esselbach. Surrounding this path, several students' projects in cooperation with different organizations around Aalen have been performed. In addition schools of Aalen have undertaken sponsorships for single parts of the trail. Students' projects consider aspects of sustainability, communication and the use of social media, smartphones and other modern devices. The KARN projects also comprise tasks to make the train barrier free and useable by senior people. Also the documentation of wheelchair accessibility and of industrial history was components within the last years.

Experiencing sustainability and enjoying the Aalen region by museums and play and adventure areas near the trail is the aim of the KARN project.

Sustainability at HTW Aalen

Several students' projects improved sustainability at HTW Aalen. For example:

- sustainability aspects of university's open day
- Accessible University
- Green Campus
- Energy saving and student's behaviour
- Public transportation

4.2 Simulation Game

4.2.1 Educational Games and ESD

Educational game, business game, planning game, simulation game—there are several terms for an innovative method and several definitions of their meaning. According to the International Simulation and Gaming Association ISAGA in this

paper the term "gaming simulation" is used, because of its broad understanding of experience-based and playful education methods (ISAGA 2015). A simulation game provides a fictive situation, which is a simplified indication of reality (Ulrich 2003, p. 3). The various options gaming simulation have four different methods in common:

- **simulation**: a dynamic and simplified imitation of real processes, e.g. flight simulator
- **game**: an activity that is based on the pleasure of doing it and the rules of the game
- **role-play**: actors overtake foreign roles and experience different situations from a different point of view
- **case-study**: the learners are confronted with a concrete situation and certain questions that require specific solutions (Ulrich 2003, p. 3).

All these methods have in common that they are simulating processes for a better understanding of real complex processes (Kriz and Nöbauer 2006, p. 81). Thus gaming simulation method is a "language" for a better understanding of complex dynamics and processes (Kriz and Nöbauer 2006, p. 80).

Klabbers (1989) on the importance of Gaming Simulation:

"We are living in a world that is rapidly growing more and more complex. Consequently we find ourselves in the position of having to cope with problems that pass our comprehension. […] governments, institutions and corporations are becoming less competent in dealing with complex problems and in coping with high levels of uncertainty. […] gaming and simulation have proved to be a powerful combination of methods and ideas in dealing with complex and unique issues and with value conflicts between various parties (stakeholders). Gaming-simulation provides […] a shared language for communication between the social and natural sciences. With the utilization of gaming-simulation […] we can learn to converge on solutions through shared knowledge and a will to understand and act" (Klabbers 1989, pp. 3–4).

Especially in the context of business and socioeconomic development, simulation games are very common. They can also make an important contribution to ESD (Ulrich 2003).

4.2.2 Educational Game VAL-U

This is a short overview taken from the papers (Holzbaur 2001, 2003) and (Van den Berg et al. 2009).

In many discussions within the last years, the need showed up for a basic training in economics skills. Entrepreneurs and intrapreneurs, small scale farmers and shopkeepers wholesalers as well as craftsmen and traders need basic knowledge in accounting. The same holds for young academics: no one should graduate without elementary knowledge about the function of an enterprise and entrepreneurship. Entrepreneurship is the attitude to start an enterprise and to take well-calculated economic risks. Entrepreneurship is based on the will to take

decisions and to act. The entrepreneur is acting within an economy and investing his time and money to achieve an economic goal. Management is an important aspect for entrepreneurship. But it is not the business administration approach to organize and control a company; it is the will and ability of achieving results and contributing to economics success. Although starting an enterprise may be a one-man-show, a successful entrepreneur needs to involve other people—customers, employees, and partners. Innovators must involve their working groups as well as their peers.

Starting from a 2002 discussion in a community developments project of CUT, the idea of the planning game emerged. Also the conception of the game was based on the concept of "real world lab". It was implemented via several students' projects. The students cooperate in several development phases with several groups of society. After the conception of the game the students organized workshops using the games and reflect the results.

The cooperation with the management faculty on the aspect of using planning games to foster entrepreneurship and contribute to socioeconomic development has led to the project "Success in Small Business". The aim of this project is the conceptualization of the Planning Game "VAL-U" (VALues & yoU).

The development of the educational game system VAL-U is a joint effort of HTW Aalen and CUT Bloemfontein. It is based on several educational games and shall involve various stakeholders from university, industry, community, and education. The game will have several levels based on corresponding concepts of values:

1. The concept of value creation
2. Adding monetary value
3. Creating value for the market and fulfilling needs
4. Valuing people and culture
5. Entrepreneurial values and Sustainable Development
6. Adding value to society—business plan development

The planning game VAL-U was designed for education in schools and in emerging countries. The goal of the planning game is to introduce the players into the fundamentals of business management and accounting. It shall support entrepreneurship and foster socioeconomic development in developing countries.

The cross-cultural planning game has been developed for all people without or with just a few previous experiences in economy, e.g. pupils of advanced schools or founders of a new business in emerging markets.

During the game play the players should first plan their own company's operations. In a later stage, competition can be included and the players strive to have the most profitable company.

The game was developed for one trainer and about 20 participants. It can be played anywhere in an easy way, because only a printout of the templates and some materials (e.g. pieces that stand for the product and for the money) are needed. It's also possible create physical products (mechanical, electronic), texts (brochures, leaflets) or some type of food or drink (e.g. as soup, hamburgers or lemonade).

5 Conclusion

This paper presents the approach and various successful methods for the implementation of (Education for) Sustainable Development at Universities of Applied Sciences. The following findings are easily replicable at other universities.

- First of all, it is essential that a university accepts its responsibility. Universities are carrying responsibility in four different ways and to fulfil their responsibility, they need to consider the main requirements of all stakeholders (students, society, economy, scientific community).
- The exchange of information and experiences in networks is very helpful.
- A sustainability portfolio is very helpful and the basis of the implementation process. It combines sustainable development (SD) in education, research, operation and transfer (EROT) with a holistic approach of SD, specifying in the three different dimensions of SD: environment and resources, economy and management and social issues.
- Education for Sustainable Development is about the imparting of competences, especially shaping competence. It has been shown that innovative methods, like project learning or simulation games can be recommended to foster these competences.
- Universities can contribute to the great transformation by means of projects that really make an impact on society. Although several successful projects show the feasibility of "real world labs" there is much to do in order to bridge the gap between University and Society and Government.
- In addition we have seen, that various joint projects, sustainable development and transdisciplinary research and development can be successfully implemented in the cooperation of Universities.
- Educational projects and educational games are building an important method for the implementation of Education for sustainable development at universities —especially at Universities of Applied Sciences.

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Introducing the Graphical Assessment of Universities' Sustainability Image (GAUSI) Instrument: A Marketing Tool

Gabriela Nicolino and Sergio Barros

Abstract

Purpose This chapter demonstrates how marketing principles can be used to incentivize universities to engage in sustainable practices, by developing institutional image and reputation. This approach illustrates some of this applied social science's contributions to sustainable development at universities. *Design* In order to accomplish that purpose, this chapter presents: (a) A literature review of marketing concepts relevant to universities' institutional image management and the contribution of associating the institution's image with sustainability; (b) A literature review of institutional image measurement methods and sustainability assessment methods used in university contexts; and (c) An introduction to the Graphical Assessment of Universities Sustainability Image (GAUSI) instrument. This tool suggests the prioritization of investment in sustainability initiatives that, according to stakeholders' perception, are important to a university's sustainable reputation and have positive influence on the decision-making process of choosing a university. *Findings* This chapter introduces the Graphical Assessment of Universities Sustainability Image (GAUSI) instrument, a tool that demonstrates how to start or further engage higher education institutions in sustainable initiatives. *Value* The chapter proposes a way to improve the appeal of engaging in sustainable practices to universities, by demonstrating the benefits to institutional image and to institutions' attractiveness as a place to study or work for students, faculty and staff members. The intention is to facilitate the approval of sustainability

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initiatives by management boards, through the submission of an alternative return on investment: the improvement of the university's institutional image, alongside with the direct branding benefits and indirect monetary gains that come with it.

Keywords
University sustainability · Institutional image · Green marketing · Sustainable development · University choice

1 Introduction

The growth of sustainability awareness in society and in the corporate environment has resulted in an increasing demand for higher education courses with a focus on sustainable development and on social-environmental responsibility. In order to fulfill such demand, universities have been developing masters' and doctors' curricula with the aim of preparing students to obtain successful outcomes from their academic research or business related actions towards production and consumption reorganization, so that negative impacts on our society are minimized.

How can universities teach about sustainability if they do not apply such concepts in their practice? Much more is expected from universities other than just teaching sustainable development. Therefore, the role of universities as contributors to society's sustainable development has emerged as a topic worldwide (Cortese 2003 cited in Wright and Wilton 2012). In 1972, the Stockholm Declaration (UNESCO 1972; Santos 2009) first referenced the subject, quoted in numerous other international forums documents ever since, such as the *Talloires Declaration* (1990), the *Halifax Declaration* (1991), the *Swansea Declaration* (1993), the *Kyoto Declaration* (1993), the *Copernicus Charter* (1993) and the *Students for a Sustainable Future* (1995) (Mason et al. 2003).

The need to transform theoretical work into tangible changes in universities' management led to the creation of a specific forum within the United Nations Conference on Sustainable Development known as Rio+20, where the Higher Education Sustainability Initiative Declaration was written and signed by over 250 higher education institutions from around the globe. The declaration states that universities should not only teach sustainable development, but also commit to encouraging research on the subject, "green" their campuses, support sustainability efforts in local communities, and engage with and share results through international forums (UNESCO 2012).

Higher education institutions have the power to create synergy between global knowledge, technology and great minds. Therefore, they bear a responsibility of becoming active agents in implementing sustainable development within society, by educating the leaders of future generations and by adopting sustainable practices on their own campuses, as a live-lab for all stakeholders and as an example for the

community (Tauchen and Brandli 2006; Owens and Halfacre-Hitchcock 2006 cited in Santos 2009).

Although this scenario of rising demand for sustainability-oriented courses and external pressure of international forums highly encourages universities to embrace sustainable efforts, higher education institutions continue to struggle to commit to sustainability for a variety of reasons. Wright and Wilton (2012) identify a lack of understanding of sustainability as one of the barriers to implement sustainable initiatives on university campuses, in addition to difficulties in accepting people's differing opinions on the subject within the university hierarchy, as well as a significant resistance to change.

Universities' managers' perception of the greatest barrier for engaging in campus sustainability, though, is the financial cost associated with campus greening (Wright and Wilton 2012). Sustainability initiatives are typically not considered part of the traditional university budgeting process, therefore making boards and managers resistant to approve them under existing institutional structures (Wright and Wilton 2012).

This chapter proposes a marketing approach to incentivize sustainability in universities' management, by suggesting that adopting sustainable initiatives on campuses can present a valuable return through the development of the institutions' image and reputation. As demand for higher education courses concerning sustainability rises, more and more institutions will find it difficult to differentiate their offers from each other. Therefore, if a university embraces sustainability as part of its structure and meets the demands for a green campus, society may perceive its expertise and true commitment to minimizing social and environmental impacts. Consequently, this will enhance the university's credibility with regard to the courses offered and its own institutional image.

It is important to establish if positioning universities as sustainable ones will provide a competitive advantage in the higher education environment. As a strong branding strategy, sustainability could improve universities' institutional image and thereby attract human talents, e.g. students, faculty and staff members, which could in turn attract public and private funding to sustainability projects and research (Terkla and Pagano 1993).

2 Literature Review

2.1 Marketing Concepts Relevant to University Sustainability

2.1.1 Institutional Image

Bringula and Basa's (2010) demonstrated that within the marketing literature there are different, and yet complementary, definitions of institutional image. For example, it is possible to divide the concept into two components—functional versus emotional. The first considers tangible and easily measured aspects of an

organization, while the second one is related to one's feelings and attitudes towards it (Kennedy 1977 cited in Bringula and Basa 2010). In a university context, the functional component can be interpreted as campus infrastructure (e.g. classrooms condition, labs capacities, campus accessibility and transportation), while the emotional relates to the institution's educational capacity recognition (credibility of courses and research programs) and its interactions with constituents (hiring policies, labor conditions, director and professor accessibility to students, etc.).

Dobni and Zinkhan (1990), on the other hand, separate the concept of institutional image into cognitive and affective components, respectively people's beliefs and feelings towards an organization. Whereas Nguyen and LeBlanc (2001) define institutional image as the result of an aggregate process by which the public compares and contrasts the various attributes of organizations, and which can differ according to specific stakeholders, such as clients, employees, and shareholders, due to their different types of experiences and contact with the organization.

In short, an institutional image can be defined as the beliefs, ideas and impressions that an individual or a group has about an organization. Institutional image management is essential for understanding stakeholders' opinions and, as a result, establishing an efficient and effective line of communication with them (Kotler 2000). Kotler (2000) also states that people's attitudes towards an institution are highly conditioned by its perceived image; therefore, the performance of a for-profit or a nonprofit organization can either benefit from or be damaged by their institutional image.

Universities and colleges are not different from corporations regarding institutional image and relationships with stakeholders, which should not be overlooked, in order to strengthen these institutions and develop their relationship with society. In a way, having a positive image may be even more important for universities than for corporations, as students and faculty have to be considered simultaneously as customers and employees, because of their extensive participation in the institution's intellectual production. Thus, attracting these specific stakeholders combines the difficulty of satisfying customers and recruiting qualified human resources, which can benefit from a positive institutional image.

Choosing to associate sustainability with a university's brand may be an alternative to improving the institution's image and attractiveness to stakeholders. Administrators and marketing professionals can choose to explore a wide range of positive secondary associations with the institution, like quality of campus life, commitment to a sustainable future, commitment to the benefit of society, credibility of faculty members, as long as evidence is provided regarding the true engagement with whatever is claimed (Dahl 2010). The importance of being transparent and truthful with sustainability claims will be further discussed later in the chapter.

2.1.2 Strategic Positioning of Institutional Image

The choice of one organization's service or product over their market competitors depends on the proposition of a clear and exclusive value to customers compared to

other organizations (Fill 2006). Hence, the fewer practical distinctions among market offers, the more important it is for organizations to aggregate value to their products or services, with the aim of delivering a clear advantage to customers (Fill 2006 cited in Bax and Woodhouse 2013).

Considering the large number of higher education institutions in the market today, when planning a strategy for constructing a university's institutional image, it is easy to be driven to common associations as "traditional" or "highly technical", which provide clear value to stakeholders, but might not differentiate the university from other institutions. Kotler (2000) explains that differentiation should strategically position a brand considering the competition, by promoting a specific value that is exclusively offered, or best offered by the organization in comparison to other market players. As nowadays still relatively few higher education institutions are fully engaged in sustainability, pursuing sustainability positioning can provide a significant differentiation strategy. Positioning can be defined as the development of the offer and the institutional image with the aim of occupying a distinctive place in customers' minds (Kotler 2000).

Nevertheless, not all differentiations are relevant for stakeholders (Kotler 2000), thus, for institutions to create customer value through differentiation, they need to understand what benefits stakeholders are looking for, by identifying which service characteristics or brand associations are worth pursuing. As illustrated by Fig. 1, customers' perceived value of an offer is determined by comparing various benefits against costs.

Some of the items listed in Fig. 1 directly relate to university sustainability. An institution engaged in pursuing sustainability in its management, operations and educational systems, for example, could provide product and service benefit through high quality education and good campus facilities, while diminishing energy cost with a reliable transportation system.

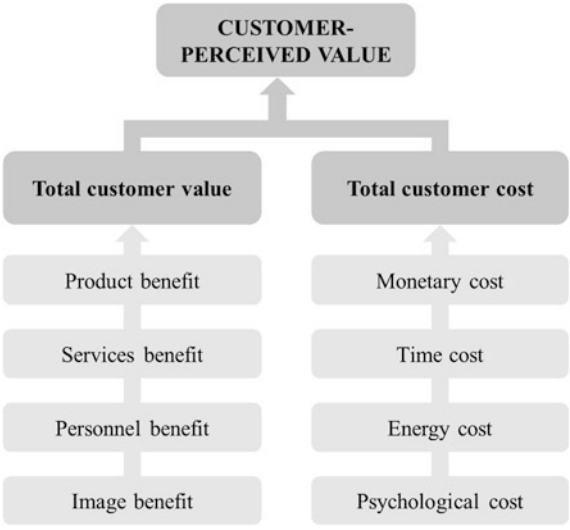

Fig. 1 Customer-perceived value determinants. *Source* Kotler. Administração de Marketing. São Paulo: Pearson Prentice Hall (2000, p. 57)

2.1.3 Institutional Reputation

Institutional image is susceptible to alterations if an organization fails to deliver on its promises or to meet stakeholders' expectations. In contrast, institutional reputation is based on the extent to which stakeholders believe that an institution is capable of and/or is willing to comply with its promises. By consistently meeting stakeholders' expectations, institutions prove trustworthiness and expertise, associating credibility with their reputations (Baek et al. 2010). In addition, Herbig and Milewicz (1995), define reputation as

> the estimation of the consistency over time of an attribute of an entity. This estimation is based on the entity's willingness and ability to perform an activity repeatedly in a similar fashion (Herbig and Milewicz 1995, p. 5).

The authors explain that reputation guides public expectations, because, in the absence of more accurate indicators, individuals will view organizations' previous behavior as an indicator of their future behavior. Taking that into account, customers can infer the quality of new products and services, based on the perceived quality of previous ones. A university interested in offering a new graduate course, for example, would clearly benefit from possessing a positive reputation, therefore, stakeholders would believe in the quality of the new course, based on the institution's history of quality education.

Nevertheless, the quality of services and products does not determine institutional reputation alone. Reputation is the result of all direct or indirect stakeholders' interactions with the institution, including staff helpfulness and sympathy, market communication or media appearances.

Shamma (2012) groups the most common reputation definitions into three categories: reputation as a state of awareness, where it is understood as an aggregation of perceptions about the organization; reputation as an assessment, meaning the judgment and evaluations of an institution; and reputation as an asset, an intangible one, but with real economic value to the organization.

Regardless of its definition, a well-perceived reputation establishes a competitive advantage for the institution. Herbig and Milewicz (1995) state that an organization with a good reputation has a "goodwill stock", in other words, customer loyalty. Such an organization has the opportunity to redeem itself if it commits errors in its operations or gets undesirable results from new projects, given its prior record of service/product quality. An organization with a bad reputation might not be given this second chance. Instead, even with good quality services or products, it will take longer to gain public trust, as it is expected that an institution with a poor reputation will keep disregarding stakeholders' expectations.

For universities to build a sustainability reputation they first have to understand how their institution's reputation is perceived by stakeholders, so that marketing efforts can focus on deconstructing current perceptions and shift these towards sustainability. As an institution's reputation is constructed over time, it takes continuous and patient marketing efforts to effectively achieve a change in reputation perception. However, once a sustainability reputation is established, an institution gains stakeholders' trust to experiment, invest and develop new projects

with believability that it is pursuing positive social-environmental changes and impacts on campus or on society.

2.1.4 Decision-Making Process

There are many proposed models for buyers' behaviors, and the stages of the buying process can apply to almost any individual decision-making process, like choosing a university to attend as a student or to work as an employee or faculty member. Kotler (2000) divides the purchase decision-making behavior into five stages: problem recognition, information search, evaluation of alternatives, purchase decision, and post-purchase behavior. Similarly, Engel et al. (2005) propose a seven-stage process, consisting of: need recognition, information search, pre-purchase evaluation of alternatives, purchase, consumption, post-consumption evaluation, and divestment.

Both authors recognize there is a difference between day-to-day decisions, which are more frequent and demand less time, effort, and monetary investment, from less ordinary decisions. This second group usually involves bigger impacts on the individual's life and demand more investment, therefore involving greater risks, as would be the decision to choose a university to attend or to work at. Kotler (2000) names those as low-involvement and high-involvement decisions, respectively, differentiated by the amount of effort devoted to each stage (Engel et al. 2005).

Kotler (2000) explains that the perceived risk of a purchasing decision varies according to the amount of investment required, the performance uncertainty of products or services, and the self-confidence of the decision-maker. In addition, Salomon (2002) categorizes purchasing risk as:

Monetary risk, associated with financial harmfulness;
Functional risk, related to attributes not functioning as expected;
Physical risk, concerning compromising the person's physical integrity or health;
Social risk, related to disapproval by people close to the decision-maker; and
Psychological risk, meaning the association of negative values with one's self-image.

Therefore, a university with an institutional image as a sustainability university, strategically market positioned, aggregates positive intangible values to its courses and campuses, as innovative and environmental-friendly, and consequently to its customers, which minimizes social and psychological risks. A strong sustainability reputation, on the other hand, gives credibility to the institution's social-environmentally responsible initiatives, which can diminish functional and even physical risks.

Additionally, Baek et al. (2010) introduced the concept of prestige, also associated with institutional reputation, as the status associated with a brand. Achieving prestige with a sustainable reputation refers to the perception that a university has unique expertise in the subject (Baek et al. 2010), which directly reduces the perceived-risk of choosing the institution as a place to study, work or invest in.

Both credibility and prestige are responsible for saving information costs, considered the "information gathering and processing costs, which include expenditure of time, money, and psychological costs" (Baek et al. 2010, p. 4). The information cost saving facilitates and positively influences the second and third stages of the purchasing decision-making process and provides the decision-maker with more confidence about choosing to attend, work at or invest in a particular university.

2.2 Assessment of Universities' Sustainable Institutional Image

2.2.1 Assessing University Institutional Image

Although academicians have extensively researched how to assess corporate image, studies on universities' institutional image have only started being conducted recently. Terkla and Pagano (1993) published a five-year study of Tufts University's perceived image amongst various groups of individuals, from incoming freshmen to faculty administrators. The authors asked respondents to assess five university-image factors: spirit and temperament, curriculum, competitiveness, academic life, and demographics, through 27 semantic differential response options. The use of a five-point scale allowed respondents to rate their opinion from one extreme to another, e.g. rural-urban, without suggesting a good-bad correlation to either qualities. The authors described it as a "relatively flexible image-measuring tool that can provide information on how different constituencies view an institution" (Terkla and Pagano 1993, p. 2). A semantic differential scale is believed to minimize acquiescence, i.e., the propensity to respond positively to items, irrespective of item contents, a common issue in psychological surveys (Friborg et al. 2006).

Terkla and Pagano's (1993) findings determined, among other things, that Tufts University's perceptions by faculty and administrators varied from students' perceptions, therefore illustrating the usefulness of their approach for identifying the divergence between the University's desired and perceived image.

More recently, Bringula and Basa (2010) conducted research on three Philippine universities, correlating attributes of their institutional image to attracting prospective entrants. Freshmen students selected answers from a five-point Likert scale, qualifying aspects from "highly considered" to "not considered" in their choice of university. Those aspects related to eleven indicators of institutional image: tuition fee, tuition fee payment scheme, admission process, schedule of classes, course offerings, school facilities, faculty profile, scholarship and grants, kinship patronage, security in campus, and performance in licensure exam. The study showed, for example, that school facilities and faculty profile were considered in the decision processes by students in all three universities, suggesting that investments in developing and communicating these aspects can provide a competitive advantage for the university. The study also identified that the freshmen "moderately considered" the tuition fee of their universities, and suggested that most students were not responsible for paying for their education, implying that marketing strategies should address money matters directly to parents.

Zaghloul et al. (2010) also made use of a five-point Likert scale in an attempt to develop a reliable instrument for institutional image to aid in marketing efforts performed at the University of Sharjah, in the United Arab Emirates. Freshmen and senior students indicated their opinion ranging from "very bad" to "very good" about 18 aspects with influence on institutional image, such as: their and their parents' overall image for the University of Sharjah, quality of education, admission procedures, teaching, technical and sports facilities, cost of education, location and transportation. The results suggested the university's image is based on these aspects and "eventually, such image influences the impression of students towards the institution and is considered a cornerstone in student retention" (Zaghloul et al. 2010, p. 8).

2.2.2 Assessing University Sustainability Efforts

Different tools and mechanisms have been designed for assessing and reporting the sustainability of corporations, regions and countries, such as the process-oriented *Global Reporting Initiative* (GRI 2013) and *ISO 14000 Series* (ISO 2009), or the outcome-oriented *Ecological Footprint* (Rees 1992) and *Triple Bottom Line* (Elkington 1999). Although internationally recognized, because these tools were not originally designed for higher education institutions, they do not address the educational and research dimensions of university sustainability (Lozano 2006). Therefore, most sustainability assessment and report methods have to be modified to be appropriate for universities.

Nevertheless, some tools have been developed to meet higher education institutions' specific needs, such as the *National Wildlife Federation's State of the Campus Environment*, the *Sustainability Assessment Questionnaire*, the *Auditing Instrument for Sustainable Higher Education (AISHE)* and the *Higher Education 21's Sustainability Indicators* (Shriberg 2002). Shriberg (2002) compiles and compares eleven of these tools and concludes that ideal cross-institutional sustainability assessment should:

- *Identify important issues*: recognize issues of major importance to campus environmental, social and economic efforts and provide mechanisms to prioritize sustainability-related issues.
- *Be calculable and comparable*: quick, yet penetrating ways to measure status, progress, priorities and direction of the university's efforts, through both quantitative and qualitative data, allowing cross-campus comparisons.
- *Move beyond eco-efficiency*: promoting incremental and systemic change with the goal of no negative impacts.
- *Measure processes and motivations*: question mission, rewards, incentives and other process-oriented outcomes, asking "why" and "how" campuses pursue sustainability in addition to "what" they are currently doing.
- *Stress comprehensibility*: to include a broad range of stakeholders, comprehensibility should not be sacrificed for precision, as long as translation into understandable outcomes is possible.

Because most of the specific university-sustainability assessment and report tools mainly focus on environmental aspects, Lozano (2006) proposed modifying the GRI Sustainability Guidelines and developed the Graphical Assessment of Sustainability in Universities (GASU) tool. The author added an educational dimension to the original GRI economic, environmental and social dimensions. This educational dimension consists of three categories: curriculum, research and service indicators.

GASU functions with a worksheet for each dimension, where the institutions' administrators grade all indicators from 0, when there is total lack of information for the indicator, to 4, when the indicator suggests excellent performance. Responses generate charts with graphical representations of the university's performance on each sustainability dimension.

Lozano (2006) chose to develop an indicator-based assessment tool for universities, because of its higher levels of transparency, consistency and usefulness for decision-making, when compared to other approaches. Indicators can also "be easily measurable and comparable, making them more objective than accounts or narrative assessments" (Lozano 2006, p. 9).

Nejati and Nejati (2013), in turn, conducted a study to create an instrument to assess universities' perceived engagement with sustainable initiatives. An initial pool of 28 sustainable practices was adapted from Wright's et al. (2010) checklist for a sustainable university, prepared and extracted from the literature after a thorough review. An exploratory survey was conducted to identify the most relevant university sustainable practices in students' opinion, narrowing down the initial pool to a list of 12 items, concerning community outreach, sustainability commitment and monitoring, waste and energy, and land use and planning.

The authors' proposed instrument was a questionnaire with the final 12 sustainable initiatives with the response options "not sure", "no", "ongoing process" and "yes", to determine how stakeholders perceive the university's level of engagement in these activities.

Nejati and Nejati (2013) concluded that the proposed scale can help to assess a university's performance in making the transition to the notion of "sustainable university" from stakeholders' perspectives. Furthermore, the authors propose future research to investigate the impact of perceived sustainability on university image.

3 Graphical Assessment of Universities' Sustainability Image (GAUSI)

The following instrument provides a mechanism to assess an institution's sustainability image and to identify the sustainability practices that have the greatest appeal to three stakeholder groups: students, faculty and staff members. The Graphical Assessment of Universities' Sustainability Image (GAUSI) involves three steps: (1) assessing these stakeholders groups' perspective of which

sustainability initiatives are considered important; (2) identifying the relevance of such sustainability initiatives for these stakeholders' decision to attend or work at a particular university; and (3) measuring how they perceive their university's commitment to these sustainability initiatives.

3.1 The GAUSI Questionnaire

The Graphical Assessment of Universities' Sustainability Image (GAUSI) is a tool to help assess a university's perceived commitment to sustainability practices, therefore illustrating its image as a sustainable institution. It is also constructed to identify what kind of sustainability initiatives improve the institution's attractiveness for the respective stakeholder groups. This chapter suggests that the GAUSI be administered to students, faculty members and general staff, to identify what sustainability practices can increase the appeal of universities as a place to study or work. Administrators and marketing professionals can also choose to apply the instrument to other stakeholder groups, based on particular interests.

Terkla and Pagano (1993) proposed a list of semantic differential response options for assessing universities' characteristics. This list was applied to both managers to rate their expectations of what their institution should be and to students to rate what they think their university was. By measuring the divergence in answers, the authors were able to compare the desired versus perceived image of the institution.

Based on their particular study's methods, we propose a questionnaire of sustainability practices (Table 1), for stakeholders to evaluate their level of agreement with three different stem statement, allowing the comparison of divergence in responses. The stem statements are the following:

(1) *Sustainable universities should be strongly committed to:*
(2) *When deciding at what university to study/work, I find these universities' initiatives important:*
(3) *I feel my university is strongly committed to:*

Table 1 presents the list of sustainability practices to be rated by stakeholders, composed of 23 initiatives in which higher education institutions should engage, to pursue sustainability. The items were initially extracted from Nejati and Nejati's (2013) instrument to assess universities' perceived engagement with sustainability initiatives. The list was then adapted to avoid redundancy between some of the items and to comply with principles proposed by the Higher Education Sustainability Initiative Declaration (UNESCO 2012) of teaching and encouraging research on sustainable development, greening campuses, supporting sustainability efforts in local communities, and engaging with international frameworks. Thus, the sustainability initiatives were categorized as: Assessment and Reporting (A&R),

Table 1 List of universities' sustainability practices included in the graphical assessment of universities' sustainability image (GAUSI) instrument

No	Item	Category
1	Regular sustainability audits on campus	A&R
2	Sustainability audits of the surrounding community	A&R
3	Creating a written statement of the university's commitment to sustainability	A&R
4	Creating written statements of each department's commitment to sustainability	A&R
5	Incorporate social/environmental responsibility concepts into all relevant disciplines	E&R
6	Policies for hiring and promoting faculty based on their knowledge of and work in sustainability	E&R
7	Supporting students who seek environmentally and socially responsible careers	E&R
8	Requiring potential social/environmental impact analyses of research conducted on campus	E&R
9	Arranging opportunities to study campus and local sustainability issues	E&R
10	Incentivizing participation in socially/environmentally friendly activities	E&R
11	Aiming for self-sufficient campus operations	COp
12	Reduction of university's ecological footprint	COp
13	Optimized and sustainable campus land-use	COp
14	Intelligent and sustainable campus building planning	COp
15	Usage of renewable and safe energy sources, like solar panels	COp
16	Reutilization of campus waste	COp
17	Environmentally and socially responsible purchasing practices	COp
18	Consulting students/faculty/employees' opinions on campus sustainability issues	COp
19	Easy transportation to, from and between campuses	COp
20	Organizing social and environmental community outreach programs	COr
21	Encouraging participation in social/environmental volunteer activities around the community	COr
22	Creating/sponsoring green community centers to benefit the local environment	COr
23	Partnerships with government, non-governmental organizations, and industry working toward sustainability	COr

Education & Research (E&R), Campus Operations (COp), and Community Outreach (COr).

The questionnaires use five-point Likert response options, allowing respondents to share their level of agreement with the declarative statements (Table 2). Li (2013) explains the popularity of the Likert method:

> First, a Likert scale can be easily constructed and modified. Second, the numerical measurement results can be directly used for statistical inference. Last but not least, measurements based on Likert scaling have demonstrated a good reliability. In general, with

Table 2 Scale of agreement used by the graphical assessment of universities' sustainability image (GAUSI) instrument

No	Item	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Score system		*1 pt*	*2 pts*	*3 pts*	*4 pts*	*5 pts*
1	Regular sustainability audits on campus	( )	( )	( )	( )	( )

> Likert scaling, researchers can collect and analyze a large quantity of data with less time and effort [compared to other scales used for measuring subjective perceptions of individuals]. (Li 2013, p. 1)

Users of the instrument should complete their own factor and reliability analyses to establish internal consistency based on each specific institution's sample's responses, as variation in respondents' answers can lead to different factor and reliability analysis outcomes.

3.2 Suggested Methods

3.2.1 Sampling Design

As previously stated, this chapter suggests the use of the GAUSI tool to investigate students', staff and faculty members' perceptions of universities. However, administrators applying GAUSI can determine whichever stakeholder group they are interested in sampling, e.g. community members, potential partner companies, students' parents or high school senior students. The sample size should be selected to meet statistic requirements of representativeness based on the total number of the selected stakeholder group.

The selection of respondents should be random, regardless of age, gender, etc. unless there is an interest in segmenting stakeholder groups for specific purposes, like comparing the perception of first year and graduate students.

3.2.2 Procedure

Responses to each of the three stem statements should be analyzed separately and coded as (Table 3):

Table 3 Score system for graphical assessment of universities' sustainability image (GAUSI) instrument

Answer	Point(s)
Strongly disagree	1
Disagree	2
Neutral	3
Agree	4
Strongly agree	5

An arithmetic average of responses should be calculated as the final score for each item, such as in $(\bar{x} = \left(\sum_{i=1}^{n} x_i\right)/n)$, where n is the total number of responses and $\left(\sum_{i=1}^{n} x_i\right)$ is the sum of the points of all responses, per item. Consequently, each item will have three final mean scores, one for each of the stem statements (1), (2) and (3), henceforward referred to as $\bar{x}_1$, $\bar{x}_2$ and $\bar{x}_3$, respectively.

Results can provide the basis of an action plan to implement sustainability at the university, by prioritizing investments and efforts on initiatives identified as:

- Beneficial to consolidating an institution's sustainability image.
- Valuable to improving a university's appeal in stakeholders' decision-making process.
- Not a university strength

This principle of prioritization is translated into the following logical sentence: $P \Leftrightarrow a \wedge b \wedge c$, where

(P) An item is selected for priority investment.

(a) An item is perceived as essential to a sustainable university; when $\bar{x}_1 \geq 4$.
(b) An item is perceived as important in the choice of a university; when $\bar{x}_2 \geq 4$.
(c) An item is not perceived as a university's commitment; when $\bar{x}_3 \leq 3$.

We suggest that selection of an item for priority investment occurs if, and only if, sentences (a), (b) and (c) are true simultaneously but acknowledge that this is a judgment call and others may choose alternative decision rules.

3.2.3 Graphical Representation

The calculation of the items' mean scores $\bar{x}_1, \bar{x}_2$ and $\bar{x}_3$ results in a graphical illustration of respondents' perceptions across each of the items, for each stem statement (1), (2) and (3). Figure 2 presents the chart based on the "results" of a fictitious questionnaire, to demonstrate how results could be interpreted and used by marketing professionals. In this example, initiatives for priority investment would be items 3, 7, 9, 12, 19 and 22, as they comply with the requirements listed previously ($P \Leftrightarrow a \wedge b \wedge c$).

In other words, these initiatives were rated 4 to 5 on the Likert scale in response to the stem statements (1) and (2), meaning they would strengthen this particular university's sustainability image, and would make the institution more attractive to respondents to attend or work. Finally, these items also had mean scores of 3 or less for stem statement (3), which suggests that respondents perceive the institution's commitment to these initiatives as regular, poor or non-existent. Although this could be seen as a disadvantage for the university, it also presents opportunities and room for improving its institutional image through sustainability practices with positive impact on the institution's appeal to stakeholders. For example, according to Fig. 2, the institution could benefit from either creating a written statement of commitment to sustainability or better communicating an existing one to its stakeholders. Developing a positive institutional image and reputation depends not

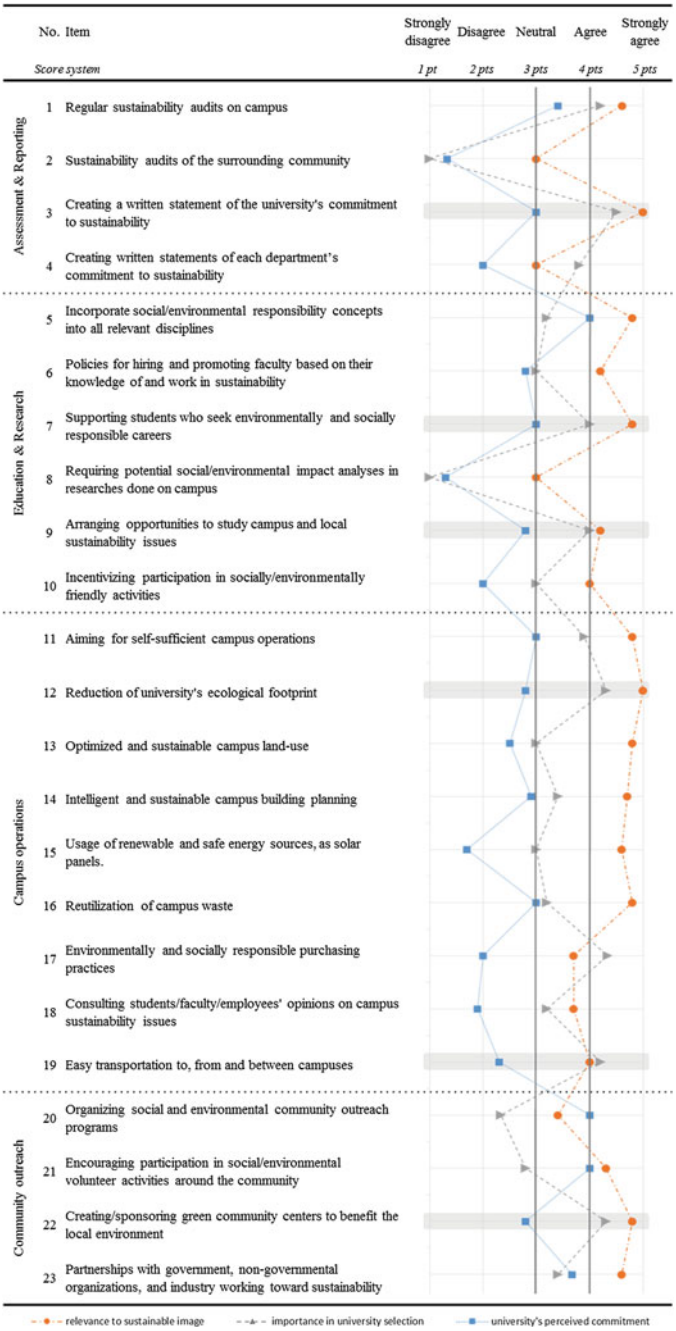

Fig. 2 Graphic display of results from a fictitious graphical assessment of universities' sustainability image (GAUSI) questionnaire

only on the university's engagement in sustainable practices, but also on making the public aware of its engagement.

3.3 Contribution of the GAUSI Instrument

GAUSI results can provide a customized guide for the respective institution to initiate or further engage itself towards sustainable development according to marketing principles. The instrument provides a means to involve students, staff and faculty members in decisions about which sustainability practices are most important for their university. By engaging constituents in campus greening, the institution maximizes sustainability initiatives implementation's repercussion and sustainability awareness on campuses, also maximizing the improvement of its institutional image and reputation.

The graphic resulting from the GAUSI instrument allows for many interpretations. For example, it can identify what university sustainability dimension needs further development, e.g. Education and Research or Campus operations. Additionally, responding to the premises of the analyses, administrators and marketing professionals can use results to identify perceived university strengths and possible competitive differentials to promote. For example, item 1 (regular sustainability audits on campus) received a score higher than 4 for relevance to sustainability image and importance in university selection. It also received a good score for perceived university commitment. Therefore, it might be valuable for the institution to design communications announcing which sustainability certifications and audits it has successfully received or passed.

Another value of this type of analysis is the identification of divergences in constituents' perceptions. For example, GAUSI can be used to identify differences between engineering and journalism students' perceptions of an institution. It can also compare the views of university sustainability by students from different countries. Finally, another potential use of the instrument can consist of analyzing the gap between administration and students' perception of universities' commitment to sustainability practices, by illustrating the divergence between desired and perceived image.

3.4 Limitations of the GAUSI Instrument

As a sustainability image assessment tool, GAUSI focuses on the benefits of implementing sustainability practices to public perception of higher education institutions. The prioritization method proposed in this chapter identifies the sustainability practices with the greatest benefits to a university's institutional image and attractiveness to stakeholders; however, it does not take into account the positive social and/or environmental impact each initiative would generate. The prioritization method also does not consider the financial costs of implementing and

maintaining the initiatives listed in the questionnaire. Potential social-environmental impact and associated financial investment can be crucial for the administration to decide which sustainability practices are worth investing in and viable to commit to.

Finally, GAUSI has not yet been tested as a survey instrument. Such testing may reveal additional limitations, which have not been anticipated by the authors of this chapter. For one, the instrument might need adaptations in response to factor and reliability analysis.

4 Discussion

As sustainable consumption is becoming an issue of greater interest worldwide, customers are reveling preferences for green institutions and are willing to spend more time, money or effort to acquire environmentally-friendly products and services (Han et al. 2011). Thus, associating universities' brands with sustainability might be a good way to help lead society on a more social-environmentally responsible path, while adding value to the universities' institutional image, reputation and market differentiation strategy.

The demand for sustainable development and social-environmental responsibility knowledge is also responsible for increasing the number of higher education courses related to the theme. As an opportunity to differentiate themselves from other institutions, instead of simply teaching sustainability concepts and applications, universities should entirely commit themselves to becoming leaders in sustainable development. Besides, true commitment to sustainability issues, in place of an opportunistic market positioning, aggregates credibility and prestige to the courses offered by institutions.

At the same time that society is becoming more sustainably conscious, it has also become more skeptical towards green advertising, due to repeated accusations of misleading claims (Khandelwal and Bajpai 2011), known as green washing (Dahl 2010). Most countries still lack a strong regulatory scheme for social and environmental advertising claims, but consumers and independent groups are active in identifying, suspecting and accusing organizations of dubious green claims (Dahl 2010). Dahl (2010) points out that the attacks on an organization's green advertising can also come from competitors seeking to identify green washing opportunism.

Facing the possibility of being discredited, universities' success in green marketing depends on truly embracing a sustainability mindset, not only advertising the institution as sustainable. A radical transparency policy and, ideally, a third-party verification from recognized organizations, such as ISO 14001 or GRI Guidelines, are essential to thrive on green advertising and avoid green washing charges (Dahl 2010). Considering all of the above, we suggest that future researchers explore the propensity of stakeholders to believe universities' green claims.

Additionally, to obtain a more thorough analysis of stakeholders' insights of sustainability in universities, future researchers can further explore the importance of an institution's sustainability image in the recruitment and hiring processes, including through a qualitative approach.

5 Conclusion

As society faces the collapse of the current production and consumption structure through environmental devastation and social inequality, sustainability is becoming more and more relevant. All organizations are pushed to rethink their management and operational systems to generate positive environmental and social impacts. Universities, based on their intrinsic purpose of education and research, should be leaders in this sustainable development movement.

This chapter presented an instrument that has been developed based on a marketing approach, aiming to facilitate the embracing of sustainability by universities' administrators and managers, by showing the gains from associating the university's institutional image to sustainability and analyzing possible benefits to improving the institution's attractiveness to students, faculty and staff members.

The proposed GAUSI tool demonstrates how the combination of marketing knowledge with sustainability adoption can improve universities' perceived image through a constructive approach that associates sustainable development and social-environmental responsibility with institutional image and reputation. These associations can support the recruitment of better students, faculty members and employees, resulting in greater intellectual production, which, in turn, can benefit back the institution's image by improving perceived credibility and prestige.

Without research on constituents' perception, it is unlikely that their expectations are met regarding higher education and sustainability. Very often, what administrators desire to achieve differs from what constituents perceive as an ideal institution. This can lead to a failure of sustainability marketing initiatives, because they were steered in the wrong direction. As an alternative, this chapter provides a research-based instrument for assessing stakeholders' perceptions of sustainability in universities, which can facilitate the engagement of internal constituents in sustainable initiatives, bringing yet more visibility for the universities' greening efforts and potentially maximizing branding and financial returns.

Finally, this chapter illustrated how the applied social science of marketing can contribute to sustainable development by encouraging universities to commit to sustainability in order to establish a strong competitive differential and aggregate positive associations to its institutional image. The review of marketing and sustainability literature demonstrated that, by embracing sustainable development, universities can comply with society's demands for social and environmentally responsible practices, while strengthening their institutions and their relationships with stakeholders.

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Assessing Resources and Dynamic Capabilities to Implement the "Green Campus" Project

Nicola Bellantuono, Pierpaolo Pontrandolfo, Barbara Scozzi and Rosa Maria Dangelico

Abstract

"Green Campus" is a project developed by Politecnico di Bari, an Italian technical university, interested to start a "journey" towards sustainability. This paper illustrates the Green Campus project through the lens of two organizational theories, i.e. the resource-based view (RBV) and the dynamic capabilities theory (DCT). RBV is adopted to present the specific resources owned by Politecnico di Bari and analyze their usefulness for developing the project. DCT is used to describe the capabilities which Politecnico di Bari should leverage on to integrate, build, and reconfigure resources in order to meet the challenges of sustainability and actually implement the project. To the authors' knowledge, neither RBV nor DCT have been still used to study organizations different from firms. The novel field of application of these theories is an interesting insight of the paper. Moreover, this study contributes to give a theoretical foundation to the topic of sustainable university, so covering a lack of the extant literature. Finally, it suggests specific directions in terms of resources and capabilities that

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universities need to commit to a sustainable future through the creation of a green campus.

Keywords
Green campus · Sustainable university · Resource-based view · Dynamic capabilities theory · Higher education

1 Sustainable Development and the Role of Universities

The dominant economic model of the last century was based on few key assumptions: our planet is characterized by unlimited capacity to provide resources and absorb pollution; economic expansion is associated with human development; social and environmental costs are dealt with as externalities. There is now clear agreement on the need to replace such an old economic model with the sustainable development model (WCED 1987; UNEP 2011).

The transition to sustainable development—which is indeed happening—implies that economic actors have to conform to what has been named as green economy (e.g. Pearce et al. 1989), i.e. an economy that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities (UNEP 2011). Practical interventions to pursue a green economy include: adjusting market mechanisms (so as to make organizations pay their pollution and consumption of natural resources), promoting sustainable consumption, adopting green procurement policies, and fostering research on sustainable technologies.

The required interventions imply a systemic innovation to address several issues: identifying real needs of consumers and satisfying them through sustainable products, defining proper business models, implementing sustainable production processes. This systemic innovation opens several challenges for universities in the fields of education, research, and technological transfer and it asks for a stronger collaboration between industry, society and university (e.g. Lozano 2006; Müller-Christ et al. 2014; Orr 2002; Peer and Stoeglehner 2013; Sedlacek 2013; Zilahy et al. 2009).

With specific respect to sustainability issues, the concept of sustainable university has lately been launched. Velasquez et al. (2006) define a sustainable university as:

> a higher educational institution, as a whole or as a part, that addresses, involves and promotes, on a regional or a global level, the minimization of negative environmental, economic, societal, and health effects generated in the use of their resources in order to fulfill its functions of teaching, research, outreach and partnership, and stewardship in ways to help society make the transition to sustainable life-styles.

UNEP (2013) identifies the principles that a sustainable university would exemplify. Some of them are quite general, such as: clear articulation and integration of social, ethical and environmental responsibility in the institution's vision,

mission and governance; integration of social, economic and environmental sustainability across the curriculum; commitment to critical systems thinking and interdisciplinarity; sustainability literacy expressed as a universal graduate attribute; celebration of cultural diversity and application of cultural inclusivity; frameworks to support cooperation among universities both nationally and globally. Others explicitly refer to a green campus, i.e. the physical place wherein a given university exploits the theoretical results of research to actually implement the concept of sustainable university:

- Campus planning, design and development structured and managed to achieve and surpass zero net carbon/water/waste, to become a regenerative organization within the context of the local bioregion;
- Physical operations and maintenance focused on supporting and enabling "beyond zero" environmental goals, including effective monitoring, reporting and continual improvement;
- The campus as "living laboratory"—student involvement in environmental learning to transform the learning environment.

In the last decades an increasing number of scholars have explored the topics of sustainable university and green campus (e.g. Amaral et al. 2015; Lozano et al. 2013), mostly referring to single initiatives of universities located all around the world. However, many studies are anecdotal and do not recur to any theoretical foundation (Admossent et al. 2007; Karatzoglou 2013). Therefore it is quite hard to generalize results as well as derive insights applicable beyond the boundaries of the specific case.

Politecnico di Bari is an Italian public technical university interested to start a "journey" towards sustainability by the "Green Campus project". In this chapter the Green Campus project is discussed through the lens of two organizational theories, the resource-based view (RBV) and the dynamic capabilities theory (DCT). RBV is adopted to present the specific resources owned by Politecnico di Bari and analyze their usefulness for implementing the project. DCT is used to describe the capabilities which Politecnico di Bari should leverage on to integrate, build, and reconfigure resources in order to meet the challenges of sustainability and implement the project.

Both RBV and DCT are relevant theories developed within organization theory, defined by Davis and Marquis (2005) as a potential "queen of social sciences". Being at crossroads between sociology, economics, psychology, and political science, according to the two scholars "organization theorists are best placed to address some of the critical questions of our time because organizational processes are often the drive train by which social and economic change are effected". The chapter illustrates how organization theory, in particular RBV and DCT, can be adopted to explain and support the creation of a green campus, which is one of the main campus sustainability challenges. In particular, the study (i) contributes to give a theoretical foundation of the topic of sustainable university, so covering a lack of the extant literature and (ii) suggests specific directions in terms of resources and capabilities that universities need to commit to a sustainable future through the

creation of a green campus. Moreover, to the authors' knowledge, neither RBV nor DCT have been so far used to study organizations other than firms. The novelty of the field of application of these theories allows the chapter to give some interesting insights.

2 Theoretical Background: The Resource-Based View and the Dynamic Capabilities Theory

Both the Resource-Based View (RBV) and the Dynamic Capabilities Theory (DCT) have been conceived to study firms' resources and capabilities. Resources and capabilities have been recognized as the foundation for strategy formulation and the main source of sustainable competitive advantage (e.g. Wernerfelt 1984; Amit and Schoemaker 1993).

Resources can be distinguished into property-based and knowledge-based (Miller and Shamsie 1996). The former refer to tangible resources, whereas the latter represent the ways in which firms combine and transform these tangible resources (Galunic and Rodan 1998). Firms with valuable, rare, inimitable, and non-substitutable resources are able to achieve competitive advantage (Barney 1991).

Capabilities refer to the capacity to deploy resources using organizational processes with the aim to achieve a desired end (Amit and Schoemaker 1993). Capabilities can be distinguished into ordinary capabilities (OCs) and dynamic capabilities (DCs). OCs can be defined as the "set of abilities and resources that go into solving a problem or achieving an outcome" (Zahra et al. 2006) and that "permit a firm to 'make a living' in the short term" (Winter 2003), whereas DCs are "the firm's processes that use resources—specifically the processes to integrate, reconfigure, gain and release resources—to match and even create market change" (Eisenhardt and Martin 2000; Teece et al. 1997) and that "operate to extend, modify or create ordinary capabilities" (Winter 2003), governing their rate of change (Collis 1994).

By focusing on how resources can be created and how a firm's current stock of resources and capabilities can be renewed in changing environments, DCT can thus be conceived as an extension of RBV. In fact, dynamic capabilities relate to the modification, creation and extension of a firm's resource base. In the past few years, DCT has received a growing attention by management scholars.

RBV has been widely used as theoretical lens through which studying sustainability management issues (Lozano et al. 2014a). Hart (1995) expanded RBV of the firm to include the constraints and opportunities given by the natural environment and proposed a natural resource-based view of the firm. On the other hand, the use of DCT to study the strategic management of environmentally related issues is much less developed, even though very promising (e.g. Aragon-Correa and Sharma 2003; Dangelico 2010). Despite both RBV and DCT have been conceived to study firms' resources and capabilities, since they appear to be useful theoretical lenses to

study sustainability challenges faced by organizations, in this chapter, they will be applied to another type of organization: a university campus.

3 Sustainable Universities and Green Campus Initiatives: Overview of the Literature

To move society towards sustainable development, it is crucial to promote sustainability wherein perspective managers and policy makers are educated, and acquire knowledge and know-how for their future activities (Viebahn 2002; Alshuwaikhat and Abubakar 2008; UNEP 2013; Godemann 2014; Peer and Stoeglehner 2013; Sedlacek 2013). Therefore, especially in the last decade, universities, research centers, and other institutions involved in higher education have shown an increasing commitment towards sustainability. Such a commitment disclosed in the form of new or modified curricula (e.g. Lozano and Lozano 2014; Holm et al. 2015), in new research and technological transfer activities (e.g. Waas et al. 2010; Peer and Stoeglehner 2013) and/or in the creation of green campuses (e.g. Tan et al. 2014). Interesting reviews of the literature on sustainable universities are reported in (Amaral et al. 2015; Karatzoglou 2013; Lozano et al. 2014b).

Several studies address the initiatives that universities perform to implement sustainability in their daily routines (e.g. Sharp 2002; Uhl 2004; Brennan et al. 2004; Koester et al. 2006; Parker 2007; Krasny and Delia 2014; Müller-Christ et al. 2014; Simpson 2010; Yuan et al. 2013; Wals 2014). Velasquez et al. (2006) propose a university sustainability model built based on the simultaneous adoption of surveys, literature review, and benchmarking of the best practices adopted by several universities around the world. The model is tailored according to a top-down approach: it moves from defining the university's own vision on sustainability and developing a consistent mission so as to lay a foundation for future actions and philosophies that underlie them. The third phase deals with the appointment of the sustainability committee, namely an organizational structure composed by the representatives of the university's stakeholders. The sustainability committee is responsible for disseminating information on sustainability as well as for promoting and coordinating the actions to be performed. Once all these phases are carried out, a specific sustainability strategy can be defined. The authors propose to classify sustainability initiatives in higher education into four areas, namely education, research, sustainability on campus, and outreach and partnership.

The same classification is adopted by Jabbour et al. (2013), who conduct two case studies in Brazilian business schools and derive several insights from them. In particular they stress the driving role of personal motivation of few researchers who succeed in incorporating environmental management issues in their research and teaching activities. These studies also reveal that as implementing environmental management practices is matter of willingness and requires additional effort in people involved in the organization at all the levels, resistance to change somehow

occurs, so that the transition towards a green business school is marked by advances and stagnation and is significantly affected by path dependence.

Müller-Christ et al. (2014) move from the results emerged within the 4th UNESCO Chair Conference on Higher Education for Sustainable Development (HESD) to investigate the role that campuses, curricula, and communities may play to put into effect the role of universities to promote sustainable development. First of all, it is highlighted that higher education institutions are part of a larger society, thus linkages with similar institutions around the world and neighboring community of people, companies, and institutions should be strengthened. Several success stories of universities that have complemented their existing curricula with sustainability courses or even proposed new curricula entirely focused on sustainability suggest that these initiatives should be considered as windows of opportunity. Sustainable initiatives, indeed, enhance the reputation of the school, so attracting more talented students, better faculties, and many sponsors. Nonetheless, to promote these initiatives, universities should pay attention to pressures coming from external stakeholders as well as leverage on internal drivers (e.g. by establishing incentives for professional development of teaching staff). It is also stressed the need to achieve high commitment by the most influential decision makers within the organization, who should be open minded about refocusing of courses on sustainability issues. Finally, greening the campus facilities is viewed as a mean to improve the quality and effectiveness of sustainable development initiatives in higher education. To achieve this result, some key points have been identified, starting from promoting the concept of well-being among the whole campus' community and engaging all its components in participating to the change. Moreover, given that the duties of academia include the promotion of societal development, the campus itself should be regarded as a test field to implement innovative ways to be green, which will be potentially adopted also outside the campus boundaries.

Alshuwaikhat and Abubakar (2008) propose an integrated approach for universities willing to achieve sustainability. Within such a framework three streams are identified, related to: (i) sustainability teaching and research; (ii) implementation of an environmental management system that encompasses both infrastructures (what is called green campus) and day-by-day operations, such as energy efficiency, waste management, and pollution prevention; (iii) public participation and social responsibility, in terms of establishment of partnerships with stakeholders to promote various initiatives that range from spreading knowledge on sustainability to overcoming people's disparities and discriminations. De Castro and Jabbour (2013) use such framework to assess the sustainability of an Indian university. Shi and Lai (2013) propose a different approach to evaluate and rank higher education institutions in accordance to their sustainability, which is based on the university sustainability model developed by Velasquez et al. (2006).

4 A Case Study: Politecnico Di Bari Green Campus Project

Politecnico di Bari is among the universities that intend to actively contribute to the transition towards a sustainable future. It is a public university, the unique technical university of Southern Italy and operates three sites in the Apulia Region, namely Bari (wherein the main campus is located), Taranto, and Foggia. In the academic year 2014–2015, it encompassed about 600 full-tenured professors and research fellows, 300 people in the technical-administrative staff and more than 11,000 students. The primary aim of Politecnico di Bari is fostering excellence and innovation in scientific research, advanced education and technological transfer in the fields of engineering and architecture. In the field of research, Politecnico di Bari is a small but very active university. It is indeed involved in several research projects at local, national and international level. In 2011, 2012, and 2013 Politecnico di Bari has been rated in the SIR World Report (http://www.scimagoir.com) as the best public Italian university with respect to Normalized Impact.[1]

Politecnico di Bari recently decided to increase its commitment towards sustainable development by transforming its 20 years old campus located in Taranto into a green campus. The choice of Taranto was not by chance. Founded by Spartan settlers in 706 B.C., the city has a long history and was among the most important colonies of the Magna Graecia. Today, Taranto is a city of about 200,000 inhabitants, a primary Italian port and one of the principal military bases of the Italian navy. It is also one of the main industrial cities in Italy: its vast industrial area includes a dockyard, an oil refinery, and one of the largest steel plants in Europe (ILVA), counting almost 24,000 direct and indirect workers. Started at the end of the sixties, such a heavy and big industry plant made the economy of Taranto greatly dependent on it, while severely undermining traditional economic sectors (i.e. fishing, agriculture, and farming), and jeopardizing the touristic development of the area despite the existence of one of the most important Italian archeological museums (MARTA), the Old Town which, located on an island, is an extremely fascinating site (although also seriously affected by urban blight), and the countryside and the seaside which offer a breath-taking panorama.

Taranto is commonly considered one of the most polluted cities in Europe: in 2012, the ILVA owner and some top managers were brought to trial (according to the prosecution documents, decades of emissions of dioxins, benzo[a]pyrene and other cancer-causing chemicals caused an environmental disaster, damaged the health of people that live in the surroundings of the plant, and impelled farming in an area of 20 km around it). Thus, nowadays Taranto faces several challenges: land reclamation drainage (the area interested by these actions is about 115 km^2) and industrial reconversion (into which in 2012 the Government decided to channel 366 million euros, which are expected to be increased in the near future). Besides the critical economical and occupational crisis which affects Italy and Europe in general, the area of Taranto is thus affected also by a severe environmental, social,

[1] http://www.scimagoir.com/methodology.php.

and health crisis, which is extremely complex to manage because, as discussed, the economic model adopted in the area is strongly dependent from the large industry (and the steel plant in particular).

The activity of Politecnico di Bari in Taranto started in 1992 when a M.S. in Engineering for the Environment and the Territory and some important research projects were started. Over the years new engineering courses were offered and the peculiarity of Taranto as the environmental research center of Politecnico di Bari was lost. More recently, Politecnico di Bari decided to re-shape its campus in Taranto in accordance with the sustainable university paradigm. According to this perspective, the campus (and indeed the entire city of Taranto) would become a full-scale laboratory, wherein to study problems related to the environment (with a focus on environmental monitoring and land reclamation) and sustainable production (with a focus on eco-design) as well as to develop and test attendant technologies. Such a project, named as "Green Campus", was developed by two professors of the Politecnico di Bari. Working on topics related to sustainable development (in particular corporate social responsibility) in the campus located in Taranto and, one of the two, being born and living in the same city, for the two professors was quite unavoidable to reflect on how Politecnico di Bari could contribute to change the situation in the area of Taranto. They started studying the concept of sustainable universities and analyzed past (successful and unsuccessful) cases of industrial restructuring processes (e.g. Pittsburgh in USA and Sheffield in UK). In many cases huge investments in research and education were essential for the success of restructuring initiatives. In 2012 a first draft of the Green Campus project was presented to the Rector of Politecnico, who enthusiastically promoted its presentation to the whole academic community. A few months later, the Strategic Committee of Politecnico di Bari examined the project and asked for a more details, including the list of the main specific actions with the attendant costs. Unfortunately, at that time the Italian Ministry of Education, University and Research did not have budget lines suitable to fund such projects as the Green Campus. Therefore, on the one hand the project was included in the Strategic Plan of Politecnico di Bari, on the other hand it has yet to receive funds.

In the green campus in Taranto, Politecnico di Bari is planning to: (i) develop laboratories to implement organizational and technological solutions that are consistent with the green economy model; (ii) do research and deliver higher education programs to train new managers and engineers able to address the challenges of sustainable development. The final aim is to create sustainable companies coherent with the productive vocation of the area and specifically to support, by technological transfer projects, the creation of startups and spinoffs on environmental monitoring and recovery and sustainable production. Due to these characteristics, the Green Campus could attract direct investments of companies interested to develop and test best available techniques for land reclamation. Thanks to the Green Campus project, Politecnico di Bari can enhance its research and teaching in Taranto, and strengthen its competitiveness at the international level, with special attention to the Countries around the Mediterranean Sea.

The project includes both infrastructural and soft actions for a total of about 6 millions euros. Infrastructural actions deal with the buildings and the campus area (i.e. gardens, walkways, and car parks) for a total of about 10,000 m^2. They involve: improvements in buildings thermal performance (e.g. energy smart installation, roofing and window fixtures that allow thermal insulation), energy production (e.g. development of a solar thermal plant, building of a photovoltaic car park shelter, indoor corridors paving with power generating tiles), improvements in water efficiency (e.g. water re-use and creation of rainwater tanks for gardening and bathrooms), reductions of outdoor thermal islands and enlargement of permeable paving, creation of a vegetable garden to be directly managed by students, building of 28 lodgings with an A-class energy saving rating, creation of local typical drywalls all along the campus perimeter, special planting to reduce air, soil, electric and acoustic pollution.

Soft activities deals with the organization of events (summer schools and masters on sustainability related topics) and research meetings (conferences and bilateral meetings with universities interested to the topics and mainly located in the Mediterranean Sea) to support the design of ad hoc courses and to attract international scholars so as to create an international research center. The aim is to create a campus which should be unique in the Mediterranean Sea. Soft activities involve organizational actions at the university level, e.g. the appointment of a "Poliba goes green" team, consisting of professors, students, and technical and administrative staff, who should monitor the execution of the Green Campus project and define the actions needed to transform the whole Politecnico di Bari into a sustainable university.

Differently from the typical green campus projects, the Politecnico di Bari Green Campus project involves not only infrastructural, but also organizational, social, and operations-related actions, thus it is the way Politecnico di Bari chose to start its sustainability "journey".

The main expected outcomes of the project are:

- Strengthening the international dimension of research on urgent related to sustainable development;
- Fostering the development of research, innovation, technological transfer and education as well as the creation of startups and spinoffs working in fields consistent with the needs of the local area (according to the European Smart Specialization Strategy);
- Contributing to start an industrial restructuring process so as to transform Taranto into a town-lab wherein to study and test the way to achieve sustainable development by overcoming the juxtaposition environment-industry;
- Using the campus of Taranto as a pilot project to transform the whole Politecnico di Bari into a sustainable university.

Politecnico di Bari is working to involve in the project public institutions (e.g. Municipality of Taranto, Apulia Region, Ministry of Education, University and Research), private organizations (e.g. responsible and local active banks) and network of organizations (e.g. the Regional District for the Environment and Reuse;

local Universities; Local Action Groups). Also, Politecnico di Bari entered the UN Sustainable Development Solutions Network (SDSN), a network mainly composed by universities and research centers founded by the UN General Secretary Ban Ki Moon in 2012. The aim of the network, directed by professor Geoffrey Sachs (The Earth Institute—Columbia University), is to find tangible solutions to major sustainable development challenges. In particular, Politecnico di Bari is member of the Med Solutions, the SDSN Mediterranean regional hub.

The Green Campus project is currently in standby because of the lack of financial resources and the limited commitment so far showed by local firms and public institutions as well as part of its academic community.

5 The Green Campus Project Discussed Through the Lens of RBV AndDCT

In this section the resource based view (RBV) and the dynamic capabilities theory (DCT) are adopted to discuss the Green Campus project briefly reported in Sect. 4.

Politecnico di Bari owns specific resources and capabilities that have represented a useful starting point to develop the Green Campus project. In the following, such resources and capabilities are identified and discussed.

Resources include both *property-based* and *knowledge-based* ones. Among the former, it is possible to identify the campus area located in Taranto (with a large green area) and the inner buildings; facilities and equipment of laboratories and classrooms; internet connection and computer facilities; a library and the on-line access to thousands of scientific journal and books. Among the knowledge-based resources, it should be pinpointed: wide knowledge and know-how in several fields of engineering and architecture (owned by researchers and professors); high quality publications; research projects; national and international collaborations with academic institutions, research centers, and companies; awareness and knowledge of the complex problems affecting the area of Taranto; great motivations towards the solution of the problems in particular by some faculty researchers.

The analysis of capabilities sheds light on: capability to attract students; capability to provide high level training to students on sustainability related topics and on the way to address environmental problems; capability to conduct high quality research with the support of national and international academic community; capability to networking; capability to develop research projects; capability to design academic courses; capability to take part to as well as organize international conferences and meetings; capability to access research funds. These capabilities can be classified as ordinary capabilities. In order to develop a new set of resources and capabilities suitable for the implementation of the Green Campus project, Politecnico di Bari should put in place a set of dynamic capabilities. Based on Dangelico (2010), dynamic capabilities for environmental sustainability are classified into four categories, namely resource building, resource reconfiguration, resource integration (internal), resource integration (external). Each of these

capabilities can be useful for moving the Green Campus project away from the current standby position. In the following, there is a list of activities that can help to build each of them, in the case of the Green Campus project.

- *Resource Building*: training and further specialization of researchers and professors to strengthen and/or acquire further competencies on sustainability; recruitment of well-known international researchers and professors with specific sustainability competencies (to create a research center attractive for students, the academic community and companies); recruitment of young researchers able to work on sustainability related topics; access to EU research funding and promotion of a public-private partnership to fund infrastructure and soft actions.
- *Resource Reconfiguration*: creation of a new department, wherein researchers with sustainable development competencies are grouped; creation of more laboratories wherein research on specific sustainability issues are conducted and students trained; enhancement of the involvement and commitment of Politecnico di Bari's top management.
- *Resource Integration (internal)*: enhancement of cross-departmental collaborations; creation of interdisciplinary and transdisciplinary research on sustainability related topics (those affecting the area of Taranto).
- *Resource Integration (external)*: collaborations with other universities having tracks of excellence in sustainability research; more active participation (e.g. launch of M.S., master and PhD courses jointly managed with other Mediterranean universities) into international networks such as SDSN; participation and organization of international conferences on environmental issues; launch of events (e.g. conferences and workshop; meetings with politicians) to increase the awareness on how the Green Campus project can contribute to address Taranto's problems as well as enlarge the community consensus on the project itself; involvement of companies and organizations that can support the implementation of the project.

6 Conclusions

Moving from the traditional economic model towards another that is consistent with the principles of sustainable development cannot be effectively carried on without re-thinking the system of higher education. To this aim, in the last decades several initiatives have been promoted to implement sustainable universities and scholars have reported these attempts in numerous papers. Nonetheless, to the best authors' knowledge, in most cases this topic has been addressed without recurring to any theoretical foundation. This chapter is aimed at filling this gap, thus it has proposed the adoption of resource based view (RBV) and dynamic capabilities theory (DCT), two important perspectives in the broader organization theory, to discuss a specific project of sustainable university, called Politecnico di Bari "Green Campus".

By adopting the RBT, the property-based and knowledge-based resources as well as the capabilities owned by Politecnico di Bari and useful to develop the Green Campus project have been identified. Also the dynamic capabilities that Politecnico di Bari should put in place to implement the project have been identified and discussed based on the following categories: resource building, resource reconfiguration, (internal and external) resource integration.

The study presents both practical and theoretical implications. With regard to the former, it has provided universities willing to embrace the journey towards sustainability with specific directions in terms of resources and capabilities needed for creating a green campus. The types of resources and capabilities identified in the Politecnico di Bari "Green Campus" project can, indeed, be easily used to classify other universities' resources and capabilities. With respect to the theoretical implications, the chapter presents one of the first attempts to analyze the sustainable universities initiatives through robust organizational theories. Through the adoption of the two theories, indeed, this study helped identifying some resources and capabilities useful for sustainable universities. As such it also represents a starting point to identify means to improve them (e.g. incentives for professors and enhancement of commitment by top management) already mentioned in case studies and theoretical frameworks reported in the literature (e.g. Jabbour et al. 2013; Muller-Christ et al. 2014), but not classified as such. This study, thus, provides a strong theoretical base to some relevant issues presented in previous studies. Moreover, it enlarges the field of application of RBV and DCT which, to the authors' knowledge, have not yet been used to study organizations different from companies.

Some limitations should be acknowledged, as well. First, the considered theories have been applied to address a single case, whose distinctive features, of course, limit the generalizability of results. Therefore, future studies should be devoted to apply the two proposed theories to other universities involved into a sustainability-oriented change. Second, the case study, which refers to a project not yet implemented, has been conducted only using qualitative data. Future studies should address this gap by integrating qualitative data with quantitative ones, such as, for example, number of researchers with specific competencies on environmental sustainability, number of patents on sustainable technologies, number of publications on environmental sustainability. We hope that this study can represent the starting point for a deeper discussion on the application of RBV and DCT to universities' sustainability-oriented change.

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Think Big, Live Green: Community-Specific Sustainability Engagement Campaigns

Erin D. Moore

Abstract

Following the heels of a very successful campaign in the College of Agriculture and Life Sciences called CALS Green, Cornell University sought to develop a university-wide behavior change campaign that would support its climate neutrality goals. Thus, the Think Big, Live Green campaign was designed to be entirely customizable for each college and unit based on their own operations, resources, and community culture. The campaign has four programs that complement each other—the College Engagement Program, the Green Office and Green Lab Certification Programs, and the Cornell Building Dashboard. These programs work in tandem to provide avenues of faculty, staff, and student engagement in sustainable actions. Community research, behavior economics, social norms, competitions, community-based social marketing, and peer education are embedded throughout the campaign programs to target specific sustainable actions within each college and unit. Other key components include the College Green Teams and College Green Ambassadors that serve as role models, leaders and program facilitators within their community. These peer educators have a personal interest in sustainability and undergo training in behavior change strategies to design programs for their community. Think Big, Live Green has been successful in two colleges at Cornell, and in 2016 will become part of a larger university-wide framework that will support the sustainable campus transformation and a climate neutrality goal of 2050.

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1 Introduction

Sustainability engagement is a major component to both climate neutrality and campus operations at Cornell University. The concept of sustainability is not new, but through continued research and new programs, the campus community has new ways to make a difference. The Climate Action Plan (CAP), created in 2009, defines institutional behavior change that focuses on the daily habits of staff, faculty and students as a key source for climate neutrality. Starting with a competition called CALS Green, the bar was set at Cornell on how to encourage staff, faculty and students to make conscious decisions about energy use in campus buildings. This competition not only served as a tool for behavior change, but also as an opportunity to research theories and strategies for sustained environmental behavior change at Cornell.

In 2009, Cornell's College of Agriculture and Life Sciences (CALS) initiated a study into the beliefs, attitudes, and behaviors of its faculty, staff, and graduate students about energy conservation at work. In November 2010, CALS launched a campaign, "CALS Green: The College's Conservation and Sustainability Initiative," to promote energy conservation behaviors, focusing on five buildings that ended in November 2011. Based on an evaluation completed within a survey, there was a clear opportunity to incorporate social science theories and research within campus sustainability engagement. From this initiative—Think Big, Live Green (TBLG) was born.

As Cornell's current sustainability campaign, TBLG centers on identifying end —state behaviors and the associated benefits and barriers to create behavior programs and strategies within each college and unit. At the start of the campaign, community research and surveys are conducted to assess the motivators, attitudes, values, and current sustainable practices of a college or unit which can then be incorporated into the campaign. Based on the specific barriers and benefits of each practice, outreach materials, marketing and communication tools are designed and integrated throughout that college or unit that aimed to transform t unconscious, unsustainable practices into a repetitive sustainable practices (i.e. behavior change). The TBLG programs and marketing materials are then created based on specific college/unit actions, competitions, strategies and community culture to meet the needs of its audience. Basic concepts of community based social marketing (McKenzie-Mohr 2011) (CBSM) are used and taught to staff and faculty to encourage peer-to-peer education.

In this paper, Cornell University will document how conceptual and theoretical frameworks of CBSM, social science and behavior economics are used to create sustainability behavior change programs within the university. The purpose of this paper is to outline Cornell's strategies for engaging the campus community in sustainability through behavior change programs, and provide a guide for similar programs at other institutions. The programs at Cornell are designed to specific, individual community settings, which is essential for prolonged behavior change. Each program uses social science theories involving communications, marketing, and education to engage communities with the university. CALS Green laid the foundation for behavior change at Cornell, and Think Big, Live Green has evolved into a campus wide program that each college/unit can format for its community and operations. This paper will describe the campaign structure, and how TBLG will be even more effective through faculty engagement to help meet Cornell's climate neutrality goals.

2 Sustainability at Cornell

Sustainability is embedded in every aspect of Cornell University through education, research, and outreach. In 2007, President David Skorton signed the American President's Climate Commitment, sealing Cornell's promise to achieve climate neutrality by 2050. This action led to the creation of Cornell's Climate Action Plan (CAP) which is the roadmap for a truly climate neutral campus. Since its creation, the University has initiated broad actions to green the campus and reduce carbon emissions by over 30 %. Society is one of the cornerstones for achieving climate neutrality. Through behavior change education and outreach, Cornell University strives to teach all of its staff, students, and faculty how to be socially-responsible citizens, and how to drive the sustainable transformation of the campus and surrounding communities.

3 Sustainability Engagement at Cornell

In 2009, Cornell's College of Agriculture and Life Sciences (CALS) initiated a study into the beliefs, attitudes, and behaviors of its faculty, staff and graduate students about energy conservation at work (Dixon et al. 2012). The study followed the framework of the Theory of Planned Behavior (Ajzen 1991) to examine the influences of beliefs, perceived norms, and personal efficacy on people's intentions to reduce their energy consumption at work (Dixon et al. 2012). CALS Green was Cornell University's first college—level energy conservation and sustainability behavior change campaign. Six (6) academic buildings within CALS participated in a competition to conserve energy between November 2010 and November 2011. Key components of the CALS Green program included friendly competition, educational outreach, peer education, and continual feedback to emphasize the benefits

of adopting sustainable behavior patterns, and of participants' individual and collective progress (Frongillo et al. 2012). CALS Green employed an online platform called Cornell StepGreen™ to encourage building occupants to commit to energy saving actions once a week. The program also used social media (Facebook™ and Twitter™), email, and CBSM to encourage behavior change within the college. One key element of success included the use of college green teams—college staff, faculty and students with personal interests in sustainability—to engage the targeted audience in sustainability-themed activities. The green teams served as internal champions, building liaisons, and informal advisors to the CALS green core staff (Frongillo et al. 2012). In addition, the green teams also empowered their community to take responsibility for their individual actions, and make thoughtful decisions on how to manage resources on campus and within their homes.

Once CALS Green was completed, additional research was conducted to measure its success and to determine the next steps for creating a university wide engagement campaign. *The McComas Survey—Opinions about Energy Conservation at Cornell* concluded in July 2012 and provided data on additional college communities within Cornell (the College of Engineering and the Johnson School of Management) that would be optimal for participation in a sustainability engagement campaign. The survey questions focused on education, attitudes, and reasoning involved when trying to conserve energy at work. The survey concluded that respondents cared a great deal about energy conservation within the workplace, but were unclear on what actions they could take within their individual workspace. The survey also concluded that social norms within each college are greatly influenced on what their peers are doing in their own colleges/units across campus. From this information and research, Cornell was positioned to create a new program that would enable participation in sustainable behaviors from all the colleges and units.

4 Think Big, Live Green

Think Big, Live Green (TBLG)—it's how staff, students and faculty live and work at Cornell. As an offspring of CALS Green, the purpose of this campaign is to achieve resource conservation and community wellbeing impacts through customized and multi-modal behavior change strategies that utilize peer education, leadership development, CBSM, web-based and social media. Sponsored by the Energy & Sustainability Department (E&S Department) within Cornell Infrastructure, Properties, and Planning (IPP), the TBLG campaign is comprised of four (4) programs that employ CBSM, self-audits, and communication strategies to engage the Cornell community:

- College Engagement Program
- Green Office Certification Program
- Green Lab Certification Program
- Cornell Building Dashboard

Each college that participates in TBLG has a customized formula for behavior change that includes multiple facets of social science strategies.

4.1 Community Research

Before a college or unit commences a campaign, research on the community's attitudes, behaviors and operations is needed to identify any barriers and benefits to sustainable behaviors as it relates to that community-a key parameter of CBSM. A computerized survey is used to collect college/unit data due to the size of a college's or unit's population. The E&S Department develops the survey in collaboration with the Cornell Survey Institute (SRI) and Cornell Work/Life Services in Human Resources. Questions were grouped within 4 different categories that are directly related to achieving Cornell's climate neutrality goals:

- Community culture and engagement
- Energy conservation
- Lab management
- Transportation management
- Waste management

Within these categories, the communities are asked questions about college/unit wide initiatives, culture, key actions and opinions. This information is used to identify current perceptions, motivations, and the probability of performing sustainable behaviors to design multi-modal behavior change strategies. Based on the research conducted within two colleges, common themes to engaging in sustainable actions were:

- Most respondents receive information about campus events and initiatives via email, social media and conversations with peers.
- Any type of peer education program should require no more than a 1 h per week commitment, based on the current workload of individual jobs.
- Most respondents are willing to engage in sustainable actions and purchasing—particularly if the actions and items are cost-effective.
- Social norms and creating a sense of community contribute to successful behavior change strategies.

Common barriers to engaging in sustainable behaviors were:

- Most respondents believe they have little or no control over their individual work environment.
- Most respondents do not know about the available resources that support sustainable practices.
- Most respondents do not think that sustainability is included in their job duties and responsibilities.
- Most respondents believe changing learned behaviors are hard and would inconvenience their current routines.

From these findings, the campaigns have been structured using the following guidelines:

- Identify actions that are convenient and easy to do within a specific community. This strategy lays a solid foundation for encouraging harder behaviors that require more flexibility from the targeted community.
- Make sure sustainability-related information and resources are easily assessable to staff, faculty and students to support sustainability behaviors.
- The college Green Team and Green Ambassadors should plan and execute the campaign programs within their respective community.

Knowledge alone is not a guarantee for pro-environmental behavior, especially abstract knowledge about environmental problems, which lacks an action orientation and is almost invariably based on survey results or public opinion polls (Kruse 2011). Therefore, internal leadership within a college or unit is needed to advance sustainable practices.

4.2 College-Level Leadership

In order for TBLG to be successful, college-level planning, leadership and support is essential. Upon completion of CALS Green, other colleges and units began to review their operations and culture to identify areas of improvement. Within the TBLG structure, the establishment of a college-level Green Team and Green Ambassadors is needed to empower communities and set the tone for college/unit sustainability initiatives. Figure 1 shows a standard structure for establishing a college/unit Green Team.

College Green Team: Each college needs to support their community's participation in TBLG by establishing a Green Team that consists of college-level administration and representatives. The Green Team's responsibilities are to plan, establish, and promote the TBLG campaign for the college, and empower the Green Ambassadors to engage the college/unit community around the campaign initiatives. Based on a study conducted by Bin (2012), the support of upper management helps mobilize human and financial resources to support the program, expedites coordination of working relationships and schedules between involved parties, and can facilitate the removal of any institutional or organizational barriers, all which are crucial to the success of an energy behavior program in the workplace (Bin 2012). Ideally, the team is represented by the Dean or an Assistant Dean, the Facilities Director or Manager, 3–4 faculty/staff representatives, and 2–3 student representatives from the college/unit. The E&S Department works directly with this team and provides team building, CSBM training and implementation strategies that have shown to be effective in sustaining behavior change. This team also coordinates with the E&S Department to conduct community research, establish a timeline and campaign goals, and identify Green Ambassadors within the college/unit.

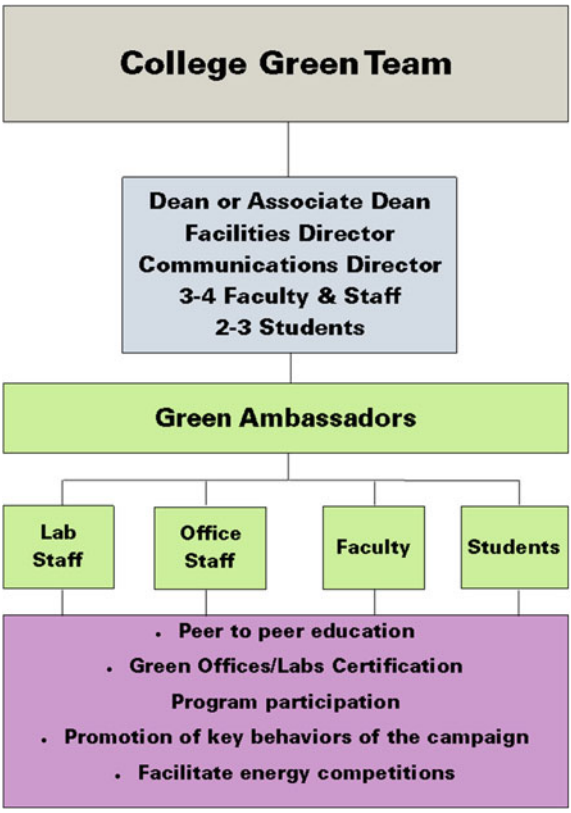

Fig. 1 College Green Team and Green Ambassadors diagram

College Green Ambassadors: Based on the proven results of the CALS Green initiative, Green Ambassadors are needed in every college/unit to foster peer education around sustainability initiatives. The group consists of staff, faculty and students who have a personal interest in sustainability, and are supported by the College Green Team to create programs, events and incentives to change behavior in the college/unit. Green Ambassadors are responsible for choosing the sustainability themes that the college/unit will support for the TBLG campaign. Social interaction and communication play an important role as they may facilitate or impede certain activities, and oberservation of others' behavior (social models) usually has a strong influence on one's own behavior (Kruse 2011). These themes are chosen based on data from the community research survey, the goals of the college, and the interests of the Green Ambassadors. Once the themes are chosen, the Green Ambassadors participate in team building activities, brainstorming sessions, and working meetings to develop strategies for college/unit engagement. The College Green Team supports the Green Ambassadors through advising on communications, outreach materials design, building facilities, education, program logistics and CBSM concepts.

4.3 College Level Engagement

College Engagement Program: The College Engagement Program (CEP) is the main component of the campaign that utilizes social science strategies. Based on the themes created by the Green Ambassadors, the college/unit community is introduced to different programs and activities that encourage sustainable behaviors. Each theme lasts for approximately two (2) months and focuses on actions that are measurable and probable. Within in each theme, the Green Ambassadors are advised to pick 1–3 sustainable behaviors identified from the community research and create different strategies to encourage those behaviors. Based on the identified barriers for each action, the Green Ambassadors will structure the theme based on proven social science theories and principles that will work best to overcome the barriers. The Green Ambassadors are encouraged to include behavior economics, social norms, incentives, personal commitments, and competitions. Once the CEP is completed at the end of the academic calendar, community research is again conducted in the form of a post survey to measure the effects of the initiatives and activities.

Green Labs and Offices Certification Programs: The Green Labs and Offices Certification Programs are the two (2) main forms of personalized engagement for labs and offices on campus. The programs utilize behavior economics and goal setting strategies as methods of engagement for sustainable actions within a specific workgroup. Each program utilizes a categorized checklist with specific behaviors that offices and labs can use to incorporate sustainability into the lab and/or office operations. The categories for the programs are:

- Chemical Management (*in lab spaces only*)
- Energy Conservation
- Events Planning
- Innovative Practices
- Transportation and Travel
- Waste Management
- Wellbeing, Outreach and Engagement

Establishing a specific workgroup for each program is essential to participation because the checklist is structured so that all members of the workgroup are required to participate in the same actions. Once the checklists are completed and submitted to the E&S Department, each lab and office will receive a certification valid for two (2) years. Each office and lab is also receives university wide recognition for the achieving its certification. The participation rates for both programs are tracked by each college/unit to create social norms aimed to increase university wide participation. Since the launch of both programs in September 2014, over 35 offices and 7 labs have received a certification. The Green Labs Certification Program will undergo an extensive makeover in 2015 to increase participation. Many barriers have been identified since the launch of the program including:

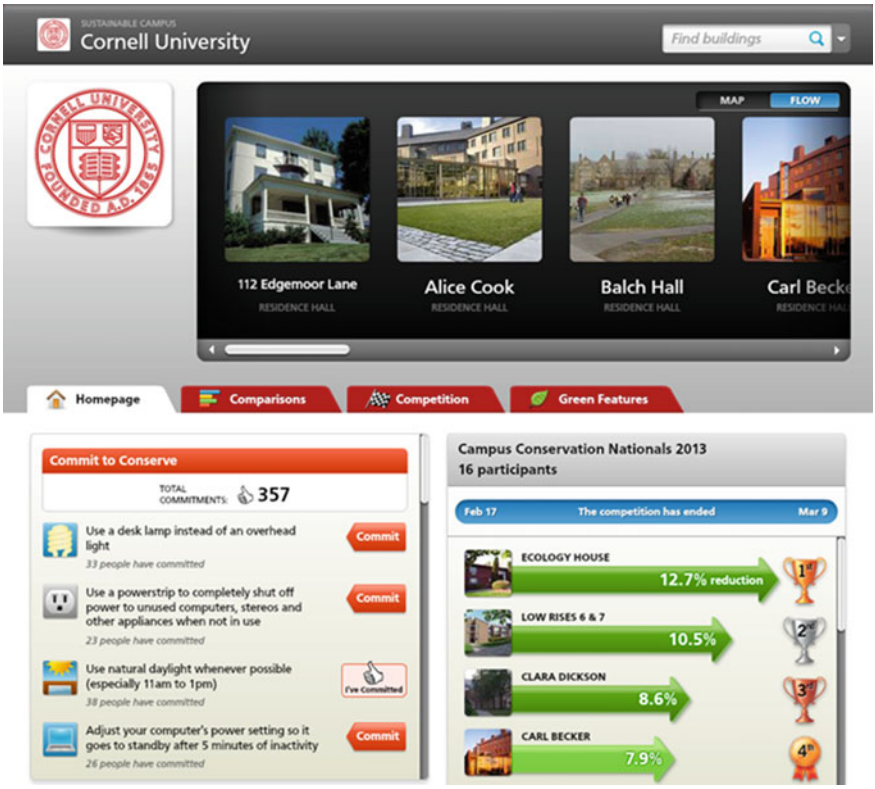

Fig. 2 The Cornell University Building Dashboard—www.buildingdashboard.cornell.edu © Lucid Design Group™

- Lack of communication channels specific to the Cornell research community.
- Lack of motivation from the target audience that uses labs on campus.
- High turnover rate of graduate students and research assistants in lab spaces.

Cornell Building Dashboard: The Building Dashboard is a major engagement tool for TLBG. As an internet-based display of real-time building energy use, it supports competitions within each college and unit or between colleges across campus (Fig. 2). The Building Dashboard® system was created by the Lucid Design Group™, and is based on social science and behavior change strategies. The dashboard specializes in goal setting capabilities, public commitments, and social media connections. It is customized based on an individual university or college's needs with different applications and widgets that highlight university-wide sustainability initiatives and green features. The different widgets and applications can compare buildings' utility usage on a daily, monthly and yearly basis. During energy competitions on campus, Green Ambassadors use the Building Dashboard as a gauge of how well individuals within the buildings are conserving energy and, if needed, target specific departments more aggressively to increase participation.

5 Moving from Plans to Action

Thus far, two out of the fourteen colleges within the Cornell community have participated in TBLG since its creation in 2013—the College of Engineering (COE) and the College of Human Ecology (CHE). Each campaign has had a different presence within the community based on the college principles, operations, size and number of the college facilities, and community. The college-level leadership structure is consistent within both colleges, and has the campaign flexibility to adjust to meet the needs of its community. Other colleges and units have opted to participate in TBLG programs each year as social norms have been established for colleges/units to incorporate sustainability within employee and student engagement and curriculum.

College of Engineering: As a very data driven community, COE took much interest in seeking to lower its carbon footprint, specifically through building energy conservation. As engineers, the college focuses much of its research interests on renewable energy, building automation controls, and energy efficiency. Behavior change research is not a strong interest area within the COE community, and the campaign needed much support from the E&S Department for the community to be successful. The first Green Ambassadors meeting took place months before the campaign officially launched. The initial meetings, facilitated by the Cornell Team and Leadership Center (CTLC) and the E&S Department, focused on team building and personal sustainability. The meetings occurred every month and allowed the Green Ambassadors to reflect on what sustainability means to them as individuals, and discussions on how to engage their peers in the college. The initial launch of the campaign took place in August 2013, with a social media promotion of COE offices and departments "pledging to Think Big, Live Green". This program was very effective in garnering university attention to TBLG, and creating social norms to be a campus leader and trailblazer in sustainability engagement (Fig. 3).

The first official theme in COE focused on paper reduction called "The BIG Paper Cut". Five (5) specific actions were targeted during this month-long campaign (Fig. 4):

- *Cut the paper cup*. Use a reusable cups and mugs.
- *Don't print it… SYNC it*. Use different cloud sharing applications instead of printing documents.
- *Get to know your recycling bin*. Understand what is recyclable and what is compostable.
- *Two sides are better than one.* Only print double-sided.
- *Put paper in its place*. Recycle all paper products.

The BIG Paper Cut utilized incentives, reminder prompts in close vicinity of where actions would take place, and peer education to encourage behavior change. In collaboration with Cornell's R5 (Respect, Rethink, Reduce, Reuse, Recycle) Operations and Information Technology Department, different informational sessions were hosted throughout the month to discuss recycling campus, and cloud-sharing programs

Fig. 3 College of Engineering Green Ambassadors © Cornell University, 2013

Fig. 4 Sample posters used during the BIG Paper Cut theme in the College of Engineering. © Cornell University, 2013

available exclusively to Cornell staff, faculty and students. These programs helped structure conversations focused on office waste and document management within the college. As a result, various departments within the college started using OneDrive™ and Cornell Box™ to share documents. Based on the post survey that was conducted in the college after the completion of the campaign, 84 % of the respondents stated that they "recycle at work most of the time" as a result of the campaign theme. A limitation that impacted this theme's success was due to all landfill and recycling at Cornell being measured and weighed on a university-wide level, and not on a college or per building basis. Although college wide recycling and waste management was encouraged, there was no way to accurately measure any increase or decrease in the rate of recycling that took place during the theme.

The next theme that COE created was called "Green Your Workplace". This theme was the official launch of the Green Office and Green Lab Certification Programs as a college campaign initiative. Labs and offices in COE were encouraged to get their certification. To encourage participation, E&S sponsored a program called "Swap It Out". Lab and office users could trade in their old space heaters for energy efficient CozyToes™—heated footpads that only use 75 W when plugged in. The COE community could also trade in their standard electric plug strips for energy efficient EcoStrips™—plug strips that can sense when a computer is off or in hibernation and automatically shuts off power to any appliances plugged into the strip. These incentives made it easier for labs and offices acquire their certification and invest in energy conservation. At the end of the month-long theme, 7 departments and 4 labs obtained a certification and were recognized by the college and the E&S Department for their achievement. The celebration of their success created positive reinforcement of their collective efforts, and refueled community support for upcoming themes. Lastly, due to the successful implementation of CozyToes™ and EcoStrips™ within COE, the Cornell Procurement Office negotiated with these product vendors to formalize the capability of purchasing these products university-wide.

College of Human Ecology: The College of Human Ecology has sustainability embedded within the college culture as one of its eight (8) research themes. Therefore, faculty members and staff already demostrated a passion for engaging their community and seeking results that can be translated to a broader community. The CHE College Green Team took full control of creating its campaign and aligning their college goals to reflect and support the goals of the university. Planning began with a review of the different themes of sustainability that were the most interesting to the college. Based on these themes, the Green Ambassadors then worked in teams to finalize target actions and engagement strategies for college. The College Green Team consulted with faculty members that specialized in social sciences and human development to create synergies of research and engagement within the campaign.

CHE's first theme was very similar to COE's "Green Your Workplace" theme and focused on labs and offices obtaining their certification. The reasoning for launching this theme at the beginning of the campaign was to provide a personal sustainability baseline and tailored feedback for each lab and office on their own

operations. The Green Office and Lab checklists allowed for each participant to set individual goals throughout the year in each area of the program. Throughout the theme, the College Green Team and the Green Ambassadors used incentives such as competitions, a "Swap It Out" program, free lunches and ice cream, and team building exercises to encourage participation. At the end of the campaign, 16 offices and 2 labs received their certification.

COE, CHE, and other college/units have participated in TBLG programs that are available university-wide. "The Energy Smackdown" is the university's annual fall energy reduction competition, and includes academic, lab and residential buildings on campus. Using the Cornell Building Dashboard, buildings within each college and unit compete to reduce energy for 6 weeks. The dashboard is the main behavior change strategy that is employed during the competition. It uses tailored feedback, social norms, and commitments to engage communities. "The Energy Smackdown" competition leads up to the annual Holiday Setback Program, during which the university reduces campus energy supply to the buildings during winter break (2 weeks). During the competition, the key energy conservation actions are targeted include:

- Turning off lights when not in use.
- Unplugging non-essential electronics when not in use.
- Closing doors and window during the winter months.
- Installing an EcoStrip™ at applicable workstations to reduce plug load.
- Using a CozyToes™ instead of a space heater.

Since each college/unit is responsible for paying their own utility bills, any avoided utility costs directly benefits each college/unit's budgets. This creates an incentive to support this program under the TBLG campaign. During the 2013 Energy Smackdown, the College of Engineering avoided over $15,000 in electrical energy costs, and the entire university avoided over $140,000 during the 2013 Winter Break Setback Program. During the 2014 Energy Smackdown, CHE avoided approximately $9000 in electrical energy costs and the residence halls that participated avoided over $14,000. A college or university's ability to accurately measure building energy consumption on a per building basis limits the capability of completing a college-wide energy competition. In order to facilitate this competition, Cornell University invested in real time metering and monitoring of electrical energy usage in over 75 campus buildings. This investment can pose a large upfront cost to a college or university's facilities. Therefore, other colleges and universities must conduct a cost benefit analysis before establishing a robust metering system.

6 Conclusion and Looking Forward

In the coming years, TBLG will continue to grow and engage communities within Cornell. Since the campaign is designed for specific communities, continuous research on the colleges/units is required to accurately engage the campus

community in sustainability practices. This requires sustainability office personnel and a continuously commitment of the College Green Team, Green Ambassadors, and resources to be successful. Also, the structure of the TBLG campaign requires a large time commitment of the Campus Sustainability Office personnel to support the college/unit campaigns. Therefore, engagement campaigns are established one college/unit at a time during an academic year. For replication at other colleges and universities, it is recommended to establish roles and responsibilities for all parties involved before commencing the sustainability research on a community. Hiring sustainability coordinators in each college and unit are recommended to lead the facilitation of the engagement campaign for the respective community. This allows a university sustainability office to support multiple colleges and units simultaneously, and provide oversight and strategic planning for university-wide behavior change. Other colleges and universities should also have a commitment to campus sustainability, such as a climate action plan or a university sustainability strategic plan in place before establishing a behavior change campaign. This creates a university responsibility and investment in promoting sustainable practices. As part of the 2016 Climate Action Plan Update, TBLG is now part of a larger framework to build capacity for achieving climate neutrality (Fig. 5).

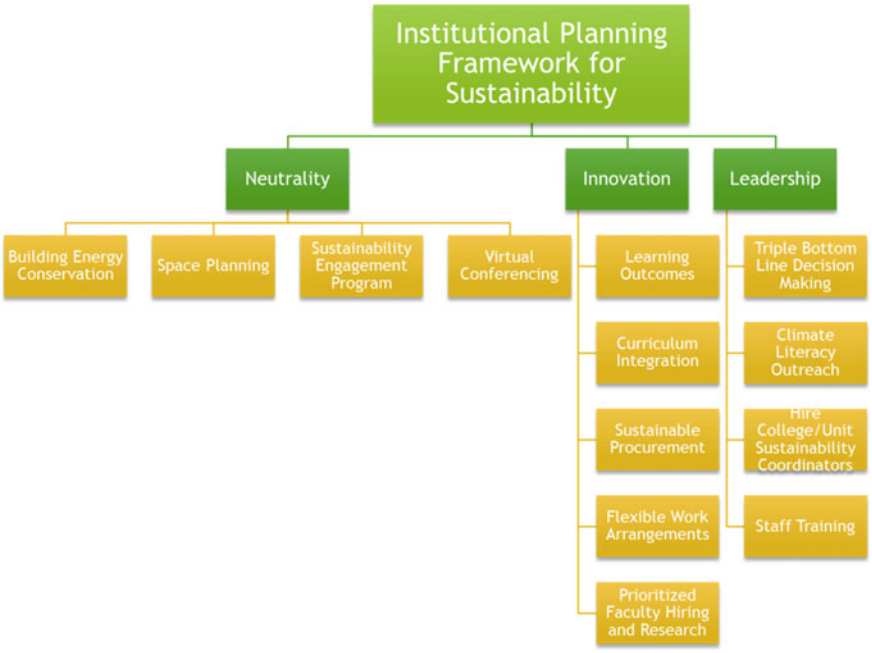

Fig. 5 Cornell Institutional Planning Framework for Sustainability, © Cornell University, 2013

Every Cornell student, faculty, and staff member must understand both the challenges raised by climate change, and ways to generate and participate in solutions. As part of this framework, colleges/units will be required to implement three (3) or more initiatives with measurements that align with the CAP. These initiatives can include TBLG, building energy conservation, curriculum integration, staff training and hiring college/unit sustainability coordinators. Once the framework is finalized, social science theories will be used to engage the community, evaluate programs, and provide guidance on forming initiatives for individual colleges/unit. Each college and unit at Cornell will have the opportunity to imbed sustainability into all areas of its curriculum, operations and research through this framework at a level that will be empowering, manageable, and impactful. Through this framework, Cornell University will solidify its responsibility to take control of its environmental footprint, and train future leaders to engage their people in any issues that affect society, and the ability to live a sustainable life.

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Author Biography

Ms. Erin Moore has had a passion for sustainability and environmental science since childhood. Her career experience involves education, energy analysis and management, and community outreach. She received a B.S. in Meteorology and a minor Environmental Science from North Carolina State University in Raleigh, North Carolina. She later returned in 2011 to obtain a Graduate Certificate in Environmental Assessment. Erin also maintains a Professional Energy Manager (PEM™) certification from the Institute of Energy Professionals™. Her first experience with engaging communities came as the Education Director for the Raleigh Girls Club of the Wake County Boys and Girls Clubs in Raleigh, NC. There, she was responsible for designing and managing education programs for young girls focused on science, technology, engineering, and

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In 2011, she returned to NC State University to work as an Energy Data and Outreach Specialist for NCSU Energy Management and the University Sustainability Office. While back at NC State, her work focused on conducting campus energy audits and creating outreach materials to promote campus sustainability and energy conservation. She joined Cornell University in June 2012 as the Energy Outreach Coordinator and was promoted to Sustainability Engagement Manager in 2014. Erin's work includes data analysis, project management, and sustainability engagement for the Cornell community through the Energy and Sustainability Department. She also coordinates with different college/units at Cornell to participate in the Think Big, Live Green sustainability engagement campaign. Because of her work with the campus community, she received the 2013 Cornell University Partners in Sustainability Award. She would like to thank her mentors, friends, students, Energy & Sustainability colleagues, supervisors and Cornell community who "Think Big, and Live Green" everyday. Their support and contributions are the epitome what it means to have a sustainable life.

Obstacles to Curriculum Greening: The Case of Green Chemistry

Manuel Vallée

Abstract

Purpose This paper articulates how the efforts of curriculum greening reformers are mediated by surrounding constituents, including departmental colleagues, chemistry colleagues from outside their department, campus administrators, and students. *Design/methodology/approach* I perform a "field" analysis, which is informed by: (1) a review of the green chemistry literature from the chemistry discipline; (2) interviews with key informants; and (3) a content analysis of key websites. *Findings* Surrounding constituents mediate reformer efforts through the resistance they exert, or through the resources they provide, such as green teaching materials, and the resources required to integrate the materials. *Originality/value* This chapter addresses a gap around the way curriculum reform efforts are mediated by surrounding constituents. Beyond chemistry, this analysis can help reformers of other disciplines better circumvent sources of resistance, and accentuate the forces that can help their efforts.

Keywords

Curriculum greening · Green chemistry · Environmental education · Sustainability · University greening

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1 Introduction

Universities are central to sustainability efforts. Beyond the tremendous resources consumed and waste produced, they significantly impact student understandings of human-environment relations through the systems of ideas, practices, and values they impart. This ideological impact is arguably most significant as it imparts beliefs and value systems that permit, facilitate, and even encourage environmentally destructive behavior (Schnaiberg and Gould 1994). Alternatively, curriculum greening offers the potential for societal transformation, for it can promote deep eco-literacy, compel students to question and change environmentally destructive norms and processes, both within and outside the university, and orient graduates towards the building of a sustainable society (Martin and Jucker 2005), instead of becoming "part of the rearguard of a vandal economy" (Orr 1994). For these reasons, reformers have spent the last four decades trying to green mainstream education, turning specifically to university curricula in the 1990s (Haigh 2005). However, they are still far from their stated goal of ensuring "all university graduates are environmentally literate and have the awareness and understanding to be ecological responsible citizens" (ULSF 2001).

The social sciences have a key role to play in accounting for the lag, for its research methods and concepts can illuminate the social factors that are hindering or even stalling reform efforts. Previous social science research has found curriculum-greening efforts are hampered by several factors, including disciplinary boundaries (Higgitt et al. 2005) and traditional curriculum culture, which emphasizes teacher-centered approaches and top-down modes of communication (Posch 1996; Tilbury 1999). Additionally, Haigh (2005) articulates how curriculum-greening efforts can be stifled by the following factors: (1) confusion about curriculum greening's remit; (2) the university tradition of prioritizing research over teaching; (3) financial incentive structures; (4) tokenism; and (5) academic values that adhere to an industrial model of progress. While these analyses are important for illuminating larger social dynamics, they under analyze the individuals who mediate curriculum-greening efforts.

To address that gap I pursue a "field" analysis (Bourdieu 1992) of the chemistry discipline, focusing on how reformer efforts are mediated by other constituents, such as departmental colleagues, campus administrators, and students. Chemistry is a strategic case because it has yet to experience widespread change, despite the fact there have been serious attempts to green the curriculum over the last two decades. Although a few schools (such as Hendrix College, Simmons College, and Scranton University) have impressively infused green chemistry principles throughout their curriculum, chemistry departments at more than 1200 American four-year colleges and universities have fallen well short of where they could be. Drawing from a review of the green chemistry literature and interviews with key informants, I found other constituents mediated reformer efforts by their resistance levels or through the resources (such as access to green teaching materials and resources required for integrating the materials) they provided.

In the next two sections I discuss my methods and theoretical framework, and then trace the emergence of the environmental education movement, which includes addressing nascent efforts to green the chemistry curriculum and the failure of such efforts to exert a greater impact. Thereafter I discuss how surrounding constituents mediated the reformers' curriculum-greening efforts. By illuminating the chemistry case, this sociological analysis can help us better understand the curriculum-greening process for all disciplines, thereby enabling us to quicken the greening of curriculum, campus and society.

2 Methods and Theoretical Framework

To shed light on the curriculum-greening process I chose to analyze the chemistry case. There are two factors that make this a strategic case to analyze: (1) there has been an active movement within the discipline to green its curriculum; and (2) those efforts have yet to yield widespread curriculum greening. Although a handful of schools have impressively infused green chemistry principles throughout their curriculum, chemistry departments at more than 1200 American four-year institutions are far short of where they could be. These factors provide a great opportunity to understand the forces that stymie active attempts to green a curriculum.

In trying to illuminate the mediating "micro" factors I drew on Sarah Creighton's research (1998), which focuses on the way university greening initiatives are driven by the leadership and activities of campus constituents, such as students, administrators, trustees, professional staff, faculty, and the surrounding community. While curriculum greening is only lightly addressed in her analysis, this topic is well served by an analysis grounded in the efforts of people, for if curricula is to be changed, it is people who will be driving those changes.

My approach also draws on Bourdieu's "fields" concept (1992), which seeks to understand how the efforts of some are mediated by neighboring constituents. In this case, the analysis focuses on the way curriculum-greening efforts are mediated by departmental colleagues, chemistry colleagues in the larger discipline, campus administrators and students. This included identifying how these individuals supported efforts, how they hampered them, and how reformers sought to circumvent obstacles.

My analysis was informed by three activities: (1) a review of the chemical discipline's literature on green chemistry; (2) a review of key websites dedicated to green chemistry (such as the American Chemistry Society's (ACS) website, the Beyond Benign website, and the University of Oregon's Greener Education Materials for Chemists database); and (3) interviews with seven key informants, each of whom are academics in chemistry departments where some level of curriculum-greening has occurred. The review of the literature and websites provided an overview of the issues, whereas the interviews served to deepen that knowledge and better explain the process behind curriculum-greening efforts. Moreover, I intentionally sought out individuals from institutions with curriculum-greening

success because they would be ideal candidates to identify: (1) factors that enabled curriculum-greening to succeed; (2) factors that hindered those efforts; and (3) strategies for successfully circumventing those obstacles.

3 The Environmental Education Movement

Since 1975 there has been a concerted effort to improve the education system's provision of environmental education (Haigh 2005). One area where universities have experienced success is environmental studies, as there was a tripling of programs between 1975 and 2000 (Brint et al. 2009), and the programs are now found at most universities. However, progress in other areas has been disappointing. For example, few universities require students to take courses aimed at enhancing environmental literacy. Because courses are usually electives, most students complete degrees without being exposed to environmental perspectives. In the few instances where eco-literacy courses are required, the courses tend to be introductory level courses that are not integrated with the student's main course of study (Haigh 2005). While these courses aim to ground students in core ecological issues, Haigh (2005) argues they are problematic because they are "often seen as something apart from the learner's main education, a discrete package of knowledge, another course to be passed and forgotten, but not something generally relevant to their course of study" (p. 38).

Another disappointment has been the relatively slow integration of green chemistry principles. Green chemistry is a movement within chemistry that emerged in the early 1990s, and aims to lower the amount and toxicity of chemicals produced. Towards that goal, green chemists work to select and design chemicals "with reduced toxicity and [with] reaction pathways that eliminate by-products or ensure they are benign" (Poliakoff et al. 2002, p. 807). It's argued that this, in turn, will lead to less toxic waste, fewer environmental harms, and less human exposure to dangerous toxicants (Anastas and Warner 2000). Many chemistry leaders view green chemistry's development as a revolutionary event, with the potential to eliminate the intrinsic hazards of particular chemical products or industry processes (Anastas and Warner 2000; Poliakoff et al. 2002; Cannon and Warner 2011). At the same time, however, some suggest the revolution has stalled, tracing the lack of progress to a lag in the greening of university curriculum: "only when more universities teach green chemistry will graduates be able to apply these principles when they enter industry" (Poliakoff et al. 2002, p. 810).

In America there are chemistry departments at over 1200 four-year colleges or universities, with over 600 offering bachelor degrees certified by the American Chemical Society (Cannon and Warner 2011; UC Santa Barbara Library 2014). While efforts to teach green chemistry principles can be traced as far back as the mid 1970s (Morton 1982; Woodhouse and Breyman 2005), it has yet to be widely

adopted by American higher education. For example, only eight of the 1200+ departments have comprehensively incorporated green principles into their undergraduate curriculum, and only four offer postgraduate degrees in green chemistry. A less demanding reform would be for schools to have added an undergraduate green chemistry course, or have aligned a pre-existing course with green chemistry principles (such as the organic chemistry lab at University of Oregon). However, here too, the picture is disappointing. Woodhouse and Howard (2009) found most universities fail to offer even a single green chemistry course, and this corresponds with my own findings. While I was able to find 38 institutions that offer coursework in green chemistry (21 of which were listed on the ACS's green chemistry website), that represents less than 7 % of the 600+ ACS certified chemistry programs. Additionally, most of these offer green chemistry as an "elective," which means the majority of chemistry majors can complete degrees without exposure to green chemistry principles. So far, chemistry's curriculum greening has been tokenistic at best, which has under mined the green chemistry revolution's potential impact.

4 Mediating Factors

Once an instructor decides to green a course, their success is mediated by the activities, either supportive or hindering, of neighboring constituents. In this section I explore the respective roles of department colleagues, chemistry colleagues from outside their departments, campus administrators, and students. Beyond elucidating how some resisted curriculum greening efforts, I explain how reformers responded to the resistance, as well as how some constituents provided much-needed support.

4.1 Departmental Colleagues: Potential Roadblocks

Departmental colleagues can be supportive of greening efforts or can be quite resistant to them. Regarding resistance, many green chemistry proponents have faced departmental colleagues who sought to undermine them, either by disparaging or by politicking against efforts to green departmental courses. The resistance can come from numerous sources: (1) turf protection, as some fear greening efforts will reduce the coverage of topics and experiments they hold dear (personal communication); (2) inertia to change, fed by the "if it ain't broke, don't fix it" attitude, which necessitates proof that green chemistry can be an improvement over the traditional curriculum (Kirchhoff 2009; Klingshirn and Spessard 2009); and (3) obstructing beliefs, four of which are detailed below.

According to an informant, resistance can come from the misconception that green chemistry merely consists of minimizing the use of dangerous materials and production of toxic waste in the laboratory. In his case he approached a colleague about greening her organic chemistry lab, but the colleague resisted, based on her belief her course had already been greened (personal communication). It turns out

she had already revised the course to eliminate dangerous experiments, and to minimize both the use of dangerous materials and production of toxic waste. What was missing, however, was the pedagogical component. Although the instructor decreased the lab's ecological impact, she did nothing to educate students about the changes made, or why she made them, thereby side-stepping an important thrust of the green chemistry movement: making students more aware of chemistry's potential toxicity (Cannon and Warner 2011). As a green chemistry proponent emphasized, discussing the process of selecting and rejecting experiments is an important part of the student's learning experience (Goodwin 2004).

A second obstructing belief is the misconception that green chemistry is "hippy chemistry" (Klingshirn and Spessard, 2009, p. 90), that is to say less rigorous, and disadvantageous to students (Kirchhoff 2009). Green chemistry proponents have responded by arguing such objections have no scientific basis as: "the principles of science underlying traditional chemistry are exactly the same for green chemistry" (Klingshirn and Spessard 2009, p. 90). Moreover, they believe that successfully addressing this belief has tremendous potential for winning over adherents, emphasizing that green chemistry's pedagogical value is what has the most power to win colleagues over: "If proponents can convince colleagues that green chemistry is rigorous and is simply an alternate way of viewing key chemical concepts, implementation becomes more attractive" (Klingshirn and Spessard 2009, p. 90). Case in point, while Collins (1995) originally feared that greening chemistry courses would undermine the chemical knowledge being taught, those fears lessened when he discovered "the nature of the superb green chemistry that already exists," and that "green chemistry is real chemistry" (p. 965). Moreover, after greening his own courses, he became a significant green chemistry innovator and proponent at Carnegie Mellon University.

Another obstructing belief concerns thinking that undergraduate education is meant to be training for graduate school or a career in chemistry, and that altering traditional experiments deprives students of that training. While many skeptics adhere to this belief, it too is seriously critiqued by green chemistry proponents, who argue teaching chemistry "should be education, not training" (Goodwin 2009, p. 49). From their perspective, a college education is not about being trained to do specific lab experiments, but rather about gaining solid grounding in chemical principles, which students should be able to apply reflexively and creatively in diverse settings. The contrast in perspectives speaks to a difference in teaching commitment: while some are committed to imparting lab capabilities, others are committed to imparting higher order thinking skills. This suggests green chemistry might be more readily adopted if the discipline prioritized the teaching of higher order thinking skills.

Fourth, some resist curriculum greening because they believe chemistry should teach students how to handle dangerous chemicals and that green chemistry fails to do this (Klingshirn and Spessard 2009). One informant explained to me that, until the last decade, working with dangerous chemicals was an unquestioned norm within the profession, which often led to cavalier decisions about experiments, which he underscored with the following example:

> About a decade ago I was working on an experiment that I knew could blow up and my unquestioned acceptance of danger was so deep-seated that instead of questioning the need for the experiment, I decided to do the experiment with my non-dominant left hand… so that if I lost my hand in the experiment, I would still have use of my dominant hand. (personal communication)

Several other informants attributed the use of dangerous chemicals to the chemists' adherence to "macho chemistry": i.e. an inclination towards achieving chemical objectives by brute force. Another explained that, to many, working with dangerous chemicals is a defining element of a chemist's identity, and it is something they take pride in. In turn, they believe that working with dangerous chemicals is a right of passage that all chemistry students should go through.

Regardless of the source, green chemistry proponents reject the assumption that classrooms should expose students to dangerous situations. For example, Klingshirn and Spessard (2009) argue students do not need to learn how to handle dangerous chemicals as few go on to practice chemistry professionally, with most only taking chemistry to satisfy vocational requirements, where chemistry is of little consequence. They also maintain that if students obtain chemistry jobs, they will have numerous opportunities to learn how to handle hazardous chemicals. This point is underscored by the fact the federal Occupational Safety and Health Act requires on-the-job safety training for the proper handling of hazardous chemicals and wastes (ibid).

Additionally, there is reason to believe the cavalier attitude will diminish over time, due to the growing social consciousness around health, safety and environmental protection issues. One chemistry professor offered that opposition is also emerging within the discipline, with some arguing students have a right to pursue their education without placing themselves in harm's way, especially when there are ways to dramatically increase the safety of lab experiments. Klingshirn and Spessard (2009) report such safety considerations are another factor that can reduce faculty resistance to green chemistry.

4.1.1 Strategies for Responding to the Resistance

The topic of colleague resistance was brought up by four of my seven informants, who countered it with a variety of strategies. One professor explained that he and his partner simply ignored the departmental naysayers, and persisted in their curriculum greening efforts. While they proved to be quite successful, they were significantly advantaged by the fact they were senior faculty, who had already obtained tenure. In cases where reformers are junior faculty, the resistance can be more daunting as resistant faculty are likely to exercise greater influence in departmental politics, and may even be able to influence the reformer's tenure process. In one case, reformers at a top-rated public university faced resistance from senior faculty, who believed green labs would not be as quantitatively rigorous (personal communication). Reformers met the challenge head-on, developing experiments that were as rigorous, if not more so, which helped win over enough skeptics to enable reform.

While successful at that university, the strategy was not as effective at another public university, where a small core of older faculty (about 25 %) has continued to actively resist reform efforts, and has refused to be swayed by any evidence provided by reformers (personal communication). The resistors argue they have successfully taught the courses for decades, and their first-hand teaching experience outweighs any evidence reformers can provide (personal communication). According to one of the reformers, the struggle has been made more difficult by the asymmetry of responsibilities between the two groups. On the one hand, most reformers are junior faculty and are carrying heavy service loads to qualify for promotion. On the other, the resistors are made up of tenured professors who carry smaller service loads, and have more time to devote to the struggle.

At a third school the response was not to try winning the support of the resistors, but rather to wait them out. The professor explained that while he was department chair he knew the greatest resistors were only a year or two from retiring, so he delayed rolling out green chemistry reform until the main resistors retired and were replaced by more supportive individuals.

These cases underscore the point that curriculum greening can be a time and energy-consuming political struggle, where departmental colleagues need to be won over one by one, and where there is no guarantee of success. These problems may help explain why the greatest success has tended to occur at smaller schools, like Hendrix College and Simmons College. The relationship between department size and curriculum greening is one that should be further examined in future research.

4.2 Leadership from the Chemistry Discipline

While the old guard has provided plenty of resistance, other parts of the discipline have provided important support. Since the 1990s numerous individuals have exhibited remarkable leadership around green chemistry, which has contributed significantly to its institutionalization. For example, green chemistry proponents organized symposia on alternative synthetic pathways at the 1993 and 1994 American Chemical Society meetings, created the Presidential Green Chemistry Award in 1995, and established biannual green chemistry conferences in 1997. Additionally, the not-for-profit Green Chemistry Institute was founded in 1998, Paul Anastas and John Woodward published their seminal book *Green Chemistry: Theory and Practice* the same year, and the *Green Chemistry* journal was established in 1999 (Woodward and Breyman 2005).

Eventually, these initiatives led to the production and widespread dissemination of green chemistry teaching materials. In 1998 the Environmental Protection Agency and the American Chemical Society jointly developed the Green Chemistry Educational Development Project, which provided: (1) an annotated bibliography; (2) introductory activities in green chemistry; (3) real world cases in green chemistry; and 4) a short course on green chemistry (Caan 2009). Moreover, in 2001 the *Journal of Chemical Education* began encouraging submissions on green chemistry

(Caan 2009). Besides being disseminated through that journal, teaching materials were increasingly uploaded to the internet, as manifested by the University of Scranton example, and the University of Oregon's GEMS database (Greener Educational Materials for Chemists) (Caan 2009; Klingshirn and Spessard 2009). Additionally, between 2001 and 2014 Kenneth Doxsee and Jim Hutchison organized annual "Green Chemistry in Education Workshops" at the University of Oregon, where participants benefitted from the experience of those who had successfully greened their own chemistry courses. Green chemistry proponents also developed the Green Chemistry Education Network, a clearinghouse for disseminating green laboratory exercises, and for providing support mechanism to those wishing to green their courses (Klingshirn and Spessard 2009). As well, in 2003 Doxsee and Hutchison published their *Green Organic Chemistry: Strategies, Tools, and Laboratory Experiments* textbook, and by 2009 several prominent textbooks had begun to include green chemistry content, though some would claim only tokenistically (Caan 2009).

The availability of teaching materials is essential to curriculum greening. While an instructor may develop an interest in greening a course, it takes significant time and resources to develop new curricula, which can deter even highly motivated instructors. This is particularly true for courses with laboratory experiments, where developing effective experiments can take an inordinate amount of time (Klingshirn and Spessard 2009). Moreover, while faculty could spend research time on developing innovative curricula, it is less likely to occur at research universities, where faculty face strong publication pressures. With green teaching materials readily available, the task becomes infinitely easier and widespread curriculum-greening is much more possible.

Nonetheless, the availability of green teaching materials is, on its own, an insufficient condition. For example, whilegreen chemistry materials for some courses (such as the organic chemistry labs) have been readily available for over a decade, widespread adoption has yet to occur. While this underscores the necessity of having motivated instructors, even the combination of those two factors can be insufficient as interested instructors might not have access to resources required for integrating green materials into their courses. For instance, significant time is needed to integrate green materials, which instructors may be unable to devote in university settings, where research is usually prioritized over teaching. This is where campus administrators can play a major role, by providing the resources curriculum-greening projects require.

4.3 Administrators: Controllers of the Funding Faucet

While motivated instructors are the most important agents in curriculum-greening projects, campus administrators (such as college deans, campus presidents, and university presidents) can influence the process in numerous ways. For example, they can create obstacles to change, such as creating onerous processes for the

creation of new courses. Alternatively, they can facilitate curriculum-greening efforts by hiring full-time staff or creating campus-wide committees dedicated to the issue. As well, they can encourage curriculum greening through the development of education campaigns, competitions, and other programs. Most important, however, is the control they exert over funding and other campus resources, which is important for numerous reasons.

First, funds are necessary to purchase required equipment or materials. As well, funding is necessary for bringing curricula-greening workshops, such as the "Green Threads" workshops brought to the Universities of Louisville and Montanain 2015 (University of Louisville 2015; University of Montana 2015), or for sending interested individuals to workshops at other campuses, such as the annual 'Green Chemistry in Education' workshops offered by the University of Oregon, which, as of 2009, had been attended by representatives of over 130 schools (personal communication).

Funding can also provide teaching buy-outs to those needing time to green their courses. According to one informant, obtaining a one-year teaching buyout was vital to his ability to develop a green organic chemistry course. Moreover, while many green teaching materials are now easily accessible, another informant emphasized that teaching buyouts are still necessary, as instructors still need time to integrate materials, draw up and test new experiments, and coordinate the transition to the new course, which can include acquiring necessary materials and resources. At one prominent school, useful teaching support came in the form of graduate student funding and graduate lab space, both of which were used to develop and test new potential experiments.

Alternatively, Haigh (2005) argues a lack of funding has been an obstacle to curriculum-greening at many universities, as administrators tend to place far greater value on research, especially when it can attract external funding. This is particularly true of research universities, where less value is placed on teaching than at liberal arts colleges. This tendency might be tempered in chemistry's case, as administrators can be attracted to green chemistry's potential to reduce the university's legal liabilities, as it pertains to both student health and environmental pollution (Klingshirn and Spessard 2009). Moreover, administrators can view chemistry-greening as a fundraising tool, as happened at one public university, where the College Dean used green chemistry's cache to spark fund-raising for the construction of a new building and to brandish her legacy.

Funding's importance highlights that while faculty are the most important factor in curriculum-greening efforts, administrators can also play a pivotal role. However, their importance can be diminished if instructors can obtain funding from external sources, such as wealthy benefactors or government agencies. One example is Hendrix College, where an alumni donation enabled instructors to develop green experiments, and to successfully green their organic chemistry labs (Goodwin 2009). At UC Berkeley, a $300,000 dollar grant from the National Science Foundation enabled instructors to develop the "Public Ethics of Green Chemistry" course, which they began offering in 2012 (Berkeley Center for Green Chemistry

2010). Additionally, an earlier grant from the California Environmental Protection Agency enabled instructors to develop: (1) green curricula for their undergraduate organic chemistry labs; (2) an interdisciplinary graduate course in green chemistry; and (3) two other graduate courses addressing green chemistry (ibid).

4.4 Students: Potential Sources of Resistance or Potential Catalysts

In Creighton's analysis (1998) students factor heavily in university greening efforts, and for good reason as students have acted as the environmental conscience and main driver of environmental change on numerous issues. While course instructors are the main mediators of curriculum-greening efforts, students can play an important role, either in supporting or resisting them.

Karpudewan et al. (2008) report that students found green chemistry to be interesting, useful, and timely. Moreover, Klingshirn and Spessard (2009) report that students are more likely to buy into green chemistry when there is a strong campus interest in improving the environment. While this may very well be the tendency, students can also be a source of resistance, out of fear that taking the greener course would negatively impact career opportunities. For example, many chemistry students view their degree as a pathway to a career in the petrochemical industry, and at one highly-ranked university students became concerned that taking a green version of introductory chemistry would negatively impact their career opportunities in that industry (personal communication). At another school a similar situation occurred the first year a green organic chemistry lab was offered. Because course instructors wanted to pilot the lab the first time it was taught, they randomly picked one of the lab sections to receive the green content. This unsettled students, particularly pre-med students, who had not signed up for a "green" lab, and feared they were being forced to take an inferior version of the lab, which would disadvantage them on their MCAT exam and medical school applications (personal communication).

Such resistance can be demoralizing for instructors who invest significant amounts of time and energy in redesigning the curriculum. In turn, the resistance can foster cynicism and resignation, which can undermine greening efforts. However, in the above case the instructor remained strong in her conviction and worked hard to bring students on board. Eventually, she persuaded students to see that green lab experiments were just as rigorous, and had the advantages of being safer and cutting-edge chemistry. In turn, as students came to understand the course intentions and advantages, word quickly spread about the course. The following year so many students flocked to the course that instructors were forced to turn students away, even though the teaching capacity had doubled. Propelled by student enthusiasm, all labs were greened within the next two years.

Apart from becoming supporters, students can also be catalysts for curriculum-greening efforts, as occurred at Gordon College. In 2003 green

chemistry was not part of the curriculum. However, that year an undergraduate student took an interest in green chemistry and, even though her advisor repeatedly discouraged her from doing so, chose to write her honors thesis on the topic (The Green Chemistry Commitment 2015: Gordon College). Doing so had the effect of educating her advisor and the rest of the chemistry faculty, which transformed them and the college administration into enthusiastic proponents. Beyond greening their courses, the department has since developed year-long student research projects on green chemistry, and became founding members of the Green Chemistry Education Network (Gordon College 2015).

5 Conclusion

While motivated instructors are necessary to the curriculum-greening process, I have sought to show that the process can also be significantly influenced by other constituents, who can either resist change or support it. Beyond illuminating the chemistry case, this field analysis contributes to the environmental education literature by re-focusing the conversation around instructors, and the people who they vie with and against in their respective fields. In turn, this can help us better understand the curriculum-greening lag existing for other disciplines (such as architecture, engineering, and urban planning).

Looking forward, there are several ways to build on this analysis. First, although this analysis illuminated the roles played by departmental colleagues, chemistry colleagues from outside the department, campus administrators and students, subsequent research should also examine the roles played by other constituents, such as university trustees, professional staff, and neighboring communities (Creighton 1998). Second, we need to better understand the way the process is shaped by government agencies, industry (whose shadow over campuses seems to be growing longer with each passing year), and the larger political-economy within which universities are embedded. Third, while this analysis side-stepped the process by which instructors decide to green their courses, this is another issue that needs to be better understood. A fourth way to build on this research is to relate this analysis to the "macro" factors found in previous research, such as traditional curriculum cultures, interdisciplinary boundaries, and traditional academic values (Haigh 2005; Tilbury 1999).

As mentioned at the beginning of this paper, while universities have been and continue to be a significant contributor to sustainability problems, curriculum greening has the potential to be a big part of the solution. Moreover, social science researchers have an important role to play in that process, as they can identify the factors stifling curriculum-greening efforts, thereby helping reformers better navigate through the process, and accelerate the speed at which we are greening campuses and society.

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Author Biography

Manuel Vallée is interested in the intersection between environment and human health. While his doctoral research focused on the social construction of pharmaceutical consumption for Attention Deficit/Hyperactivity Disorder (ADHD), since then his research has turned upstream to elucidate the social production of disease, which includes analyzing how disease is mediated by exposure to environmental toxicants, how mainstream medicine suppresses information pertaining to toxicants, how governments foster public acquiescence for aerial pesticide spraying programs in urban areas, and how universities contribute to environmental destruction.

Changing Energy Behavior Through Community Based Social Marketing

Cynthia McPherson Frantz, Bridget Flynn, Stephanie Atwood, Daniella Mostow, Cecilia Xu and Sarah Kahl

Abstract

Achieving carbon neutrality on college and university campuses will require more than just new technologies. Behavior change programs are a highly cost effective method of reducing costs and carbon emissions; however most facilities and sustainability offices lack training in the social science of behavior change. This paper introduces readers to Community Based Social Marketing (CBSM), a systematic, empirically grounded approach to behavior change. A team of faculty, staff, and students used CBSM to develop the behavioral component of Oberlin College's Climate Action Plan—targeted to eliminate 10–15 % of the College's carbon emissions. After analyzing the College's Greenhouse Gas Inventory we identified a short list of behaviors associated with significant carbon emissions to target for further study. Quantitative surveys, qualitative focus groups, and field observations were used to collect baseline data on these behaviors, as well as to identify the key barriers to changing them. Two behaviors were targeted for initial intervention: turning off lights in unused classrooms, and using cold water for washing laundry. We developed interventions using insights from our survey results as well as insights from behavior change research, and conducted two field studies to evaluate their effectiveness. This paper concludes with a discussion of lessons learned and suggestions for the implementation of CBSM research programs at other institutions. The approach described here is replicable at other institutions. It also provides students with an engaging real world context in which to learn and practice basic research skills, thus furthering a core curricular goal of higher education.

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1 Introduction: Behavior Matters

As hotbeds of scientific understanding, progressive ideas, and student activism, colleges and universities around the world are leading the charge against climate change. In the United States alone, nearly 700 college and university presidents have signed the American Colleges and Universities Presidents' Climate Commitment (ACUPCC), and are setting ambitious timelines for achieving carbon neutrality. Changes in energy sources and infrastructure upgrades are critical to these efforts; however carbon neutrality will require more than just new technologies and fuels. The adoption and proper *use* of new technologies, as well as energy conservation and curtailment, are essential for achieving carbon neutrality. In other words, people will need to change their behavior.

The systematic attempt to change energy-related behavior on college campuses benefits multiple stakeholders in a variety of ways. In comparison to investments in infrastructure improvements or technology shifts, behavior change programs are remarkably inexpensive. They directly contribute to carbon neutrality goals by helping to minimize both avoidable and unavoidable carbon emissions (and thus also minimize the purchase of carbon offsets). They typically also reduce utility costs, creating benefits to those who must pay the bills and balance the budget. If students are involved in the process of developing and assessing these programs, they become a valuable pedagogical tool for furthering the educational mission of the institution. In addition, they have the potential to have a broader cultural impact as faculty, staff, and students learn new behaviors on campus that may spill over into their behavior elsewhere. This is particularly true on residential campuses, where many students are living away from home for the first time, and are forming habits they are likely to carry with them for the rest of their lives. Thus behavior change programs do not simply affect what happens on campus; they are an important piece of creating a broader cultural shift towards sustainability.

However these benefits only accrue if the behavior change programs are successful—and not all of them are (e.g., Geller 1981; Midden et al. 1983; Hirst 1984). The social sciences have a wealth of theories, methodologies, and insights to contribute to effective design and assessment. There is also a growing network of researchers and practitioners cataloging lessons learned and developing turnkey strategies for shifting common energy-related behaviors (to be described later). Unfortunately many facilities and sustainability personnel lack training, financial support, and/or the institutional support required to put this knowledge to use.

This paper will introduce readers to Community Based Social Marketing (CBSM, McKenzie-Mohr 2011), a systematic, empirically grounded approach to behavior change, and describe how a team of faculty, staff, and students use CBSM

to begin developing the behavioral component of Oberlin College's Climate Action Plan—targeted to eliminate 10–15 % of the College's carbon emissions. The approach described here is easily replicable at other institutions. It leverages faculty expertise and student labor to provide valuable services to Facilities and Sustainability offices working with constrained budgets and personnel. It also provides students with an engaging real world context in which to learn and practice basic research skills, thus furthering a core curricular goal of higher education.

Below we provide a brief summary of CBSM and its successes, and point readers towards resources available to support researchers and practitioners in using CBSM. We then summarize how we implemented CBSM on our college campus, describe our methodology, and summarize the empirical results of two pilot studies. We conclude with a discussion of lessons learned and suggestions for the implementation of CBSM research programs at other institutions.

2 Community Based Social Marketing: An Overview

Community-Based Social Marketing (CBSM) was developed by environmental psychologist Doug McKenzie-Mohr (2011) using principles and insights from the behavioral sciences, particularly social psychology. Historically, program designers have often selected behaviors to target and have developed interventions in a rather haphazard way, based on intuitions of what they think will work. Organizations would end up committing time and money into intensive educational workshops, media advertisement campaigns, and incentive programs that were ultimately ineffective. The CBSM approach encourages program administrators to take a systematic, empirical approach to behavior change, thereby maximizing the effectiveness of their program dollars. The method involves five steps: behavior selection, identification of barriers and benefits, strategy development, program testing, and broad-scale implementation. Effective use of CBSM techniques ensures that program administrators target high-impact behaviors, look at the broad array of factors that influence behavior (for example, social cues, self-image, local values and identities, Vigen and Mazur-Stommen 2012) and use state of the art influence tactics to design their interventions.

The first step is to determine which behaviors will have the largest impact. Three criteria are used to evaluate each behavior: its impact on the environment (e.g., amount of carbon emitted), the probability that people will change their behavior, and the percentage of people who have not yet adopted the behavior. Ideally, program dollars are focused on behaviors that are high on all three of these criteria. For example, it is highly unlikely that people would be willing to take cold showers during the winter, so it would be a waste of time to try and change that particular behavior. Similarly, a behavior such as unplugging cell phone chargers after use would not be difficult to change, but would not be very impactful because they draw so little current. Thus it would not be worth the time to try and change this behavior. Finally, if a lot of people are already participating in a particular sustainable behavior (for example, recycling plastic bottles), then

we should not waste our efforts trying to convert the few people who will not change their behavior.

The second step in the CBSM process is to identify and understand the major barriers that keep people from engaging in the targeted behavior as well as the perceived benefits of engaging in the behavior. For instance, a perceived benefit of purchasing carbon offsets may be reduced feelings of guilt while flying while a perceived barrier may be increased financial hardship. Furthermore, these benefits and barriers may by different for different subgroups within a larger population. For example, in purchasing carbon offsets, faculty and staff may have different barriers than students on a college campus because they have different financial realities.

The third step in CBSM is to develop a behavior change strategy that simultaneously addresses the identified barriers and highlights the perceived benefits of the behavior in question. An effective strategy also utilizes cutting edge psychological research on behavior change. For instance, research shows that making public commitments makes people more likely to follow through with a behavior (Sherman 1980; see Lokhorst et al. 2013, for a review). Changing norms and publicizing peers participating in sustainable behavior encourages people to change their actions because people are more likely to engage in a specific action if they see someone else doing it first (Aronson and O'Leary 1983; Goldstein et al. 2007). Prompts (e.g. reminder signs) are another effective strategy, particularly if remembering is a key barrier to performing the behavior (Houghton 1993; Smith and Bennett 1992). Finally psychological research has identified when and how to most effectively use incentives: The incentive should be directly connected to the behavior so no one is confused about the purpose and should not be too big so people still feel intrinsically motivated (Gardener and Stern 1996). It is important to note that in order for a strategy to be effective, it must be directly tied to the type barrier it is trying to address. For instance, if the barrier to engaging in a sustainable behavior is forgetting, the use of prompts will be the most effective strategy. However, if the barrier to engaging in sustainable behavior is related to public image, changing social norms will be the most effective strategy.

Two other issues are worth noting on strategy development. First, it can also be helpful to design a strategy that increases the barriers and decreases the benefits of an alternative, less desired behavior. For example, programs that make parking a car more expensive and less convenient help to change the cost-benefit analysis of riding a bike to work versus driving. Second, the perceived benefits of the target population may be quite different from the motivations of those designing the intervention. A campaign to increase biking to work may be motivated by carbon reductions, but the target population may find benefits to health a stronger motivator. The campaign should speak in the language that is most compelling to the target audience.

The fourth step of the CBSM model is to pilot and assess the effectiveness of each behavior change strategy. Due to the gaps between conception and reality, there will often be some problems with an initial behavior change strategy. The point of a pilot is to identify and address problems before investing large amounts of resources in a widespread campaign. Pilots should employ basic social science

research principles, including random assignment, a control condition, and clear quantification of outcomes.

After identifying a cost-effective and successful behavior change model, it is time for the fifth and final step of the CBSM model: widespread implementation of the intervention within the community. However, this step also involves ongoing evaluation, as new barriers can arise and old strategies can become ineffective over time (e.g., people habituate to reminder prompts). The information gleaned from evaluation can be used to refine the strategy further or to eliminate programs that are ineffective.

The CBSM approach has been used effectively all over the world to promote a wide variety of behaviors. For example CBSM was used in New Zealand to stop the spread of didymo, which is an invasive rock algae (Billingsley 2010). Didymo was starting to spread towards the north island, which poses many risks to wildlife, and threatens biodiversity. Realizing that this problem would only continue, the Ministry of Agriculture and Forestry used CBSM to identify why citizens were not taking more action against this devastating problem (Billingsley 2010).

Research into the barriers and benefits uncovered that most people were simply ignorant of the problem. They developed the CHECK, CLEAN, DRY educational campaign to address this barrier. The Ministry also partnered with other clubs in order to make cleaning equipment part of the norm for people that use the water systems, and supplied people with the cleaning materials. In 2009, the Ministry tracked their progress by surveying people in New Zealand. They found that 98 % of high-activity waterway users checked, dried, and cleaned, and a 30 % increase in the public saying they do the same. There is also evidence that didymo has slowed on both islands of New Zealand (Billingsley 2010).

CBSM was also successfully used is a Toronto-based anti-idling campaign. Motorists that were idling their engines were approached by a researcher with an information card and signs reminding motorists to turn off their engines. They were asked to make a commitment to turn off their engines when parked, and asked to place a sticker on their front windshield, which 80 % of motorists complied with. With the combination of signs, stickers, and information cards, there was a 32 % reduction in idling and over a 70 % reduction in the duration of idling (McKenzie-Mohr 2011).

Washington State used CBSM research to encourage consumers to buy recycled products. Prompts placed below products called “shelf talkers” highlighted products with recycled content to shoppers. Posters, employee buttons, and door decals also served as reminders for consumers. Stores that engaged in the study found a 58 % increase in recycled products sold, and overall, shoppers were buying 27 % more recycled content items than they had during the previous year (Herrick 1994).

Community-based social marketing works on both large scales and small, as long as the researchers take time to learn about the particular barriers and benefits of their audience and target the appropriate behaviors. The method is described in full in *Fostering Sustainable Behavior: An Introduction to Community-Based Social Marketing* (Mc-Kenzie-Mohr 2011), and is available free for download at www.cbsm.com. McKenzie-Mohr also offers workshops worldwide, and maintains a

database of case studies on a wide range of sustainability-related behaviors. To read more case studies with successful CBSM projects, visit http://www.cbsm.com/cases/search.

3 Getting Started: Implementation at Oberlin

CBSM is a straightforward, systematic approach to behavior change that can be implemented in any context with relatively few resources. At Oberlin College we assembled a team made up of a psychology faculty member trained in CBSM and basic experimental design, a staff member from the Office of Environmental Sustainability well versed in sustainable behaviors as well as how the facilities and operations functions at the college, and several students with varying levels of experience with conducting research. Our budget was minimal: a few hundred dollars (US) to offer incentives for participation in focus groups and a few hundred dollars for printing signs and posters for our interventions.

Our primary goal was carbon reduction. To identify the most promising behaviors to target, we analyzed Oberlin's most recent Greenhouse Gas Inventory. The Inventory helped us identify the biggest carbon emissions source (e.g. kWhs of electricity, tons of coal, gallons of gas, miles of air travel, and their carbon equivalent). We identified every place that a human decision or behavior resulted in significant carbon emissions; this resulted in a list of over 30 potential behaviors to target with a behavior change program. For each of these behaviors, we quantified the environmental impact if the behavior was changed, the likelihood of changing the behavior, and the frequency with which the Oberlin community already performs the behavior.

The environmental impact assessment was based on the amount of greenhouse gases emitted as well as other environmental and operational costs. We researched the amount of approximate equivalent greenhouse gas emissions created by each individual behavior and applied that to Oberlin's energy mix. Behaviors with minimal impact (e.g. unplugging cell phone chargers) received a 0, while the most impactful actions (e.g. buying carbon offsets for travel) received a 4. We estimated the probability that people would adopt a new behavior using a scale of 0–4; zero being very unlikely, four being very likely. We used previous research from other universities and community programs wherever possible as a basis for these estimations. When data was not available, multiple staff, faculty, and students gave their perspectives.

To estimate how many people were already engaging in these behaviors, we used national data and information from other schools when it was available. When it was not, the research team again consulted broadly to develop an estimate, using a 0–4 scale. The final impact scores were calculated by multiplying the three scores together. The highest scoring behaviors became the focus of further research.

Prior to beginning this research, however, we sought feedback from relevant staff (representatives of Residential Education, Facilities Operations, the Center for Information Technology, union leaders) and administrators on the targeted

behaviors. This was essential for identifying unanticipated obstacles as well as for creating clear lines of communication and buy-in among people who would potentially be in positions to approve, advocate for, and/or implement proposed behavior change programs. These conversations also helped us identify those behaviors that would be relatively easy to tackle from a logistical and political point of view (e.g. encouraging the use of cold water for laundry) versus those that would require laying substantial political groundwork to make a reality (e.g. promoting carbon offsets for college travel). Inevitably, as we collected more information we modified our estimates, and the list of high-impact behaviors changed somewhat. For our first projects, we focused on those behaviors that were relatively uncontroversial and easy to get support for: turning off lights in unused classrooms, using cold water for washing laundry, and promoting biking and walking. We also sought to collect data that would help pave the way for more controversial projects (carbon offsetting).

With a short list of high impact behaviors to focus on, we began researching the barriers and benefits associated with them. We also collected data about the frequency of our targeted behaviors, to serve as a baseline against which to measure the success of future programs. This also allowed us to more accurately estimate the likelihood of changing a behavior and the frequency with which it was already in practice. We used a mix of social science methods, including quantitative surveys (administered online), focus groups, and observational research.

A random sample of faculty, staff, and students were invited via email to participate in online surveys that were tailored to that particular demographic (i.e., students were asked about laundry but faculty were not). To increase the response rate we provided a $50 raffle prize for each population group, and sent a reminder email 4 days after the initial announcement. Our response rate was 40 %. In addition to basic demographic information, we measured attitudes, motivations, and current behaviors related to energy use. We also explicitly asked participants to explain "what makes it hard" to engage in each target behavior, and "why might it be a good thing" to engage in each target behavior. These open-ended responses were content coded, and the most common themes were identified. We drew upon this information to design our interventions (described below).

We also invited a different random sample of faculty and students to participate in focus groups. Based on initial response rate, we actively recruited in certain contexts to ensure that important subgroups were adequately represented (e.g. varsity athletes, students of color). Any subgroup that might have significantly different behavioral patterns, schedule demands, cultural values, and/or needs should receive this kind of attention.

We incentivized the focus groups for students by offering $10 cash, which resulted in only a 7 % response rate. For varsity athletes the incentive was changed to a customized Chipotle burrito, and resulted in a higher response rate of 11 %. It is likely that any compensatory option that is valued but not easily accessible, off-campus food for example, would work well as an incentive for students. When we led focus groups with faculty and staff, we scheduled them at the end of the workday and during lunch. During both times, we provided the group with food

from a local restaurant, but not much of the food was eaten. It seemed like the faculty and staff were more internally motivated to attend the event than any external incentive.

In each focus group, we started by asking general questions about observations of energy use and sustainability on campus. From there, we moved into asking more detailed questions about how people felt they could reduce their energy use, what would convince others to lower their energy use, and what specific barriers were stopping them from being more energy efficient. We then asked the group about specific projects that we hoped to implement, and noted their reactions.

Finally, we observed targeted behaviors on location to see how the campus's actual behaviors related to the self-reported information collected through surveys and focus groups. For example, a team of three student researchers walked through dormitories and academic buildings at different times of day to see which central lounges, classrooms, and bathrooms had their lights on while not in use. Laundry rooms were checked to observe the settings students used for their laundry. The observations proved to be useful for several reasons. First, physically inspecting the spaces uncovered important structural barriers that needed to be considered in targeting behaviors and designing campaigns. For example, many lights in public spaces around campus are wired so that they cannot be turned off (for safety reasons). We also found discrepancies between what people reported doing (50 % of students reported they use cold water to wash clothes) and what we actually observed (0 % of running washing machines were set to cold water).

4 Testing Our Interventions: Two Field Studies

4.1 Encouraging Cold Water Washing

We identified the use of cold water for laundry as a high-impact behavior that would be relatively easy to change and currently not very common. Through focus groups, observations and an online survey, we found the main barriers that people face when trying to change their behaviors to be unclear marking to identify which button produced cold water (many machines said "bright colors" instead of cold water), habit (many students used the default setting each time they did laundry), family norms, and misconceptions about hot water cleaning clothes better. Additionally, many people were ignorant of the benefits of washing in cold water (i.e., that it helps clothes last longer), and had not thought about the environmental impact.

Our behavioral strategy used educational signs and point-of-behavior prompts to help dispel misconceptions, provide needed information, and remind people to use cold water. We created a sticker based on a project developed by the Urban Sustainability Directors Network (USDN) in conjunction with a consultant from Action Research called "Cool is Clean" (Piraino 2013). The removable stickers were adhesive and were put directly on the machines right next to or above the option

buttons, so that students had the information and reminder when they needed it. In addition to bumper stickers, we also designed posters to put in the laundry rooms. The posters stated clearly which option students should choose if they want to use cold water, dispelled myths about washing in hot water, and explained the benefits to clothes and the environment of using cold water.

We ran an observational study in three large dormitories on campus to test the change in campus behavior after the stickers were placed. Observations were made on Saturdays and Sundays, the most common days for doing laundry. During each observation, we recorded total number of machines that were running at the time, as well as the options that the users chose for their laundry. We made two observations per dorm before, and seven observations per dorm after the stickers and posters were placed. Before the stickers, none of the laundry machines observed were running with cold water (even though on an earlier survey 50 % of students self-reported that they used cold water while washing their clothes). After the stickers were in place, 45 % of the machines observed were using cold water. With a p-value of 0.04, we were able to conclude that this was a significant increase in the use of cold water.

By informing students with the posters about the benefits and providing reminders on the machines, we were able to reduce the project's main barrier: ignorance. There was a dramatic increase of cold water usage after the poster and stickers were put up. However in our assessment, 55 % of students were still not using cold water for laundry, so there is quite a bit of room for improvement. It should also be noted that we encountered several obstacles along the way: a first attempt used magnets instead of stickers, but the magnets very quickly disappeared after they were installed. We also discovered that all stickers were systematically removed over the summer. We learned that while we had communicated about our campaign to our sales representative, he had not communicated with our local service representative about the stickers. These instances help to illustrate the importance of ongoing assessment and evaluation, as well as the need for clear communication between program designers and all others. A full write-up of this intervention (and others) is available at http://new.oberlin.edu/office/environmental-sustainability/CBSM/.

4.2 Turning off Lights in Unused Classrooms

The lighting of academic buildings makes up a significant portion of the electricity use at Oberlin College. Observations of facilities and custodial staff suggested that lights are often left on even when no class is in session. In an effort to decrease electricity use, this study tested a simple and cost effective way to encourage people to turn the lights off when they leave a classroom. Focus groups at Oberlin College revealed that students simply forget to turn out the lights or do not feel authorized to manipulate lights in a public space.

To address the barrier of forgetting, our study utilized prompts. Previous research (Werner et al. 2012; Luyben 1980; Delprato 1977) has suggested that the use of prompts in the form of simple signs is an effective strategy to help people remember to turn off the lights. A prompt is most effective when it occurs directly before the targeted behavior, when it gives direct instructions for behavior, and when it encourages positive behaviors (McKenzie-Mohr 2011). We placed our signs on the inside of doors (where people look when exiting a classroom) and tested two different designs, to see which would be most effective. One version simply gave direct instructions for the behavior ("Please turn off the lights"), while the other included a picture of a popular celebrity (Jimmy Fallon) pointing at the viewer (in order to assign a sense of responsibility) with the words, "Please turn off the lights if you're the last one out."

We ran an observational study in an academic building with 24 classrooms. We collected data twice per day (at noon and 4:30 pm) for two weeks before and after putting signs up. Each round of data collection involved visiting each classroom and recording whether or not the lights were on, and whether or not there was anyone in the room. Before the signs were posted, lights were left on 69 % of the time in unoccupied rooms, and 90 % of the time in occupied rooms. After the signs were posted, lights were left on 43 % of the time in unoccupied rooms, and only 70 % of the time in occupied rooms. Both of these decreases were significant ($\chi^2 = 44.26$ and 14.61, respectively, p's < 0.001). There was no difference between morning and afternoon times, and no differences between the two sign types.

This very simple intervention did result in behavior change over a two-week period. However, our study does not address the lasting impact of prompts beyond two weeks or the potential effects of habituation over time. There is also still room for improvement, as lights in unoccupied rooms were still left on 43 % of the time. Future research will test other sign designs, placement of the signs, the durability of the effect, and the addition of an educational component.

5 Conclusion: Implementing CBSM Research Programs on Other Campuses

How can other institutions get started with a CBSM behavior change campaign? Some minimal level of institutional support is necessary. Oberlin's commitment to climate neutrality provided a clear institutional mandate for our project. However, for institutions that do not have such a clear commitment to sustainability, there are other compelling arguments for a CBSM program: it provides a valuable educational experience for students and it saves the institution money. A small budget is also helpful, to provide incentives to survey and focus group participants. However the most important factor is assembling a team of committed people with particular skills and abilities.

It is important to have someone who is comfortable with basic research design, quantitative analysis, and the ethics review board process. The experimental designs and corresponding statistics tend to be fairly basic, but they do require some expertise. At many institutions this will most likely be a faculty member. Training in CBSM is not essential; the free resources available online provide excellent guidance in the details of the approach. Nor is it essential that the research specialist make a large time commitment. Someone could serve this capacity in an advisory role.

Another key ingredient is students who can perform much of the labor, ideally for course credit or for student wages. Designing surveys, collecting and analyzing data, developing interventions, and testing them all require time and energy. Yet they are also experiences that are immensely valuable to students. Students often learn research and statistical skills through canned projects and fake data sets. Contextualizing learning in real world problems increases student motivation and improves retention. At Oberlin, students have gained experience with a wide range of research skills, including: literature reviews, conducting interviews, recruiting representative samples, running focus groups, minimizing response bias, collecting observational data, designing and deploying surveys, data analysis, presenting at conferences, and report writing (including this chapter!). Committed and diligent students who have had some research methods and statistics training can, under the guidance of a faculty mentor, perform most of these research-related tasks.

The final key ingredient is a faculty or staff member who can effectively connect the research team with the rather long list of relevant stakeholders. Finding a champion in a sustainability office or facilities office would be particular useful. Regular communication with all stakeholders is absolutely essential for success. For example, we presented to and sought feedback from union leaders before we surveyed union employees; we sought feedback on our list of behaviors from people as diverse as the Chief Financial Officer to members of the maintenance staff. We made particular effort to engage staff working in Facilities Operations as well as Residential Education, as most of our interventions intersected with their work. Communication of this nature is time consuming, and can often feel as if it is uncovering more obstacles than it is resolving. Short-circuiting the process of stakeholder engagement will not save time, however. Obstacles—both real and perceived—will be there. It is better to discover them early in the process, in a spirit of mutual collaboration, rather than later when resources have been invested and toes have been stepped on.

One final point worth noting is that there can sometimes be a tension between the most expedient approach from a sustainability perspective and the most educational approach. As institutions of higher learning, colleges and universities should consider not simply which behaviors are most impactful on campus, but what the impact of changing habits will be beyond the campus. For example, the most effective way to reduce the use of hot water for laundry is to simply plumb all machines to receive only cold water; many institutions take this approach. In the future Oberlin will pursue a hybrid strategy, in which all machines in a laundry room but one will be plumbed to receive cold water only; students will thus still

have the choice to use hot water, but it will be significantly constrained. The educational campaign will remain in place so that students learn and internalize the benefits of using cold water. Similarly, Oberlin's electricity portfolio is becoming increasingly renewable; in terms of carbon reduction turning off lights will have a smaller and smaller carbon impact. We chose to encourage electricity conservation behaviors anyway, for three reasons. First, students and faculty are creating habits that they will take into other communities that have less renewable portfolios. Second, demand that exceeds the capacity of Oberlin's renewable resources comes from carbon-intensive sources (typically coal), making it important to keep electricity demands as low as possible. Finally, the institution still pays for the use of electricity; reducing the utility bill allows resources to be spent in more mission-critical ways.

In conclusion, Community Based Social Marketing is a highly effective approach to promoting sustainable behavior on college and university campuses. Although the focus of our work has been on carbon reduction, CBSM can be used to promote any sustainable behavior (e.g. recycling, waste reduction). The benefits to the institution are many: behavior change programs are typically much cheaper than technological or infrastructure upgrades. They usually result in cost savings as well as environmental benefits; and if done correctly they also contribute to the educational mission of the institution.

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Authors Biography

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Material Values, Goals, and Water Use: Results from a Campus Residence Hall Survey

Kala J. Melchiori, Robyn K. Mallett, Aaron N. Durnbaugh and Hanh D. Pham

Abstract

The social sciences, psychology in particular, offer a growing body of research to address sustainability issues. We specifically turn to the psychological literature on values and goals to predict eco-friendly behavior. Material values, such as the desire to gain happiness from purchasing products, predict consumption behavior (Richins and Dawsons in J Consum Res 19(3):303–316, 1992). We test whether material values predict water use, and whether the relationship will be mediated through the competing goals to conserve resources and maintain personal comfort. Specifically, we hypothesize that people will use more natural resources when the goal for personal comfort outweighs the goal to conserve resources (Gaspar in Sustainability 5(7):2960–2975, 2013). 269 residence hall students completed an online survey that included the Material Values Scale, a conservation goal item, and a personal comfort goal item. Students also reported water use, including shower time and dish washing habits. As predicted, material values, the conservation goal, and the comfort goal independently predicted water use. However, only the personal comfort goal explained the relation between material values and water use. To increase the likelihood of behavior change, campus water conservation campaigns should try to activate the goal to conserve resources, like reminding students to shorten showers, while dissuading material values, possibly by emphasizing the value of experience over consumption.

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Ecopsychology · Water conservation · Campus sustainability · Residence halls

1 Introduction: Water Conservation

Access to potable, sanitary water is a present and mounting global concern. Over 11 % of people worldwide do not have access to sanitary drinking and bathing water, leading to approximately 3.5 million deaths each year (UNEP et al. 2010). Climate scientists estimate that the number of people living with water scarcity will double by 2025 if current trends continue, primarily because climate change will increase the salinity of ground water and cause greater variability in precipitation (Attari 2014). Conserving water will ensure there is enough potable, sanitary water for people, animals, and agriculture in the decades to come. Furthermore, water conservation helps to ensure that aquatic species that are sensitive to water temperature and depth will continue to thrive and keep our ecosystem in balance. Water conservation efforts are an essential step that individuals and institutions must take in the face of climate change, pollution, and a fast-growing world population.

The average person needs just over 13 gallons of water per day for food preparation and to maintain proper hydration, sanitation, and hygiene (Gleick 1996), yet the average United States (US) citizen uses 98 gallons of water per day (Kenny et al. 2009). Many US citizens are unaware of their water waste. On average, US citizens underestimate the water used in everyday activities by at least half (Attari 2014). Simple actions can make a dramatic decrease in water consumption, including decreased but strategic watering of lawns and gardens, shortening showers, and turning off faucets when not in use. However, even when people are aware of the importance of conservation and their water use habits, they still face psychological barriers to engaging in water conservation behavior (Gaspar et al. 2011). Given that individual change is essential for sustainability, it is paramount that the social sciences address ways to encourage water conservation behavior.

Universities and colleges continue to be at the vanguard for advancing sustainability initiatives. Through campus building plans, energy infrastructure, heating and lighting controls, and equipment and material selection, universities have numerous opportunities to engage in conservation action. However, while eco-friendly facets of college campuses can influence student behavior (Too and Bajracharya 2015; Watson et al. 2015), institutional strategies will only take us so far in addressing environmental sustainability. Social science, and specifically conservation psychology, has an important contribution to make in advancing eco-friendly behavior (Steg and Vlek 2008). Additionally, the young adults who inhabit higher education campuses are at an important time in their identity development (Krosnick and Alwin 1989). Students are in a unique position to incorporate eco-friendly aspects into their identity, which can shape behavior for a significant time after they leave the university setting.

1.1 Barriers to Eco-friendly Behavior

Environmentalism is a classic psychological *commons dilemma* whereby humans depend on a common resource (e.g., water, energy) which they are entitled to share with others (Hardin 1968). The fact that individuals profit from other's conservation whether or not they personally sacrifice for the greater good explains, in part, why few people consistently engage in eco-friendly behavior despite widespread support for environmentalism (Dunlap 2002). In a commons dilemma the group fares best when everyone cooperates, but individuals benefit by selfishly consuming as much of the resource as possible (Hardin 1968). Pro-social behaviors like eco-friendly or conservation behaviors operate against self-interest because they present many perceived costs and few immediate benefits. One must sacrifice income to purchase organic food or hybrid cars and one must sacrifice time and convenience to recycle and engage in environmental activism.

Once people understand why they should and how they can engage in eco-friendly behavior and are free from structural barriers, like the absence of a water meter in their home, they must overcome several psychological barriers that often lead to inaction (Gaspar et al. 2010). Gifford (2001) identifies 29 unique psychological "dragons of inaction." We consider four psychological "dragons" that may be especially likely to find a home on college campuses. First, we discuss *psychological distance*, as campuses generally are home to young adults who perceive future events differently than older adults. Second, *perceived costs* may be especially important for young adults, who may have less income to put towards eco-friendly actions. Third, young adults are particularly sensitive to *social norms*, and college campuses offer a unique social environment in which to form locally-based norms. Fourth, young adults may be especially open to exploring and shifting their personal *behavioral goals*.

Psychological distance. Many environmental issues are construed as temporally and geographically distant, especially when people live in relatively wealthy countries like the US. Even when people understand that environmental change is occurring, they often fail to change their behavior in absence of personal experience with extreme weather events (van der Linden 2014). Personal experience with the effects of climate change brings the phenomenon psychologically closer, inducing both negative affective reactions to and increased perception of the personal risk of climate change. As a result, feeling negative affect and perceiving personal risk after an adverse weather event should increase the likelihood of eco-friendly behavior. However, people living in most regions of the US are, at this time, less susceptible to extreme weather or other events that would decrease access to potable water and thus spur water conservation behavior.

Perceived costs. Rational-economic models of eco-friendly behavior suggest that people engage in behaviors that will save or earn them money (Froehlich et al. 2010). Therefore, people are more likely to engage in eco-friendly behavior if it costs them less than not engaging in the behavior (i.e., people will conserve water if they believe it will substantially reduce their water bill). Sunk costs also represent a barrier to eco-friendly behavior change (Gifford et al. 2011). For example, if

homeowners have spent a considerable amount in repairing an inefficient water heater over the years, they are unlikely to buy a new, efficient water heater because of their perceived investment in the older model, even if the new model would result in a net gain in future savings. However, there are other competing "benefits" besides water consumption that may outweigh the economic benefit, most notably personal comfort (Horhota et al. 2014). In the moment, people may not view saving a few cents as an economic necessity when weighted against enjoying a long, warm shower.

Social norms. Social norms also play a role in our decisions to engage in eco-friendly behavior. We actively perceive the behaviors of others and are more likely to engage in behaviors that seem typical and are encouraged by those around us (i.e., behaviors that are *normative*; Cialdini et al. 1990; Kallgren et al. 2000). We are particularly likely to follow and internalize the norms of people with whom we share group memberships (Hogg and Abrams 1988). It is not yet the social norm within the US to conserve resources. On the contrary, social norms may work against eco-friendly behavior. If people do not think others are changing their behavior to better the environment, they are likely to resentfully refuse to change their own behavior to avoid enabling "free-riders" (Gifford et al. 2011).

Recent research indicates that social norms based on one's political identity may have a strong influence on eco-friendly behavior (Bliuc et al. 2015). While Democrats are likely to believe climate change science and support eco-friendly behavior and legislation, Republicans are likely to discount climate change science and either dissuade or deprioritize eco-friendly behavior and legislation. College campuses, however, can attempt to localize appeals to social norms to school identity in order to encourage students to adopt campus-specific eco-friendly norms (Ferguson et al. 2011).

Conservation versus personal comfort goals. One important, but as yet untested, way to increase eco-friendly behavior is to promote conservation over personal comfort via behavioral goals. The economic and community benefits should influence people to engage in conservation, yet the personal effort, cost required, and the fear of "free-riders" leads people to prioritize personal comfort. In fact, Horhota and colleagues (2014) found that a desire for personal convenience was a top barrier to sustainable behavior for college students.

Appealing to the goals of conservation and personal comfort directly may be one way to overcome other psychological barriers to eco-friendly behavior, even without directly addressing the other barriers. For example, merely making one's responsibilities to their community and future generations salient (i.e., promoting conservation goals) while highlighting the nobility of personal sacrifice (i.e., working against personal comfort goals) may increase eco-friendly behaviors. As noted by Too and Bajracharya (2015), green product manufacturers are aware of the tendency for people to rely on personal and material comfort, and often appeal to environmental ideals in order to sell their eco-friendly products. Coupling direct appeals for conservation and against personal comfort with campaigns that target other barriers, like perceived costs or social norms, could strengthen the effectiveness of environmental educational campaigns.

1.2 Values and Eco-friendly Behavior

At times, making an eco-friendly choice requires a perceived sacrifice of convenience or comfort. For that reason, it is important to understand how psychological values promote eco-friendly options and push people to choose conservation of resources over comfort. Values inform our goals and underlie attitudes and behavior (Rokeach 1973). People typically act in ways that reflect their values (Oskamp and Schultz 2005) and are dissatisfied with themselves when they become aware that their behavior is inconsistent with their values (Rokeach 1971). The more people report being guided by a value, the more they believe it is normative or appropriate to engage in value-congruent behavior (Cialdini and Trost 1998). For example, as environmental values increase so does willingness to engage in eco-friendly behavior (Bamberg and Moser 2007; Karp 1996; Schultz et al. 2005; Stern 2000). Moreover, learning that one underperformed in a valued domain relative to peers creates negative affect and motivates one to change the problematic behavior (Collins 1996).

Most psychological research on eco-friendly behavior draws from Schwartz's (1992, 1994) work on values. Schwartz proposes that people's values fall somewhere along a dimension from self-enhancement to self-transcendence. Where people fall on that dimension reflects how much they prioritize their own interest versus the interest of others. People who value self-enhancement make choices that contribute to personal well-being and comfort whereas people who value self-transcendence make choices that contribute to the greater good, even if it comes at a personal cost. Psychological research suggests that self-enhancement values, or an egoistic value orientation, are very strong motivators and direct goals that maximize one's own interests and personal comfort, irrespective of others' goals (Stern et al. 1993). Egotistic value orientations are especially influential when people are not particularly concerned with the environment.

Egoistic orientations often promote material values, which revolve around the desire to gain happiness from and structure one's life around purchasable products (Richins 2004; Richins and Dawsons 1992). Material values are a reliable predictor of consumption behavior. When materialistic values become central to a person's worldview, well-being may suffer because it becomes increasingly more difficult to attain the experiences necessary to satisfy materialistic needs. An emphasis on material values conflicts with the desire to make the world a better place and with the desire to protect the environment (Schwartz 1996). Conserving resources requires that a community build and maintain trust that everyone is working toward the same goal, as opposed to forwarding each person's unique, materialistic goals.

Many western societies, including the US, are guided by competing values that encourage both self-enhancing and self-transcending behaviors (Schwartz 1992). Consequently, it is not always clear which set of values is in effect and what behaviors are the most appropriate at any given time. Norm Focus Theory (Cialdini et al. 1991) suggests that when a behavior is subject to competing norms, norms that are both important and salient are considered to be the appropriate standard of behavior.

Material values may come to the forefront in situations where people experience a threat to the fulfillment of basic psychological needs for autonomy and competence (Ryan and Deci 2000). If people do not feel like they are in control of their lives, they may focus on things they can control such as purchasing material goods. The transition to college is ripe with threats to autonomy and competence. Students often experience living on their own for the first time. Moreover, constant feedback in the form of assignments and tests may make students question competence. As a result, students may prioritize consumption and comfort over conservation.

Conservation behavior may only win out when the goal to conserve overpowers the goal of comfort. Goals are desired states, such as a behaviors or behavioral outcomes, which are rewarding to engage in or to attain (Dijksterhuis and Aarts 2010). People commonly have multiple goals at any point in time, which produces goal conflict. Often only one goal is implemented into behavior. The winning goal depends on personal priorities, and people often prioritize their own well-being (Stern et al. 1993). Even when people know how to act responsibly, their behavioral goal to conserve must outweigh their goal for personal comfort for them to engage in eco-friendly behavior (Gaspar 2013). Thus, even people who care strongly about the environment do not always act in ways that protect the environment; this is known as the *value-action gap* (Chaplin and Wyton 2014; Kollmuss and Agyeman 2002).

1.3 Campus Environmental Interventions

Campus sustainability initiatives can serve as real-life examples of sustainability leadership providing practice, experience, and daily reminders that sustainable alternatives are possible (Cortese and Hattan 2010; Erickson and Skoglund 2008). As campuses reach higher levels of structural environmental sustainability, an individual's effort to conserve resources becomes a more significant factor. In energy, water, transportation, and other key environmental areas, the top-down approach may reach the limit of its impact whereupon additional conservation goals cannot be met without user participation. At that point, it becomes necessary to design strategic, campus-level behavior change interventions that support and promote environmentally responsible decision making at the individual level. Residence halls, in particular, offer a unique opportunity to psychologically nudge individual students into engaging in conservation behavior (Shriberg 2000).

Individual level decisions are often made with incomplete or inaccurate information. Moreover, sustainability activities can be, or perceived to be, inconvenient or financially costly. In the case of financial decisions, there are often marketing, advertising and other social cues that actively work against conservation, efficiency, or otherwise beneficial behavior (Thaler and Sunstein 2008). For example, abundant, well-stocked display cases with colorful plastic bottles make buying bottled beverages attractive and easy, and the sporadic presence of water fountains with short, weak flows dissuade relying on water in a reusable container for hydration.

Campbell-Arvai et al. (2014) found that making meat-free meal options the default on dining hall menus significantly increased students who opted for a vegetarian meal. People rarely wish to exert additional effort, especially when doing so is seen as going against the norm. By making a meat-free meal seem like the normative, default choice on a residence hall dining menu, the researchers were able to nudge students' choices in a more sustainable direction. Such nudges make the sustainable choice easy and more traditional choices more difficult, though not impossible.

The literature on behavior-focused programs in the higher education setting is limited and has traditionally focused on energy use or general environmental awareness. There is evidence that students are receptive to campus environmental campaigns and are often willing to adopt eco-friendly behaviors (Parece et al. 2013). For example, campus efforts that featured feedback tools such as self-audits (Savageau 2013) and energy use dashboards (Bloodhart et al. 2013) show some promise for behavior change. A new generation of energy conservation technology are coming forth from companies such as Lucid (Mok 2015) and Opower (Allcott and Mullainathan 2010) which provide real-time feedback on consumption. Petersen et al. (2007) found that providing students in residence halls feedback on energy consumption and introducing competition between residence halls was effective at decreasing energy consumption. Unfortunately, institutions often do not have the infrastructure or resources to use real-time feedback technology, therefore evaluations of the efficacy of behavioral cues and reminders to targeted audiences are still needed.

College students are a promising population to target for behavioral change as they are often living on their own for the first time, developing new habits, behaviors, and defining their identity. Campuses already support students in determining their values and identity in a number of ways. Therefore it may be relatively easy to increase campus efforts to support eco-friendly identities and goals while dissuading values and goals that may be detrimental to eco-friendly behavior.

2 The Present Study

We hypothesize that material values predict water use, and that the relationship will be mediated through the competing goals to maintain personal comfort and conserve resources (see Fig. 1). Specifically, we predict that as people's endorsement of material values increases, so will their water use. However, the relationship between material values and water use will be explained by the goal for personal comfort and the goal to conserve resources. As material values increase, the personal comfort goal will increase but the conserve resources goal will decrease. In turn, as personal comfort goals increase, water use will increase, but as the conserve resources goal increases, water use will decrease. When both the personal comfort goal and the conserve resources goal are included in the statistical model, the predictive value of material values for water use should lower, demonstrating the typical mediation effect.

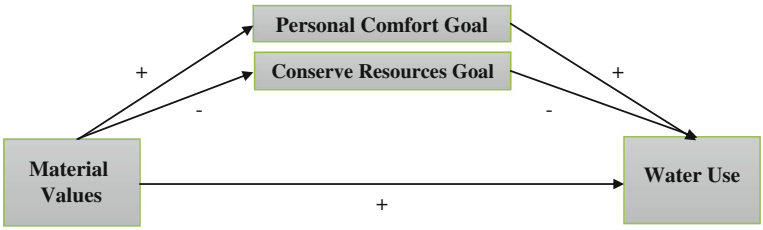

Fig. 1 Predicted mediation model where the material values-water use relation is explained by the personal comfort goal and the conserve resources goal

3 Method

3.1 Participants

We conducted an online survey of 269 undergraduate students living in apartment-style residence halls at a private Midwestern university. The average age was 19.48 years (SD = 0.78), and students were predominately White (n = 190; 41 Asian, 40 Hispanic/Latino, 16 other, 8 Black, 8 Native Hawaiian or Pacific Islander, 2 American Indian, 8 other race/ethnicity) and female (n = 192; 75 male, 2 transgender). The majority of students reported that they had spent most of their lives in suburban areas (n = 193; 50 urban, 26 rural), and most students were from the US Midwest (n = 214; 23 West, 14 Northeast, 12 South, 4 Alaska/Hawaii, and 10 non-US natives). All participants were offered a coupon for a large coffee or tea from a local cafe (valued at $3) in exchange for their participation.

3.2 Materials and Procedure

Students first completed a short form of the Material Values Scale on a 1 *strongly disagree* to 7 *strongly agree* scale (α = .67; Richins 2004). The items were "I'd be happier if I could afford to buy more things," "My life would be better if I owned things I don't have," "I usually buy only the things I need" (reverse-scored), "I like to own things that impress people," "I try to keep my life simple, as far as possessions are concerned" (reverse-scored), and "The things I own say a lot about how well I'm doing in life."

Next, we measured goals with two items using a scale ranging from 1 *strongly disagree* to 7 *strongly agree*. The conservation goal item stated, "It is personally important to me to conserve natural resources," and the personal comfort goal item stated, "I prioritize my personal comfort over everything else."

Students then reported water use, including the average length of their showers, how many showers they took in a week, if they turned off the water while brushing their teeth, and if they turned off the water while washing dishes. We summed these

items to create a water use variable (*range* = 10–29; higher numbers indicate greater water use).

Lastly, participants reported demographic information, including age, gender, race, and geographic origin.

4 Results

We tested whether people prioritized the conservation or comfort goal using a paired-samples t-test. People reported their goal to conserve resources (M = 5.29, SD = 1.34) outweighed their goal for personal comfort (M = 4.29, SD = 1.35), t (264) = 7.90, $p < .001$.

Next we examined whether the conservation goal and comfort goal mediated the relationship between material values and water use. We used the PROCESS (model 4; Hayes 2013) macro for SPSS to test for simple mediation. This analysis is similar to regression except that all paths are simultaneously estimated. The PROCESS macro uses a bootstrapping approach, generating 5000 samples with replacement. Material values, the conservation goal, and the comfort goal independently predicted water use. As predicted, the association with water use was positive for material values and the personal comfort goal and negative for the conserve resources goal. Interestingly, only the personal comfort goal mediated the relation between material values and water use (Table 1). Thus we found support for all but one path (material values-conserve resources goal) of our predicted model (see Fig. 2).

Table 1 Testing the goal to conserve and the goal for personal comfort as mediators of the relation between material values and water use

Description of estimated path	Estimate (SE)	95 % confidence intervals lower/upper
Material values → goals (conserve and comfort) → water use		
Total effect of material values on water use	.46 (.20)*	
Direct effect of material values on water use	.46 (.20)*	
Indirect effect of material values on water use through goals	.26 (.10)	.09/.46†
Material values → conserve goal → water use		
Material values to conserve goal	−.11 (.09)	
Direct effect of conserve goal on water use	−.66 (.14)**	
Indirect effect of conserve goal as a mediator	.07 (.06)	−.04/.21
Material values → comfort goal → water use		
Material values to comfort goal	.35 (.08)**	
Direct effect of comfort goal on water use	.54 (.14)**	
Indirect effect of comfort goal as a mediator	.19 (.07)	.08/.35†

*$p < .05$ **$p < .001$ (significant direct path)

†Confidence Interval did not include zero, indicating the indirect path is significant

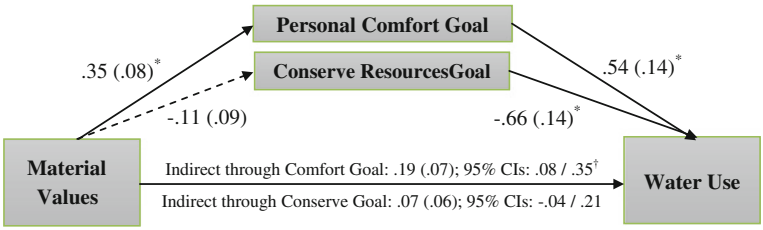

Fig. 2 The material values-water use relation is explained by the personal comfort goal but not the conserve resources goal. *$p < .001$ (significant direct path). †Confidence Interval did not include zero, indicating the indirect path is significant

5 Discussion

In our sample of college students living in apartment-style residence halls, water use was influenced by material values, the conservation goal, and the personal comfort goal. The more strongly students endorsed the goal to conserve resources, the less water they reported using. The more strongly students endorsed the goal to pursue personal comfort, the more water they reported using. Interestingly, valuing material goods did not suppress one's desire to conserve resources.

But, even though people reported conservation was more important than personal comfort, the personal comfort goal, rather than the conservation goal, explained the association between material values and water use. Students, on average, were moderately materialistic ($M = 3.83$ on a 1–7 scale), suggesting that most students have an opportunity to decrease their material values. In order to break the link between material values and the personal comfort goal, interventions should highlight other values or expressly dissuade materialism.

Gaspar (2013) differentiates between barriers, or inhibitors of goal activation, and constraints, or factors that strengthen/weaken goal pursuit, to eco-friendly behavior. Our data indicates that the goal to conserve resources may be weakened by barriers to goal activation. In contrast, material values may constrain water conservation via strengthening the goal for personal comfort. While much attention has been paid to behavioral barriers in the psychological literature on environmental behavior, there has been less research on behavioral constraints. Therefore future social science work should explore other potential constraints on pursuing the goal to conserve resources. For example, emphasis on future generations or future students at one's university may be one way to reduce material values and strengthen the desire to conserve resources.

6 Conclusions

Our study has direct implications for colleges and universities who wish to encourage campus residents to conserve resources. We propose that campus water conservation campaigns may have more success by simultaneously activating the goal to conserve while dissuading material values, like providing reminders that emphasize the value of experience over consumption. For example, a poster campaign may include some materials that activate the goal to conserve resources by reminding students of their eco-friendly behavior goals or presenting a reminder of eco-friendly actions that students can easily engage in (e.g., posters that encourage students to shorten showers). Other posters might seek to address material values by emphasizing the importance of experiences over possessions or helping one's community over consumption or individual gain.

We have used the information included here to influence material values, personal comfort goals, and conservation goals in an ongoing project on a Midwestern university campus. Some students in apartment-style residence halls will be exposed to an educational campaign featuring posters, stickers on items like dish soap and toothpaste, signs near showers, a water conservation pledge, and residence hall-wide programming. Our posters and stickers are designed to make eco-friendly behavior seem normative via priming school identity with the slogan "Ramblers Conserve Water" and featuring pictures of a well-known and liked campus staff member conserving water. These attempts should increase student's goals to conserve resources. The posters' focus on campus community identity should also decrease material values by focusing attention on one's collective well-being instead of personal comfort.

Future work should determine if the relationship between material values, goals, and water consumption is replicable at regionally, demographically, and culturally different campuses. One limitation of the present study is that it was conducted at a Midwestern Jesuit institution that has a predominately White, middle- and upper-socioeconomic status population. As values are largely shaped by cultural factors such as region, ethnicity, and SES, there may be several demographic modifiers to the relationship between values, goals, and water use. Furthermore, as members of a social justice-focused Jesuit institution with an explicit emphasis on sustainability initiatives, our participants were in a key position to align their values with the explicit values of the university. For example, some students who were attracted to the social-justice mission of the university may have had very low material values, therefore making our student population more diverse on material values than the student population on other campuses. Therefore we encourage replications of our work at non-Jesuit colleges or universities that have not adopted an environmental agenda.

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Understanding Recycling While Tailgating: Applying an Information-Motives-Behavior Skills Approach

Stephanie J. Zawadzki, Forrest G. Schwartz, Jordan C.E. Blair, Eric C. Larson and Jennifer N. Newton

Abstract

At large sporting events, venues often include multiple ways stadium spectators can recycle. However, outside the stadium, tailgaters often make up a large percentage of the event's attendees and yet may have unaccounted barriers to recycling. This paper uses both observational and survey data to examine the recycling behavior of tailgaters at an American Division I University's football events. Surveys revealed high reported intent to recycle, but observed behaviors revealed lower rates of recycling (48.7 %). Many of the tailgaters observed (40.7 %) used their own waste disposal bags, which was associated with decreased use of the venue's recycling infrastructure. Large groups not only used more of the venue's infrastructure, but were also more likely to use the venue's bags over bags they brought from home. Greater knowledge about the venue's infrastructure, higher motivation to recycle, and higher behavioral capacity to recycle were associated with increased reported recycling behavior. Certain groups, like alumni, those who tailgate frequently, and tailgaters who recycle at home reported the highest levels of predictors of recycling. Implications for future interventions and facility managers are discussed.

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Interdisciplinary research · Behavior change · Large venue · Recycling · University setting

1 Introduction

Academic institutions are increasingly recognizing the potential detrimental impacts they pose to the natural environment. In attempt to mitigate some of these consequences, various universities have enacted measures to promote the sustainability of their institutions by enhancing energy efficiency, reducing petroleum-based transportation, and limiting the production of waste (The Association for the Advancement of Sustainability in Higher Education 2013). For example, The Pennsylvania State University (PSU) adopted the goal to make PSU a zero-waste institution.

While efforts have proven successful in integrating sustainable practices into some aspects of the university's operations (e.g., housing, food services), concern has been raised over the ability to achieve zero-waste at sporting events. Moreover, waste managers have expressed concerns over the effectiveness of enacted measures at football games. This concern is particularly relevant for the 200,000 or more tailgaters at each game, who camp and socialize at each event just outside the stadium, sometimes for days before the game starts. These and other sporting events pose a significant barrier not just to Penn State and its goal of zero-waste but to other campuses and their overall ability to be a sustainable, and environmentally conscious institutions.

In order to increase tailgater engagement in recycling, it is necessary to examine current recycling levels, and identify constraints to recycling specific of football tailgaters (McKenzie-Mohr 2000; McKenzie-Mohr et al. 1995). Thus, the primary purpose of this paper is to utilize a social psychological approach to better understand tailgater recycling engagement on campus. Doing so will provide Penn State with information needed to work toward becoming a zero-waste institution. Further, it will help other institutions overcome similar sustainability challenges associated with large sporting events.. To do this, we examined the applicability of Psychology's information-motives-behavior skills (IMB) model of behavior change to recycling at tailgates by utilizing a Sociological multi-method quantitative approach. The IMB model offers a unique, but powerful frame to study recycling behavior at large events. A frame that is particularly suited to study large events that are made up of smaller groups, such as tailgates.

2 Identifying the Scale of the Problem

Boasting the second largest football stadium in the United States (Beaver Stadium), State College, Pennsylvania receives a large influx of people to attend football games and participate in tailgating. PSU football games and associated activities (tailgating) bring over 200,000 individuals to the 110 acres surrounding the football field (PSU Sustainability Institute 2013), effectively tripling the size of the town on game days. This temporary increase in population creates positive benefits, such as increased sales at local businesses. However, if poorly managed, there is potential for such activities to create negative environmental impacts.

The environmental impacts of sporting events have only begun to receive academic attention in a growing body of scientific literature. Most cite increased traffic resulting in excess carbon output and greater waste production from increased consumption (Collins et al. 2009; Lenskyj 1998). At PSU football games, it is estimated that those who attend the game and tailgating events produce anywhere from 50 to 150 tons of waste each game (A. Matyasovsky 2013, personal communication, 20 September; PSU Sustainability Institute 2013), of which only 20–35 % is recycled (A. Matyasovsky 2013, personal communication, 20 September). This increase in waste production has significant impacts on the environment, including increased resources related to waste removal, processing, and disposal. Without addressing the amount of waste produced at football events, PSU cannot meet its goal of becoming a zero-waste institution.

3 The IMB Model

Recycling behavior has drawn a wide range of attention from several academic disciplines since the 1970s (Hornik et al. 1995). Early studies predominantly focused on external incentives towards recycling, such as monetary rewards (Vining and Ebreo 1990). Subsequent research explored internal motivators, such as psychological facilitators in determining actual recycling behavior (Hornik et al. 1995).

To date, most studies on recycling behavior have focused on household or curbside recycling. Importantly, the determinants of recycling behavior in the public sphere have been found to be different from those in other environments (e.g. household recycling; Andersson et al. 2005). For example, studies conducted in the workplace demonstrated that the physical layout of workplace infrastructure (Marans and Lee 1993), workplace group norms (Tudor et al. 2007), and organizational support (Paillé and Borial 2013) had impacts on employees' recycling behavior.

Given their public nature and the fact that tailgating often happens in social groups, recycling behavior at sporting events is likely more similar to workplace behavior than private behavior. Very few studies to date have examined recycling behavior specifically at sporting events. In a qualitative study, McCullough and

Cunningham (2011) found that while participants had positive attitudes towards recycling, lack of recycling opportunities, misinformation about recycling programs, and lack of accessibility to recycling facilities made it difficult to recycle. They also found that in addition to family and friends, the athletic department of the university had strong influence on recycling intention.

Effective interventions are theory-based and informed by evidence gathered from the specific population (McKenzie-Mohr 2000). We selected the IMB model for our study because of its ability to identify possible avenues for intervention of behavior change (Darnton 2008), and its congruity with previous findings' emphasis on motivation, information, and behavioral barriers (Horhota et al. 2014; McCullough and Cunningham 2011; Mosher and Desrochers 2014; Mulder et al. 2015). The IMB model has commonly been used in preventative health behaviors, though it has also found traction in studies examining other types of behavior (Misovich et al. 2003; Osborn and Egede 2010). The IMB framework suggests information, motivation, and behavioral skills are fundamental determinants of changing behavior patterns (Fisher et al. 1994).

IMB posits that behavior is determined by three elements: *information* that is directly relevant to how to conduct the behavior, *motivation* to engage that behavior, and *behavioral skills* (objective/subjective ability) for performing that behavior. The theoretical mechanism is that information and motivation have direct effects on the behavioral skills "necessary for initiating and maintaining patterns" (Fisher et al. 1996, p. 115) of behavior. Information and motivation may have direct influence on behavior when there is no need for too complicated or novel behavior skills, such as recycling.

Seacat and Northrup (2010) were one of the first to utilize the IMB framework to predict pro-environmental behaviors, employing the model in a study of community-based curbside recycling behavior. Their findings suggest that while the IMB model significantly predicted curbside recycling behaviors in two communities, the relationships between these variables differed between them. Furthermore, they suggest that while the IMB model is useful in predicting recycling behaviors, relationships between information, motives, and behavioral skills are often site and context specific (Seacat and Northrup 2010).

While research efforts aimed to increase recycling at PSU football games have been on-going (EPA 2009), no one has examined the recycling engagement of tailgaters, the largest waste contributing group at football events (A. Matyasovsky 2015, personal communication, 3 March). To be effective, researchers and practitioners interested in designing interventions to increase recycling at tailgates must first identify potential barriers to that engagement (McKenzie-Mohr 2000; McKenzie-Mohr et al. 1995). Knowing the extent to which tailgaters' knowledge, motivation, and behavioral capacity to recycle influences their recycling behavior would be informative for future attempts to increase recycling. In the context of a sporting event, increasing information or ease of environmental engagement may be relatively easy and cost-effective ways to encourage behavior change.

4 The Present Research

The purpose of this study was to (1) examine the extent to which tailgaters are using the venue's recycling infrastructure; (2) determine who is most likely to recycle; and (3) identify possible avenues for future intervention. To do this, we collected both observational and survey data over the course of three football games. Based on the IMB model, it was hypothesized that people who (a) possess greater knowledge of how to recycle at the tailgating site; (b) are more motivated to recycle; and (c) report greater behavioral capacity to recycle at the venue, would report higher intent to recycle at the event.

5 Description of the Venue Infrastructure

The recycling program in Beaver Stadium began in 1996 with placement of recycling bins inside the stadium and throughout adjacent tailgating lots (EPA 2009). Approximately 15 student volunteers distributed roughly 2000 blue recycling bags to tailgaters. The waste disposal bags are colored to reflect the university colors: blue for recycling, white for waste. Recycling and trash bags were also available via bag dispensers attached to dumpsters and on 30 A-frame dispensers in the tailgating areas. Tailgaters also had the option to place their recyclables in the 290 blue recycling bins.

6 Procedure

Data were collected during three of the seven home games of the 2013 PSU football season in State College, PA. Individuals participating in tailgating activities were approached by a pair of researchers, explained the purpose of the study, and invited to take part in the survey. Nine independent observers worked in pairs. While survey respondents completed the questionnaire, both researchers collected observational measures.

Eleven lots were selected of the 35 tailgating lots around the stadium. Lots were chosen to provide a representative sample of potentially different group types: standard car lots, student lots, family lots (alcohol prohibited), recreational vehicle lots, and premium reserved automobile lots. Approximately 10 % of each tailgate lot was observed and surveyed. Tailgates were selected by picking every fifteenth car with the presence of at least one tailgater. In the absence of an observable tailgate at the fifteenth car, the tailgate immediately to the right of that vehicle was selected.

7 Participants

A total of 2741 tailgaters were observed. Most were men, between the ages of 31-55 and were wearing PSU apparel with no additional décor (see Table 1). The modal group size was 4 people. For the survey, 428 tailgates were approached, with 415 having at least one individual willing to participate in the survey. This resulted in a 97 % response rate. All data were collected prior to the start of each game to increase access to visible tailgaters. Only one individual per tailgate completed the survey and was selected based on their proximity to (the immediate right of) the first person that provided eye contact with the researchers. Survey respondent demographics generally reflected the group demographics (Table 1). Most

Table 1 Demographics of groups and individual survey respondents

Observations (group level)			
	Mean	SD	Mode
Group size	6.6	4.18	4
Estimated mean age	N	Percent	
18–30	142	34.2	
31–55	172	41.4	
55+	100	24.4	
Décor present	Amount	N	Percent
	No Décor	35	8.43
Home team	Apparel only	207	49.9
Home team	Apparel + Décor	159	38.3
Visiting team	Apparel only	0	0
Visiting team	Apparel + Décor	14	3.4
Avg. no. each gender	Mean	SD	
Men	3.91	2.61	
Women	2.7	2.46	
Survey respondents (individual level)			
Estimated age	N	Percent	
18–30	225	54.3	
31–55	156	37.6	
55+	34	8.1	
Gender			
Men	224	54	
Women	190	46	
PSU alumni	203	49	
PSU non-alumni	212	51	
	Mean	SD	
Tailgating frequency	2.66	1.42	
Recycle at home	4.51	0.87	

respondents were men, between the ages of 18–30, identified as PSU alumni, and reported to tailgate at every game.

8 Observational Measures

8.1 Waste Disposal Behavior

Researchers observed a number of tailgate group qualities, summarized here with their inter-rater reliability statistics. As respondents completed surveys, the research pairs counted the number of visible used (r = 0.81, $p < 0.001$) and unused (r = 0.59, $p < 0.001$) venue-provided waste bags, used (r = 0.89, $p < 0.001$) and unused (r = 0.62, $p < 0.001$) venue recycling bags, and used r = 0.80, $p < 0.001$) and unused (r = 0.70, $p < 0.001$) waste bags brought from home. Inter-rater reliability was satisfactory for all measures observed. In addition to being highly correlated, raters also showed high agreement on their observations with the largest inter-observer mean difference at 0.03.

8.2 Estimated Group Demographics

Researchers estimated overall group composition, the number of males and females in the group (coded 0 = male, 1 = female; $r_{men} = 0.94$, $p < 0.001$; $r_{women} = 0.94$, $p < 0.001$), modal estimated age (coded 0 = less than 18, 1 = 18–30 years old, 2 = 31–55, 3 = 56+; r = 0.81, $p < 0.001$), the amount of apparel/décor for either the home or opposing team (coded as 0 = nothing visible, 1 = apparel only, 2 = a mix of apparel and décor, 3 = a large amount of both apparel and décor; r = 0.65, $p < 0.001$). Due to survey length restrictions, researchers also estimated the gender (Kappa = 0.943, $p < 0.001$) and approximate age of the survey respondent (r= 0.85, $p < 0.001$). Again, inter-observer reliabilities were satisfactory for all measures. For the demographic observations all mean differences were 0.07 or less.

9 Survey Measures

To measure the self-reported amount of information, motivation, and behavior skills individual tailgaters had about recycling at the venue, respondents answered five questions on a 5-point Likert scale (1= “strongly disagree” to 5 = “strongly agree”) (see Table 2). Respondents then reported their intent to recycle that day with a single item “I am planning to recycle at today’s tailgate” with a 5-point Likert scale response (1 = “strongly disagree”, 5 = “strongly agree”). Respondents were asked whether they were PSU alumni (“yes” or “no”), whether they recycle at home (1 = “strongly disagree”, 5 = “strongly agree”), and how frequently they tailgate at the

Table 2 Survey measures

Skill	Items[a]
Information (α = 0.76)	I know the difference between a blue waste bag and a white/clear waste bag at Penn State tailgating
	I know which materials are recyclable
	I know where to leave my trash when I'm done tailgating a Penn State
	I know where to leave my recycling when I'm done tailgating at Penn State
	I know how to ensure that my recycling is collected by Penn State employees
Motivation[b] (α = 0.49)	Recycling at Penn State tailgates is important to me
	I'm concerned about what happens to my trash after I leave Penn State tailgates
	Recycling at Penn State tailgates is not a high priority during my time here
Behavior (α = 0.68)	Recycling at Penn State tailgates is inconvenient (reverse coded)
	Recycling at Penn State tailgates takes too much time (reverse coded)
	Recycling at Penn State tailgates is confusing (reverse coded)

[a]Measured on a 5-point Likert scale: 1= "strongly disagree" to 5 = "strongly agree"
[b]The motivation items showed low reliability (α = 0.49) and could not be improved with the removal of any items. Therefore, the single item most closely related to the motivation construct was selected to represent motivation in subsequent analyses: *Recycling at Penn State tailgates is important to me*

venue (1 = Less than once per year, 2 = Once per year, 3 = 2–3 times per year, 4 = 4–6 times per year, 5 = every game).

10 Analytical Strategy

In addition to statistical significance, all analyses were interpreted with an emphasis on practical significance. To help avoid the interpretation of correlations with inflated power caused by the large sample size, an absolute value Pearson product-moment coefficient of 0.3 was used as the cut-off for practical significance, though all correlation coefficients are reported (see Tables 3 and 4). As an indicator of strength of the linear relationship between two variables, a coefficient of 0.3 or higher indicated a relationship that was at least moderately strong (Cohen 1988).

Additionally, reviewing the means for the unused bags reveals possible floor effects, meaning the means for observed unused bags were so low that they are unlikely to produce meaningful effects (all Ms < 0.14). This may reflect a limitation of the observational measures: people may have kept their unused bags in their cars/RVs (hidden from observers' view), or had yet to obtain bags.

Table 3 Correlations of bag-use variables

	Mean	St. dev.	Bag-use variables				
			No. used PSU trash bags	No. used personal bags	No. unused PSU rec. bags	No. unused PSU trash bags	No. Unused Personal Bags
No. used PSU rec. Bags	0.52	0.60	0.62**	−0.22**	0.15**	0.13*	−0.03
No. Used PSU Trash Bags	0.50	0.61		−0.34**	0.18**	0.16**	−0.04
No. Used Personal Bags	0.42	0.63			−0.13**	−0.07	−0.02
No. Unused PSU Rec. Bags	0.11	0.35				0.48**	−0.02
No. Unused PSU Trash Bags	0.07	0.29					−0.02
No. Unused Personal Bags	0.06	0.78					

**$p < 0.001$

Table 4 Correlations of bag-use variables and group demographics

	Mean	St. dev.	Demographic variables					
			PSU gear	Opponent gear	No. women	No. men	Est. modal group age	Group size
No. used PSU rec. bags	0.52	0.60	0.33***	−0.07	0.19**	0.26***	−0.04	0.28***
No. used PSU trash bags	0.50	0.61	0.32***	−0.09	0.16**	0.22***	−0.04	0.23**
No. used personal bags	0.42	0.63	−0.02	0.05	0.14**	0.06	−0.02	0.11*
No. unused PSU rec. bags	0.11	0.35	0.04	−0.02	0.04	0.03	0.01	0.04
No. unused PSU trash bags	0.07	0.29	0.09	0.03	0.06	0.13**	−0.05	0.12*
No. unused personal bags	0.06	0.78	−0.01	−0.01	−0.05	−0.06	0.04	−0.07

*$p < 0.05$ **$p < 0.01$ ***$p < 0.001$

11 Behavioral Observations

11.1 How Much Are Tailgaters Using the Venue's Infrastructure?

Of 415 observed tailgating sites, 202 (48.7 %) were using the provided recycling bags (with and without other trash bags), which lessens the venue's environmental impact. 32 (7.7 %) were using only the venue's provided trash bags, which increases the venue's environmental impact. 99 sites (23.9 %) were using only personal trash bags. Their contribution to the venue's impact is unclear. It is possible that some of these tailgaters may have collected their recycling and taken it home with them to recycle there. However, those that left their bags at the tailgating grounds likely contributed to the venue's impact, because the grounds crew treat all personal waste bags as trash (A. Matyasovsky 2015, personal communication, 3 March). 69 (19.9 %) of tailgaters had no visible trash bags on site, and their contribution to the venue's environmental impact is unknown.

Based on possible associations revealed during correlation analyses (see Table 3), independent samples t-tests were conducted to examine the relation between bringing one's own trash bags and using the venue's infrastructure. Not

Table 5 Means and regression coefficients for information, motivation, and behavior skills, controlling for frequency of tailgating and home recycling behavior on reported recycling behavior at the tailgate

Variable	Means (SD)	Unstandardized beta	S.E.	Standardized beta	*t*	*p-value*
Intercept		−0.06	0.28		−0.21	0.84
Tailgating frequency	2.66 (1.42)	−0.03	0.03	−0.05	−1.24	0.22
Home recycling behavior	4.51 (0.87)	0.20	0.04	0.20	4.82	<0.001
Information	4.07 (0.78)	0.21	0.05	0.19	4.07	<0.001
Behavior skills	4.25 (0.78)	0.30	0.05	0.26	5.89	<0.001
Motivation	3.93 (0.77)	0.35	0.05	0.30	6.77	<0.001

$R^2 = 0.64$, R^2-adj = 0.41

surprisingly, groups who used personal trash bags were significantly less likely to use the venue's recycle bags, $t(413) = 4.45$, $p < 0.001$, and trash bags, $t(411.83) = 8.38$, $p < 0.001$ (see Table 5 for means). This suggests people who brought their personal bags from home may increase the environmental impact of the venue because it significantly decreases the likelihood they will use the venue's recycling bags.

11.2 Who Is Using the Venue's Infrastructure?

To investigate who was most likely to use the venue's infrastructure, we examined correlations between demographics (PSU gear, opponent gear, estimated age, and group size) and bag use. PSU gear was positively associated with more used venue recycle bags and more used venue trash bags, but not with used personal bags, (see Table 4).

Group size showed a significant, but weak trend of association with the number of used venue recycle bags, the number of used venue trash bags, and the number of used personal trash bags (Table 4). Because group size can be correlated with the amount of waste produced, the low correlation coefficients may reflect a limitation of the observational measures, like low trash bag visibility on each tailgating site.

To further explore possible relations between PSU gear, group size, and bag use, we divided group size into small (1–4 tailgaters), medium (5–7), and large (8+) groups, each category representing approximately one-third of the sample. A 3(-group size: small, medium, large) X 2(PSU gear: apparel only, more than apparel) X 3(bag type: venue recycling, venue trash, personal) mixed-model ANOVA revealed a significant main effect of bag type, $F(2720) = 11.56$, $p < 0.001$. There

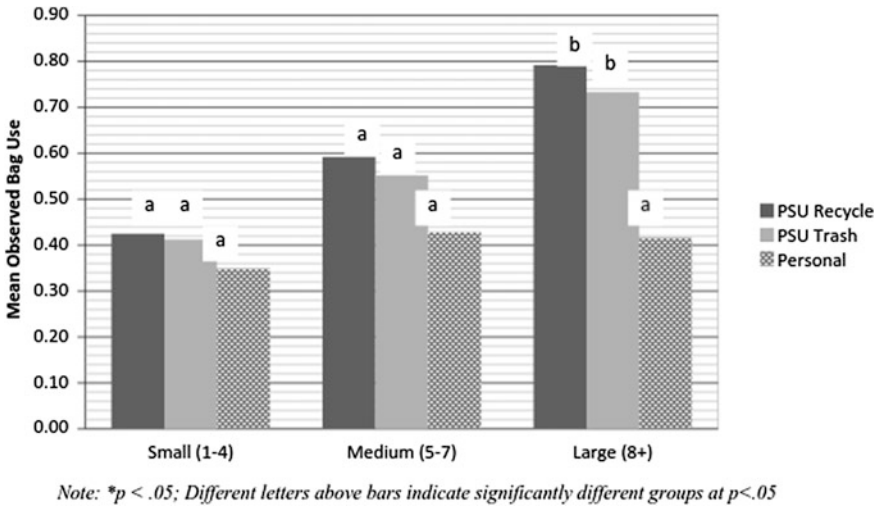

Fig. 1 Group size and bag type on bag use

were fewer personal bags observed than PSU recycling or trash bags. There was also a significant main effect of PSU gear, $F(1360) = 23.16$, $p < 0.001$. Sites with more PSU gear were observed using more bags.

Importantly, a marginally significant interaction between group size and bag type was also found, $F(4720) = 2.15$, $p < 0.07$ (see Fig. 1). Simple effects tests revealed that in addition to using more PSU bags than any other group, large groups were the only groups that were more likely to use more of the PSU infrastructure than their own personal bags.

12 Reported Recycling Behavior

12.1 Predictors of Recycling

Individual-level self-reported recycling behavior was weakly correlated with observed number of used venue recycle bags ($r = 0.263$, $p < 0.001$). Overall, respondents reported a high degree of knowledge, motivation, and behavioral skills about recycling at PSU tailgates (see Table 5). Additionally, the majority of respondents reported they were planning to recycle at that day's tailgate (90.6 %).

As predicted by the IMB model, regression analyses revealed knowledge about recycling at PSU tailgates, motivation to recycle at PSU tailgates, and behavioral skills for recycling at PSU tailgates were all significant predictors of reported recycling behavior at the tailgate (Table 5). Regression analyses also revealed the extent to which the respondent recycled at home as being a significant predictor of reported recycling behavior. Information, motives, and behavioral skills remained

significant predictors of reported recycling behavior when controlling for tailgating frequency and home recycling behavior.

Also included in the regression model was the respondent's reported frequency of tailgating and observer-estimated age of the respondent, neither of which were significant predictors of reported recycling behavior. Respondent gender and whether the respondent was an alumnus of PSU were also analyzed for predicting tailgating recycling behavior. A 2 (respondent gender: male, female) X 2 (PSU alumnus: yes, no) Analysis of Variance revealed that respondent gender and alumni status were not significant predictors of reported recycling at tailgates, all $Fs < 1.00$, all $ps > 0.30$.

12.2 Who Is Most Likely to Recycle While Tailgating?

Because the IMB model was supported in our tailgating sample, we then examined who among tailgaters was most likely to be high in information, motivation, and behavior skills. Independent-samples t-tests revealed that compared to non-alumni, PSU alumni reported higher information, $t(387.11) = 4.78$, $p < 0.001$, and behavior skills, $t(400) = 2.65$, $p < 0.01$, but not motivation ($t < 2.00$, $p > 0.20$).

Regression analyses revealed a similar pattern for frequent tailgaters (see Table 6). The more frequently respondents tailgated, the higher their venue-specific recycling information and behavioral skills were. No significant relations were found for frequency of tailgating and motivation. Importantly, home recycling behavior positively predicted all three constructs (Table 6).

Table 6 Regression coefficients for information, motivation, and behavior skills, tailgating frequency and home recycling behavior

Outcome	Predictor	Unstandardized b	Std. Error	Standardized b	*t*	*p-value*
Information	Tg freq.	0.194	0.025	0.351	7.64	<0.001
	Home beh.	0.166	0.041	0.184	4.011	<0.001
Motivation	Tg freq.	−0.009	0.026	−0.017	−0.366	0.72
	Home beh.	0.271	0.042	0.308	6.472	<0.001
Beh. Skills	Tg freq.	0.133	0.026	0.25	5.198	<0.001
	Home beh.	0.105	0.042	0.121	2.512	0.012

Note *Information* $R^2 = 0.16$, R^2-adj = 0.15; *Motivation* $R^2 = 0.10$, R^2-adj = 0.09; *Behavior Skills* $R^2 = 0.08$, R^2-adj = 0.07

13 Discussion and Conclusions

As expected, the IMB model was supported for predicting reported recycling behavior while tailgating. Tailgaters who were higher in venue-specific information, motivation, and behavioral skills were more likely to recycle than tailgaters who were low in these constructs. PSU alumni and people who tailgated frequently reported higher information and behavioral skills related to recycling while tailgating, but not necessarily motivation to recycle. Whether or not tailgaters recycled at home was a strong predictor of information and behavioral skills, as well as motivation.

Just over 40 % of observed sites were using trash bags from home. Perhaps not surprisingly, bringing one's own trash bags was associated with lower usage of venue provided recycling infrastructure. It is unknown what the contribution of these tailgaters were to the venue's environmental impact, because it is possible they sorted their recycling and then took the recycling home with them to ensure its proper disposal. However, they may have left their bags at the venue.

Interestingly, our observational results also suggest that large groups not only use more of the venue's recycling infrastructure than small and medium groups, but they are also the only demographic that is more likely to use the venue's infrastructure than their own personal waste bags. There was a difference between large groups and the others in the number of venue recycling and trash bags used, but not in the number of personal bags used. One possible explanation for this pattern is that large groups are bringing just as many trash bags from home as smaller groups are, but may run out and start using the venue's recycling and trash bags.

13.1 Practical Implications

The confirmation of the IMB model in predicting tailgater recycling behavior suggests that campaigns to increase recycling information and motivation should be audience-specific. More effective campaigns may aim to increase information and behavioral skills among non-alumni and people who do not tailgate frequently, since they were found to have lower levels of information and behavioral skills related to recycling than alumni and people who do tailgate frequently. Additionally, as a significant predictor of all three psychological constructs, home recycling behavior may be a key to future interventions. 91.3 % of respondents reported that they recycle at home. Campaigns that relate tailgating recycling behavior to home recycling behavior may be particularly effective in increasing recycling behavior among tailgaters.

Regarding the frequent use of personal waste bags we observed, these results also suggest that tailgaters who brought their own trash bags may be particularly unlikely to recycle because when they are organizing their trip, they are not planning to use the venue's provided infrastructure. Planning for a behavior has been shown to be a powerful predictor of behavioral engagement (for an extended discussion see Bandura 2001). They are instead planning to use their own trash

bags, which reduces the ability to have their recycling collected by grounds crew. Taken with the IMB model findings, these results suggest a particularly effective intervention may be to increase tailgaters' information about recycling at the venue prior to them entering the stadium grounds.

Future interventions may also want to specifically target large groups, since they are the biggest users of the venue's infrastructure. It may be beneficial to examine different ways of organizing the tailgating lots, such as grouping large parties together in several lots and concentrating more recycling facilities there. This type of intervention would help ensure that the infrastructure is readily available for those who are most reliant on it.

13.2 Limitations

This study had several limitations. First, observed recycling behavior was limited by visibility. Researchers could only observe waste disposal behavior that occurred publically. This limitation may have been particularly applicable for tailgaters who stored used and unused waste bags in their vehicles. Another major limitation of the research was that there was no way to verify if tailgaters were using the recycling infrastructure properly. We could only observe whether or not the provided recycling bags were being used. Future studies should examine to what extent recyclable materials were being sorted and disposed of properly in the venue's provided infrastructure.

Additionally, during data collection there were dramatic weather changes ranging from sunny to cold, intermittent snow. Finally and importantly, the survey instrument was not validated on the sample before data collection. In particular, motivation proved particularly hard to measure for people who were already quite energetic and motivated to do all they could to support the home team.

13.3 Moving Forward and Broader Implications

This research provided theoretical support for applying the IMB model to recycling at tailgating events, as well as shedding light on sociodemographic predictors of recycling engagement at tailgating events. In particular, our data suggested tailgaters possessed general knowledge about how to recycle at the venue, the behavioral capacity to recycle, and were motivated to do so. However, our observational results suggest that less than half of tailgaters may be recycling. A particularly effective intervention may be to increase tailgater information about the recycling infrastructure prior to their visit, when they are planning their trip and that recycling while tailgating should be related to home recycling behavior.

These findings have important theoretical and practical implications beyond PSU's campus. Theoretically, future investigations could explore the relation between pro-environmental behaviors and different spaces, like home and sporting event recycling. Future research could also compare recycling at sporting events to

other large-scale events, like outdoor concerts or ceremonies and identify additional barriers to pro-environmental engagement.

Practically, if PSU is able to reach its zero-waste goal, it would mean thousands of tons of trash would be diverted from landfills every year. Additionally, managers and stakeholders at PSU are already discussing possible ways of helping other large universities set and achieve similar sustainability-oriented goals (A. Matyasovsky 2015, personal communication, 3 March). These efforts of understanding and improving recycling compliance could be easily adapted to and replicated at other universities that host very large sporting events or other events that require large numbers of visitors to plan and pack for an extended stay at the campus.

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Social Sciences and Campus Sustainable Development: The Way Forward

Walter Leal Filho and Michaela Zint

Abstract

This short overview points out some areas where social sciences may provide a contribution to sustainable development initiatives at the campus level, presents some challenges to the application of the social sciences within this context, and outlines some of the actions needed to catalyse further developments in this field.

Keywords

Sustainability · Higher education · Social sciences · Transformation

1 Introduction to the Potential of the Social Sciences to Advance Sustainable Development at the Campus Level

People are at the core of the sustainable development challenges that we face on higher education campuses and beyond. We believe that because people are at the core of these challenges, they must also be at the core of their solutions. While natural science and engineering based approaches have traditionally been prioritized within the context of sustainable development, there is a growing realization that the social

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sciences have critical roles to play in addressing sustainable development challenges (Becker and Jahn 1999; ISS/UNESCO 2013; Mascia 2016; Petersen-Boring and Forbes 2014). As indicated by the chapters in this volume, the mounting trend to look to the social sciences for understanding and addressing sustainable development challenges, can also be observed on higher education campuses.

In fact and as also illustrated in this volume, the social sciences, with their range of insights into human behavior and interactions, can help to advance all aspects of campus sustainability (Leal Filho 2011) including as related to governance, operations, research, curricula, and community engagement.

One reason for the increasing popularity of the social sciences within the context of sustainable development, including on higher education campuses, is that the behavioral change interventions that they can inform have the potential to be more cost effective than technology. In light of this, there is an especially strong interest in what is referred to as an "instrumental approach" to behavior change. This refers to the use of behavioral interventions, typically grounded in psychological research, to change specific behaviors, and to meet particular sustainable development goals. In this volume, instrumental approaches are represented in chapters drawing on individual behavior theory (see the chapter written by Zawadzki et al.), research on values and motivations (see the chapters written by Melchiori et al.; Moseley et al.; Xu) as well as marketing processes (see the chapters written by McPherson Frantz et al.; Moore; Nicolino and Barros). In some contrast, organization and institutional theories have received far less attention, although insights from these bodies of research can also provide instrumental insights into achieving sustainable development goals. We are therefore pleased that they are represented in this volume by Bellantuono et al., Eatmon et al., Vallée, and Whitney, among others.

But it would be a mistake to only focus on the use of the social sciences based on their value in terms of instrumental benefits. For one, instrumental approaches to behavior change are problematic, unless socially accepted, for ethical reasons. Moroever, the use of such essentially manipulative rather than emancipatory approaches to behavior change does not contribute to higher education institutions' mission to develop leaders who have the competencies to transition higher education campuses as well as society toward sustainability. In this volume, emancipatory needs and approaches are identified and described by De Young, Baker-Shelley, Holzbaur and Kropp, Kolenick, Lopez et al., Iverson, and Noyola-Cherpitel et al., among others. Participatory action research, in particular, may present a promising emancipatory approach to support universities' transition toward sustainability while also advancing social science research (e.g., see chapters by Baker-Shelley; Holzbaur and Kropp).

As illustrated by the range of contributions in this volume, the social sciences, especially when considered in combination, can provide a holistic perspective of human behavior and interactions and thus, how sustainable development may truly be achieved on higher education campuses and beyond. The social sciences can broaden our visions of what may be possible, identify advantages and

disadvantages of different courses of action, evaluate these actions' effectiveness, and offer processes for enabling us to learn from, and become empowered by, our failures and successes in ways that support continuous avancements.

Because most social science research is conducted on higher education campuses, universities and colleges are in a unique position to draw on these bodies of knowledge and realize their potential benefits for transitioning toward sustainability. Yet, in the authors' experience, despite of the social sciences' potential and the growing interest in their application, the actual use of the social sciences to advance campus sustainable development goals has been limited.

2 Challenges to Drawing on the Social Sciences to Advance Sustainable Development at the Campus Level

Social science principles can also explain why their use on higher education campuses and beyond has been limited within the context of sustainable development. For example, from a psychological perspective, the social sciences may not be included in individuals' mental models as providing means to inform sustainable development transitions, from a sociological perspective, group norms may not support drawing on social science versus experience-based approaches, from an anthropological perspective, campus cultures may favor technological approaches, from an economic perspective, the benefits of drawing on the social sciences may not be perceived as outweighing the costs, and from a political science perspective, politics may have a greater influence on sustainable development decisions than scientific insights.

These social science informed perspectives as well as social science research specifically on the use of science in decision making provide helpful insights into why the social sciences may not be used to address sustainable development challenges. Here we would like to highlight some select challenges that, in our experience, have limited their use on higher education campuses and beyond. One of these challenges arises from the basic versus applied nature of the traditional social science disciplines. As is the case with basic research in the natural sciences, the great majority of social scientists seek to advance our understanding of phenomena without necessarily seeking to address a particular societal challenge, including sustainable development. The social sciences therefore provide us with insights into social phenomena and why they exist but often it is not evident how these insights can be applied. This is also the case even within applied social science research on sustainable development, where problematizations tend to be easier to find than research that can inform ways to advance sustainable development transitions. In addition, social scientists tend to engage primarily with other social scientists using discipline specific language that even other social scientists, let alone non-social scientists, are likely to have difficulty fully understanding. Lastly, social scientists have historically sought to set themselves apart from the natural sciences by focusing on social phenomena and thus, have not focused on the environment. Fortunately,

however, this has been changing and as a growing number of social scientists are recognizing that environmental problems are, at their core, social problems, and that without sustainable development, human welfare goals cannot be achieved.

It is also encouraging that all the traditional social science professional societies now have environmental sub-groups, the number of journals focused on publishing social science sustainable development research is growing, and even leading traditional social science journals are publishing more social science research conducted within the context of the environment and sustainable development. This growing body of social science research on the environment and sustainable development holds great promise for informing advances to sustainable development and we are also confident that findings from this work will lead to the development of new and more holistic social science theories.

3 Advancing the Use of the Social Sciences to Transition Toward Sustainable Development at the Campus Level

The earlier, social science-based perspectives for why the social sciences may not be used more extensively to advance sustainable development on campus and beyond, also point to ways that can facilitate their use in these contexts.

For one, individuals who make decisions influencing campus sustainable development efforts would likely benefit from the knowledge and skills to identify, review, and apply insights from the social sciences to these challenges. Zint, one of this volume's co-editors, offers a course that introduces six different social sciences and what they offer for understanding and addressing environmental problems. As part of this course, students collaborate with staff to apply what they are learning to campus sustainable development challenges. As a result, both participating students, many of whom are leaders of campus sustainable development groups, and university staff gain insights into what the social sciences have to offer. These insights, have in turn, been translated into social science-based intervention across the University of Michigan campus. Similar courses could be offered on other higher education campuses. Alternatively, more and more diverse social science content could be incorporated into courses focused on advancing campus sustainable development, which many higher education institutions now offer. It is our hope that this book could facilitate this process as a result of the variety of illustrative examples that it offers.

In addition, campus administrators could stress that they expect staff to consider social science insights when making campus sustainable development decisions. This is not to say that the knowledge and experiences staff have should not play an important role in these decisions but that social science findings should also be integrated. Importantly, such administrative guidance would be consistent with universities' missions which typically focus on contributing to society through research conducted on their respective campuses. Most universities now have

faculty in environmental programs as well as in traditional social science departments that conduct research that could be applied to local campus' sustainable development needs. Over time, this type of administrative guidance and subsequent practices should foster campus cultures that value and consistently adopt insights from the social sciences as part of these critical decisions.

The costs involved in identifying, reviewing, and determining how social science theories and insights may be applied to helping universities transition toward sustainable development are real and must be reduced if individuals are to more regularly draw on these sciences to inform their decisions. To help address this need, the students in Zint's aforementioned class are synthesizing how social science research applies to a range of campus sustainable development challenges (http://sustainability.umich.edu/environ211/). As awareness about this resource grows, it is our hope that this resource will reduce barriers individuals face to applying social science research to the many campus sustainable development challenges that exist.

The idea for the above website arose in part based on political science research which suggests that boundary organizations are needed to facilitate the use of scientific information by serving as mediators between scientists and decision makers. We recognize that a website can only do so much and hope that organizations like the Association for the Advancement of Sustainability in Higher Education, UN Regional Centers of Expertise (see chapter by Kolenick) as well as campus sustainability focused networks (see chapter by Whitney), might take on the role of helping to ensure that social sciences research is made more accessible to campus sustainable development decision makers while also identifying the type of social science research needed to advance campus sustainable development. It will be important that, as part of these efforts, not only interests in instrumental approaches (e.g., social marketing) will be addressed but that emphasis be placed on emancipatory approaches (e.g., participatory action research) which are consistent with universities' educational missions.

Even if social sciences theories and findings are used to inform campus sustainable development decisions to a greater extent, it will be important to evaluate their effectiveness within this context. Evaluation, which draws on social science methods to judge programs' performance, has been relatively rare within sustainable development contexts, including of campus initiatives. Not only can program evaluation indicate to what extent these initiatives have achieved their goals, but it can identify unexpected positive or negative outcomes, and yield insights into the characteristics of interventions to which changes can be attributed. Such insights can support sequent duplication of similar initiatives on other campuses as well as contribute to the body of social science research on campus sustainable development.

We also would like to note that by itself, each social science discipline, can only offer so much. This is because the social science disciplines tend to ask different questions about human behavior and interactions, and they are likely to adopt different approaches to answering these questions. In combination, however, the social sciences can provide a holistic understanding of the complex nature of human

behavior, including within the context of sustainable development. While there has been quite a bit of focus on the need for natural scientists and social scientists to collaborate on interdisciplinary teams, we would like to stress that there is also a need to include social scientists from a range of basic and applied disciplines for collective sustainable development impact on higher education campuses as well as on society as a whole.

4 Conclusions

There is a dormant potential for mobilizing and using the various theories, models and findings from the social sciences, as tools towards fostering a better understanding of, and transition toward sustainable development. Not to be overlooked is the importance of the social sciences in the interface between communities of experts and communities of decision makers.

Overall, one can say that social issues are an essential component of strategies for promoting sustainable development on campuses across the world. Therefore, more efforts to achieve a better integration are needed and should be intensified.

These are challenging, but also exciting, times to fundamentally change higher education campuses and society. We believe, and the chapters in this book illustrate, that the social sciences can play a critical role in supporting higher education campuses' transitions to sustainable development. Given that universities are the sources of most of the social science research that can support these transitions, the level of trust in these institutions, and their role in the professional development of future societal leaders, it makes sense that higher education institutions also be the places to test, examine, and model the social innovations will advance sustainable development globally.

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