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Building sustainability change management and leadership skills in students: lessons learned from "Sustainability and the Campus" at the University of Michigan

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Abstract Leading institutions of higher education are increasingly utilizing the campus as a laboratory not only for implementing "green projects" but also for developing the skill set of students to lead the deep organizational change necessary for sustainability. This case study of "Sustainability and the Campus" at the University of Michigan, one of the most established and largest interdisciplinary campus sustainability courses, assesses this skill building through surveys, participant observation, semi-structured interviews, and focus groups. The sample includes 64 current and former students and 11 staff who served as project sponsors. The results reveal that while student learning and project "success" are not directly correlated, students gain a deep understanding of change management complexity and build leadership skills as well as confidence while bolstering their resumes. From a staff perspective, benefits flow as much from the interaction with students, in terms of building mutual respect and shared understanding, as from the direct outcomes. While student labor is not "free" in terms of time and energy, there is no substitute for the enthusiasm, creativity, and perspective that students bring to campus sustainability projects when coupled with the appropriate scope, expectations, and communication. Key factors for project and course success include: active instructor engagement in group dynamics and project management, carefully managing student and staff expectations, and designing projects while simultaneously planning follow-up. Using systems thinking for organizational change as the linking concept between class sessions and group projects provides intellectual continuity and an opportunity for expansive thinking about leadership and change management.

Keywords Campus sustainability · Transformational leadership · Organizational change · Change management · Systems thinking · Environmental studies · Service learning · Project-based learning · Place-based learning · Action learning

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Introduction

Successful organizational transformation from piecemeal "greening" efforts to deep institutional sustainability requires the active involvement and leadership of students. However, campus sustainability professionals and advocates cannot simply tell students to go transform the institution or be a sustainability leader without providing the structure and skills training for success. Therefore, colleges and universities are increasingly utilizing the campus as a laboratory not only for implementing environmental projects but also for developing the knowledge and skill set in students to lead deep organizational changes in academia and beyond. Courses specifically on campus sustainability are an increasingly common venue to help develop these skills.

The Association for the Advancement of Sustainability in Higher Education identifies 49 courses at 40 institutions as "campus sustainability" courses, a growing number that likely underestimates actual course offerings (www.aashe.org). Since the first offering in 2001, the University of

Michigan's (U-M) "Sustainability and the Campus" course has followed an innovative strategy of empowering students to be a part of the sustainability decision-making fabric of the institution, thus developing "real-world" skills and providing leadership training while harnessing the energy and creativity that students can uniquely provide. The "wickedness"—defined as where "facts are uncertain, values in conflict, stakes are high, decisions are urgent, and an extended peer community is required for the resolution of the relevant issues" (Gough et al. 1998)—of sustainability is amplified in a complex organization like U-M, creating rich context for change management theory and practice. "Sustainability and the Campus" explicitly sets out to address this challenge through student training while also delivering direct advancements in campus sustainability initiatives, attempting to create a "win–win" scenario for students and the institution. This paper assesses the results of this effort and provides recommendations for building similar efforts at other institutions.

This longitudinal study tracks student and organizational change outcomes of the course based on four key research questions, largely exploratory and qualitative in nature: How are students' perceptions of their leadership and organizational change skills modified by participation? How do these perceptions align with the intended learning outcomes and skill set development? What is the role of the course in the success or failure of campus sustainability initiatives? And, what are the common contributing factors to project success or failure? Despite the rising popularity of "Sustainable Campus" courses as well as project-based sustainability courses in general, little research exists that systematically addresses best practices and outcomes of these unique offerings (Burns 2011), with nearly all accounts based solely on anecdotes.

Pedagogical approach

Systems thinking—following Donella Meadows' (2008) definition as a "way of thinking that gives us the freedom to identify root causes of problems and see new opportunities"—forms the core analytical framework for U-M's "Sustainability and the Campus" course. Meadows describes a system as a set of things "interconnected in such a way that they produce their own pattern of behavior over time." Applying this mental model to the campus, the course approaches organizational transformation to sustainability from an interdisciplinary, hands-on perspective using the analytical tools of visioning and identifying leverage points for change. With Peter Senge's *The Necessary Revolution* (2008) as a textbook and guide to organizational change and following Hiatt and Creasey's (2003) definition of change management as the process, tools, and techniques to manage the people side of change within the social infrastructure of the workplace, the course directly evaluates and participates in sustainability approaches at U-M.

The course's project approach is nested in the campus as a "living–learning laboratory" model (Orr 1994; Stewart 2010), drawing on strategies and pedagogies in project-, problem-, and place-based learning. The course analyzes the campus as an entity itself (with over 80,000 people and the attendant facilities) as well as a microcosm and driver of larger social systems. According to McMillin and Dyball (2009), "Universities can optimize their role as agents of change for a sustainable future by adopting a whole-of-university approach to sustainability" which includes linking educational and operational activities. This systems thinking approach recognizes the university as an interdependent and complex "mini-city" (McMillin and Dyball 2009), which allows students to examine complex problems on a more easily relatable scale.

Project-based learning is a well-documented approach to implementing the idea of the campus as a living lab. "The campus is the most readily available laboratory for hands-on projects, and acts as a shadow curriculum for students to apply to the campus what they learn in the classroom…By engaging students in the operational aspects of the university, a powerful learning experience emerges" (McMillin and Dyball 2009). Students in project-based experiences that incorporate community service, in which a contribution to their community (in this case, the university) is emphasized, the experience is more likely to influence positive leadership development (Dugan and Komives 2010).

Students in "Sustainability and the Campus" work in project teams guided by a university staff project sponsor as well as with input from faculty and their peers. This collaborative approach is intended to also mimic "real-world" problem solving. Theories on "action learning," where students work together to solve real-world problems in real time (Revans 1982; Raelin 2006), support this team-based approach to problem solving. Problem-based learning, where "students learn through facilitated problem solving," assists in the acquisition of content knowledge and critical thinking skills (Hmelo-Silver 2004) and is well documented as a means of preparing students for nonacademic situations across a number of disciplines (Norman and Schmidt 1992; Shepherd and Cosgrif 1998; Steinemann 2003).

While Dugan and Komives (2010) argue that faculty interaction and mentoring play an important role in developing leadership capacity, the opportunity for university staff to play that mentoring role in a mutually beneficial relationship has yet to be explored. Case studies document the importance of "faculty and staff acknowledgement that given the resources, opportunity and trust in their intellectual capabilities, students can participate in the sustainable development of their campus while learning critical hands-

on career skills and gaining experience" (Brunetti et al. 2003).

The course uses one of the most well-respected leadership models for student engagement, the social change model of leadership, which was "created specifically for use with college students and defines leadership as 'a purposeful, collaborative, values-based process that results in positive social change'" (Kezar and Moriarty 2000; Komives et al. 2009; Dugan and Komives 2010). The U-M course builds on this model with the intentional focus on leadership development. This connection between action learning and leadership is well documented across disciplines (Marquardt 2000). The specific traits that characterize leadership for sustainability, such as dealing with rapid change and urgency along with uncertain facts and timelines (Shriberg 2010), conflict with the often slow and conservative pace of change in most post-secondary institutions (Birnbaum 1988). This tension is used as a learning opportunity for complexity and systems thinking, ensuring that this challenge is met with analytical and theoretical rigor.

Course history and perspective

"Sustainability and the Campus," first offered in 2001, stemmed from a student group—Students for a Sustainable University of Michigan—teaming with a faculty member (Dr. Catherine Badgley) and doctoral student (co-author Michael Shriberg) with the goal of creating structure and offering credit for student work on campus sustainability. Offered originally at the second-year level in a seminar style (10–20 students) within the University's Residential College (a small Liberal Arts College within U-M), the course introduced the concepts of sustainability through the lens of the campus during its first 3 years (2001–2003). Projects conducted during this period did not have formal sponsors, although often involved operational staff, and led to some highly visible successes, most notably in increasing organic and fair trade food purchases as well as starting a vermicomposting program. After a hiatus, the course was retooled and re-launched in January 2009, offered within the new "Program in the Environment," cross-listed in the Residential College, and financially supported by the Graham Environmental Sustainability Institute. In October 2009, the course was highlighted during U-M President Mary Sue Coleman's State of the Campus Address which announced her sustainability initiative: "We will be doubling the enrollment of a course on sustainability and the campus. Here, students apply ecological, social and economic theory to hands-on practice, with our own campus as their living laboratory." Currently, the course is offered nearly every semester at the 300 level, and student enrollment hits its cap of 45 students each semester. The course fulfills a capstone requirement for "Program in the Environment" students and a core requirement within the "Graham Undergraduate Sustainability Scholars" leadership certificate program while remaining open to any student who has taken at least one other environmental or sustainability course.

"Sustainability and the Campus" is project-focused and directly linked with operational units through the Office of Campus Sustainability. Operational units submit project proposals to have groups of four to six students work with them. Approximately seven to ten projects are accepted each semester, screened first by the instructors and then by students. The projects have seven milestones (sponsor and group contracts, project plan, update/outline, midterm update, rough draft, final presentation, and final report) as well as close monitoring and advising. In most recent semesters, a professional group process consultant provided direction and support for students and instructors in team building, group dynamics, project management, and group effectiveness.

Approximately 1/3 of class time is spent directly on change management processes and systems thinking, while another third is spent in sessions led by various operational managers and campus leaders as "guest lecturers," invited to not only share the progress on sustainability in their area but also to reflect on the organizational change process from their perspective. The final 1/3 is divided between site visits (to the campus power plant, LEED-Gold buildings, local recycling facility, local farm, etc.) and class time devoted to project work. Student deliverables for the course include three individual reflective writings and a research paper in addition to the group project work. The most recent syllabus and all project reports are available at: http://www.graham.umich.edu/education/campus.php.

Methodology

This study followed a multimodal design with three distinct populations: 36 students enrolled in the course during the time of the study (Winter semester 2011), 158 students enrolled in the course between Winter 2001 and Fall 2010, and 18 university staff project sponsors (spanning Winter 2009–Winter 2011). Most students take the course during their junior or senior year, with the majority being Program in the Environment majors or minors. However, the course draws students from across campus, including engineering, policy, business, and art majors.

Winter 2011 students

Students in the Winter 2011 class received an online survey invitation early in the course (2/17/11) and again at the end of the course (4/15/11) to measure the acquisition of

leadership characteristics over the semester. The measurements were drawn by selecting 16 of Dugan and Komives's (2010) measures of social change leadership, on a five-point Likert scale (see Table 2 for results). The sample in Dugan and Komives represented a broad cross section of students in a national study of 63,000 students at 55 institutions. Thirty-five of our students (97%) completed the midterm version of our paired down version of the leadership characteristics survey, while 27 (75%) completed the post-term survey. Students enrolled in the course during Winter 2011 were also subjects of observational research to observe the development of change management and leadership skills as the semester progressed. They were informed about the purposes and objectives of the study, and provided the option to opt-out early in the semester. Informal observations by a graduate student (co-author Kathryn Harris) and the instructor (co-author Michael Shriberg) took place during in-class activities and in student team meetings outside the classroom.

Year 2001–2010 students

The 158 former students in the course were emailed once (via their University of Michigan email addresses) and invited to participate in an on-campus focus group or a phone interview. Of the 28 past students (17%) who opted to participate, 18 attended focus groups (three groups of six each) and 10 participated in phone interviews. Students participating in focus groups received a $5 gift card and refreshments. Both interactions involved semi-structured interviews (see Table 1 for question). All interviews and focus groups were audio-recorded and transcribed.

Staff project sponsors

Of the 18 staff project sponsors contacted by phone and email, 11 (61%) chose to participate in semi-structured phone interviews, engaging in the questions outlined in Table 1. These interviews were informed by and designed to complement the formal survey completed by each sponsor at the end of the semester. The interviews were audiotaped (with the exception of one due to technical errors) and transcribed, then analyzed along with the surveys. Data were analyzed via induction methods to identify trends and commonalities in responses.

This project was approved by the University's review board. This methodological approach has the standard limitations of personal and social response bias as well as possible biases due to the potential increased positive receptivity of students who responded to email requests for interviews or focus groups. This effect is likely to be particularly pronounced for students in the early years of the class.

Results: student learning outcomes and skills acquisition

Students enrolled in "Sustainability and the Campus" enter the course with higher than average capacities for socially responsible leadership based on criteria adapted from Dugan and Komives' (2010) "Value Definitions for the Social Change Model of Leadership Development" (Table 2). While there is little change in their leadership capacity within this framework or in their articulation of change management theory that can be observed over the course of the class, students' perceptions about change management and leadership were altered by

Table 1 Interview and focus group questions

Student focus group and phone interviews	• What are the top three things you learned/remember from taking "Sustainability and the Campus"?
	• What do you recall from this course about organizational change? Any specific tools or skills to understanding complex organizational change and related problems?
	• What leadership roles do you hold now or have held since taking "Sustainability and the Campus"?
	• Is there something from the course that helped give you the skills, confidence, or motivation to obtain and excel in these roles?
	• Do you know if your project was implemented?
	• What might you have done differently if you were to do your project again?
	• Is there anything that you think the course should have covered to help you with professional development?
Project sponsor interviews	• What was the outcome of the project?
	• Which student recommendations were implemented (if any)? Why or why not?
	• How did student involvement influence this project? Was there anything gained or lost as a result of student participation?
	• What were you hoping students would learn as a result of being involved with the project? Were those expectations met?
	• Did you observe any growth among the students involved with your project in terms of leadership and project management?
	• How would you reshape project setup to improve outcomes and student learning?

Table 2 Social leadership measures of "Sustainability and the Campus" students compared to national sample

Composite measures of value definitions for the social change model of leadership development	National survey means	"Sustainability and the Campus" means
I am willing to devote time and energy to things that are important to me	4.37	4.8
Hearing differences in opinion enriches my thinking	4.12	4.6
I have the power to make a difference in my community	3.98	4.3
I am comfortable initiating new ways of looking at things	3.99	4.4
I know myself pretty well	4.19	4.2
I am comfortable expressing myself	3.97	4.2
Being seen as a person of integrity is important to me	4.34	4.5
I work well in changing environments	3.73	4
I can make a difference when I work with others on a task	4.07	4.5
It is important to develop a common direction in a group in order to get anything done	4.04	4.3
I hold myself accountable for responsibilities I agree to	4.34	4.7
My actions are consistent with my values	4.07	4.3
I value opportunities that allow me to contribute to my community	3.87	4.6
I respect opinions other than my own	4.18	4.6
When working in groups I support what the group is trying to accomplish	4.07	4.6
I enjoy working with others toward common goals	4.07	4.5

Adapted from Dugan and Komives (2010). National survey data courtesy of John Dugan

their participation, often in unexpected ways. Students gained confidence (the only measure that U-M students' initial mean was in line with the national mean was "I know myself pretty well") and reported feeling empowered by having their projects taken seriously. One student commented: "I remember it was really nice feeling like my work actually had a purpose… It was all worth it in the end because I felt really proud." Another stated: "It really felt empowering to have the information available to come at a problem and understand it in a way that was really satisfying—unlike a lot of other classes where they tell you about the problem and you are just really left to deal with that however you can." Key results regarding student learning and skills acquisition can be broken down into four key findings.

Complexity dominates

Projects start as a relatively simple idea—build a garden, install solar panels, educate staff about sustainability, etc. Prior to engaging, students typically have difficulty comprehending how the analysis or implementation of something so conceptually simple could take an entire semester. By the end of the course, students report that organizational change—even for a relatively minor project—is exceedingly complex. One student, looking back at his project on increasing organic food in the dining halls 10 years later, reports: "You have these pie-in-the-sky ideas of—we should grow food for kids and make it all organic—but you talk to the nutritionists, the chefs, and the people making the decisions, [and] you see why that might work, why that could work, and what are the barriers for that." A student who analyzed removing trays from dining halls reports: "The amount of people you have to talk to even figure out the numbers and how this is going to work is ridiculous, so many back and forth emails and meetings that usually don't get you very far." By the end of the course, students' understanding of organizational change and change management was far more complex and nuanced. Moreover, they learned that the pace of change typically does not match the pace of their appetite for progress. Passion is necessary but not sufficient for progress in a complex campus and large bureaucracy.

Student learning and project "success" are not directly correlated

Students' perceptions of whether or not their project was "successful," defined in terms of project implementation and tangible outcomes, were not correlated with their acquisition of skills and understanding, or even their sense of empowerment. In fact, projects that "failed" often allowed for more learning opportunities about organizational processes and leadership. For example, one team completed a very well-researched and written report on implementing green practices in a U-M department. However, the group failed to adequately engage with their project sponsor, so the work was not useful in the context of the operational unit. While the project was not a success in terms of direct impacts, the student learning objectives in terms of organizational

change were met, as—in retrospect—the lesson about context and complexity was well received. However, reported student satisfaction is correlated with the degree to which projects are "implementation-based" as opposed to "research-based." Those projects for which there was a visual, concrete outcome (e.g., an educational display, a vegetable garden, a website, a site design) are more satisfying to students than those for which the outcome is a report with recommendations. Students clearly want to get their "hands dirty."

Projects build confidence, a key precursor to leadership

Defying expectations, students almost universally lacked the vocabulary to answer direct questions about organizational change and leadership, despite the explicit attention given to these ideas in the classroom. Moreover, their perceptions of leadership remained positional and hierarchical despite the attention given to nuanced situational models of leadership. However, with prompting that moved away from theoretical language, students almost universally reported increased confidence in their own leadership abilities as well as evidence of having acquired change management skills. Students easily recounted techniques like benchmarking, navigating hierarchy, producing valuable data, and managing meetings for success. For example, one student reflected, after working on reducing waste in the University Unions: "It gave me confidence in the environmental activism arena to be a leader and recognize that…I feel passionate about it and have legitimacy when I am a leader." Another student, who is rising fast in the environmental profession, reported: "It definitely gave me more confidence that I knew what I was talking about going into those leadership roles." Project sponsors noticed this progression in confidence and ability over the course of the semester: "From day one, they absolutely had no idea all the pieces involved in making something as small as a little garden happen. Then at the end of the project, you could see it in their eyes, 'We just figured out how to do that!' And I think they realized it was just way more complex than we thought it was going to be, but we did it."

Students build marketable skills

An unexpected outcome, widely reported by students, is that the project and course serve a very specific need: building their resumes. For example, "I have used this class countless times on my resume and in interviews," and "[During a job interview] I was able to pull out this large scale project that I was a part of that was successful that had a lot of work and a lot of applicability to the field that I am interested in…This is a class that ultimately is going to give you an edge in the workforce because you know how to do projects, you know how to work in a group, you know what it's like to have a supervisor to answer to and you know what it is like to collect information from a variety of places." Students leave this class better prepared to engage in organizational change and leadership in part because they leave the class with a specific, professional skill set that more closely mirrors real-world problem solving.

Project management and course pedagogy results

Table 3 lists "Sustainability and the Campus" projects, categorized by type of project and state of implementation. Projects fall into four categories (Feasibility Studies, Assessment Reports, Recommendations Reports, and Implementation Projects). Project outcomes are measured by their stage of implementation on a scale from 1 (projects at the very beginning stages of implementation) to 5 (projects that have been fully implemented on campus). The results indicate that the type of project is helpful in predicting project outcome, with implementation projects having the highest success rate and assessment reports at the lowest end. Feasibility studies have a bifurcated distribution—they are either implemented or ignored. However, as noted previously, student learning outcomes are influenced by the process more than the outcome. From a results-oriented project sponsor perspective, three key factors for successful implementation of campus sustainability initiatives stand out.

Balancing scope, expectations and communication

Projects succeed or fail in large part due to the interaction between the scope of the project, the expectations of the sponsor and the students, and the communication between all parties. The key for scope is to have a project that stretches, but does not break, students' and sponsors' capacity for action in a 14-week period as part of their job or student responsibilities. Students typically start with too expansive a vision of what they can get done in a semester (e.g., install solar panels on Michigan Stadium, conduct a full assessment of the feasibility of a zero-waste campus, etc.) and sponsors often start with too narrow of a view (e.g., build a Facebook page). While the project outcome is context-dependent and a moving target, a reasonable scope is necessary for project success. The instructors spend significant time with sponsors defining an appropriate project scope and then communicating this to the students early in the term while allowing for and encouraging well thought-out adjustments along the way since determining those incremental adjustments is part of the learning process. One project sponsor explained the delicate balance this way: "framing the project without telling them how they need to do it and what they need to do, but still giving them the handrails to go in the right direction."

Table 3 Project implementation

Stage[a]	Type[b]	Project title	Year
1	FS	U-M Football Stadium Solar Power Feasibility Study	2009
	RR	Trayless Dining: Pilot 1	2009
	FS	Ann Arbor Bike Sharing	2010
	RR	Trayless Dining: Pilot II	2010
	RR	Reinvigorating the Office Supply Reuse Program	2010
	AR	Solar Roof for the Power Plant	2011
	RR	Greening Campus Landscapes	2011
2	AR	Worm Bins	2001
	AR	Post-consumer food waste	2001
	AR	Big Ten Sustainability Report	2010
	RR	Building a Unions Education for Sustainability Program	2010
	I	Advancing Student Sustainability Engagement Through Social Media	2010
	RR	Reducing Paper Usage	2010
	RR	Identifying and Encouraging Green Products Purchasing	2010
3	FS	Organic produce: feasibility in dining services at the U-M	2001
	AR	Building a sustainable residence hall at the U-M	2002
	AR	Sustainable food opportunities	2002
	AR	University Unions Sustainability Assessment	2009
	AR	LEED Assessment of Building (LEED-EB)	2009
	RR	Green IT Certification	2009
	AR	Options for Reducing/Eliminating Bottled Water Use	2010
	RR	Greening the Outdoor Adventures Program	2010
	RR	Energy Conservation in the Labs	2010
	RR	"Zero Waste" Unions	2010
	RR	Greening Commencement	2011
4	RR	Transitioning to a Single-Stream Recycling Program	2010
	RR	Zero Waste Camp Michigania	2011
	RR	Sustainable Labs	2011
5	AR	Fair Trade Coffee at the U-M	2002
	FS	Sustainability Tracking, Assessment and Reporting (STARS) for U-M	2010
	I	Creating a Student Sustainability Guide	2010
	FS	Assessing and Planning for a Student Sustainability Fee	2010
	I	"Water literacy" Project: 2011 LSA Theme Semester	2010
	I	Garden for Outdoor Adventures	2011
	I	Bottled Water Behavior	2011

[a] *1* Not yet implemented: not implemented as described in student recommendations, *2–4* partially implemented: project is being implemented in stages; may require additional research and/or resources for full implementation, *5* implemented*:* implemented to the extent possible, mostly based on student recommendations

[b] *FS* feasibility study (students analyze the viability of new ideas and initiatives), *AR* assessment report (students provide background research, benchmarking and an assessment of the resources, timeline or other details to be considered to bring an idea from theory to practice), *RR* recommendations report (students provide detailed recommendations for implementing a specific campus project or initiative), *I* implementation (projects which can be implemented during the course of the semester or shortly thereafter)

Projects begin with a class session devoted to team building activities, typically guided by a professional facilitator, to determine expectations for outcomes and group interactions. However, many students and sponsors report that expectations and work styles can vary greatly between the students and staff. As one sponsor reported, it is a matter of pointing students "in the right direction without crushing their enthusiasm!" Communication ties the scope, expectations, and project experience together. Projects can survive an initially poor scope and even misconstrued expectations if they have strong communication among and between students, the instructors, and

staff. In one recent example, students fairly quickly realized that the intended deliverable was unattainable but were able to adjust their scope and expectations accordingly through working closely with the staff sponsors. The course now requires a written contract at the beginning of the semester between student teams and the staff sponsors, which includes scope of work and expectations and rules about communication with the caveat that changes can be made as the semester progresses. This contract is designed to emphasize the interaction of scope, expectations, and communications upfront and in writing.

Students' unique contribution goes beyond "free labor"

Most staff sponsors (17 out of 19) reported that projects, particularly those that had sat on the "backburner," advanced during the semester in part simply because the project's end-of-term deadline demanded sponsors' attention. Another key factor is the additional work hours being put into the project by students. However, this "free labor" benefit is not the key reason for staff to participate, nor is it the most beneficial outcome of having students involved in a structured project. In fact, even if staff could have implemented the projects on their own with the same amount of time, students bring unparalleled energy and creativity as well as a unique perspective to campus sustainability initiatives. One sponsor reports "Student input allowed us to move faster, and added a little more depth and…to look at it from 360° instead of us having blinders on and saying we need to look straight ahead." Another sponsor emphasized having students is the best way to "find out what students were interested in" since for a number of initiatives, the target audience is students. The following sponsor quote sums up the dominant opinion:

> "They [the students] are innovative and think outside of the box. They bring that level of enthusiasm and that out-of-the-box thinking to projects that people on our side, our side being the operational side, may not think that way or may not approach a project in a certain way, but the students don't have those limits in the back of their mind so they just open it up and bring all kinds of cool ideas."

Sponsors have to be committed to the educational goals as well as the outcome, which involves significant time commitments and personal investment in the process:

> "You have to be patient because if they are proposing things that you know are outlandish…you have to allow yourself to have that reaction in your head, like 'okay this is completely stupid and would never work,' but then let yourself start to work through it and think, 'how could this work?' [For example,] this recommendation they are making that would cost a million dollars and doesn't make sense, but how might it make sense, or how could those costs come down?"

Moreover, nearly all of the sponsors underestimated the time that they would need to put into effectively working with the students as guidance is critical to the project. "I really underestimated the time commitment, I *really* underestimated, I don't mean that it was a huge time commitment, I was just completely askew in what I thought it would be."

The dominant sentiment was that the partnership between students and staff can be beneficial not only for a specific project but also for increasing motivation, cohesion and enthusiasm: "I have worked with this university for over 20 years, and that class was the first opportunity I actually had to interact with students. It was like, 'Oh my god! This is what I have been working for all these years,'" said one sponsor. Working with students also seemed to serve as an almost cathartic benefit for many sponsors, demonstrating to students what while they may agree with them on what should, in theory, be done, the practice of implementing projects is fraught with difficulties that are often beyond their control.

Projects are "sparks"

Unless a project is implementation-based and conducted on an extremely small scale, it is not likely to be completed and implemented in the span of a semester. Even a project with a very concrete outcome—designing a native plant bed—may be finished within the semester but then must be implemented (e.g., built, planted, and managed) after the course ends. Therefore, the work conducted during the semester is best conceived of as a spark that will require follow through. In the evolution of "Sustainability and the Campus," the instructors have tried to fill in the gap from in-class project completion to project implementation to move the project to completion (Table 3) through facilitating student internships, work-study positions, and independent studies as well as continuing projects over multiple semesters. All these efforts combined have increased the probability of project success and led to deeper understanding for students and more professional development opportunities as well as partnerships among students, faculty, and staff.

Lessons learned for campus sustainability courses

With the increase in recent years in problem-based, project-based courses in which students directly engage in campus sustainability combined with the need for developing sustainability leaders that are capable of and versed in systems

thinking and organizational change for sustainability, the demand for institutions of higher education to expand, enhance, and increase sophisticated offerings on campus sustainability is high. Our research and experience reveal four key lessons for successfully implementing such offerings:

1. Manage expectations of students and staff

   Combining the realism of project sponsors who often feel overwhelmed with the unbridled enthusiasm and often unrealistic outlook of students can lead to an unsuccessful project without proper management of expectations. With students, the key is to be realistic about expected outcomes while allowing creativity and the ability to push the envelope. While most students learn the harsh realities of complex change over the course of the semester, upfront attention and retrospective debriefs smooth out the process and lead to better learning and project outcomes. With operational staff, the key is to ensure them that student energy can be funneled to positive purposes, and that the projects will not push them too far outside their comfort zones. These findings are in line with and expand the emerging campus sustainability literature on the change management process, with the increasing emphasis on personal enabling forces for change (e.g., Sharp 2009).
2. Pay careful and specific attention to group dynamics and project management

   Teaching a unique course like this requires not only moving from the more familiar role of "sage on the stage" to "guide on the side" but also diverting course time from content to process by delving deeply into group dynamics and project management. The professional consultant engaged in "Sustainability and the Campus" offerings was invaluable in teaching students not just how to come to a positive project outcome but also how to effectively work as a team, using techniques like administering an MBTI test, conducting mid-point check-ins, establishing a group contract, and leading reflective exercises. These same activities were done by the instructors in semesters without a facilitator but with less emphasis and expertise. Students almost universally disparage group process efforts during the semester, thinking they take away time from "the real work." In retrospect, however, students assign great value to these efforts in terms of professional development and project outcomes. They almost universally claim that this group project was a better experience because of the group process learning. One student explains, "…going through it I was kind of like, 'this is dumb, I just want to work on my project,' and some of my group mates absolutely hated it. [But] in retrospect that group project went really well and I think that most groups I have been in haven't because we didn't talk about what we need from group members or what irritates us or what works well. So, maybe it was a little awkward going through it but in retrospect [it was] a good thing."

   Similarly, specific time and attention must be spent on project management skills (e.g., creating a timeline and set of responsibility, running effective meetings, etc.) if project success and professional development are to be maximized. As the course evolved, a set of very clear guidelines, specific mileposts, and direct feedback points has developed to provide a clear structure for project management. The instructor and Graduate Student Instructor have to directly engage in many stages of the project through surveys, team meetings, and other feedback mechanisms. Students have a tendency to avoid this direct engagement unless it is part of the defined structure of the course. This process focus and approach dovetails with the emerging literature on student learning's emphasis on engagement and student-centered knowledge acquisition.
3. Carefully balance class time, using systems thinking as a connective thread

   Perhaps the stickiest wicket in designing a syllabus for a project-based campus sustainability course is the balance between "project time" and "teaching time." While the two are inextricably linked, there is a tension between spending time learning and experiencing campus sustainability writ large versus focusing specifically on completing a project. Over time, the U-M course has evolved from spending significant time introducing key concepts and challenges in sustainability (e.g., Sustainability 101 through the lens of the campus) to focusing on organizational change and leverage points for systemic action. In part, this evolution has occurred because students entering the course are far savvier about sustainability than they were a decade ago, and the basics of environmental problems and sustainability are repetitive to many of them. Concurrently, this evolution is occurring because addressing organizational change and challenges of a true systemic transformation to sustainability provides a stronger connective thread between project work and class sessions. Even if a student's particular project has little to do with local foods, a guest lecture from a chef followed by an analysis of food flows through the campus and leverage points for change can be applied to almost any issue or project. Discussing these issues in terms of systems thinking for organizational change can increase their confidence in other professional endeavors, and the research revealed strong student demand for and appreciation of this framework.
4. Consider project follow-up upfront

   A major challenge of running a campus sustainability course is that even the best designed projects can encounter unexpected problems or students who put forth

less effort than is required to be successful. The ultimate status of each project at the end of a semester is impossible to determine before the semester begins. One proven way to mitigate this and improve the odds that a project has a lasting impact is to plan for project follow-up before the project begins. In the early days of "Sustainability and the Campus," this type of planning did not occur. As the course has progressed, however, the planning has become more elaborate, with some projects spanning multiple semesters and others designed with student internships or other forms of engagement negotiated early on. In the future, U-M is planning to move to a model where project sponsors would be eligible for startup funding for project implementation—which could be applied to pay students or offset any initial costs—in order to further improve odds for successful outcomes. This model follows along with the "lifelong learning" models currently gaining in popularity through education, with the semester or classroom forming only a permeable boundary to the learning process.

These findings and lessons learned are largely consistent with, yet more than expansive than, outcomes reported from similar experimental courses. For example, a project-based bioenvironmental engineering course at the University of British Columbia reported students having learned about the complexity and challenge of addressing an environmental problem through the project-based learning approach (Brunetti et al. 2003). A recent case study of an operations management course at Kennesaw State University's Coles College of Business identified similar struggles and successes (Maloni and Paul 2011). These data, while still limited and necessarily context-dependent, are more extensive than have been reported for any other courses with similar methods and approaches in the literature.

Conclusion

Attempting to achieve the win–win goal of project advancement and training students in organizational change for sustainability via a campus project-based course involves connecting students and staff via a unique partnership. One of the strongest outcomes, cutting across all results and lessons learned, is that students and staff have complementary needs and skills which can be melded together effectively with a thoughtful structure and realistic time commitment. Specifically, students benefit greatly from the "real-world" view of university staff, learning about complexity, responsibility, and the types of analysis and arguments that can lead to high-level support. Staff benefit from the students' perspective, energy, enthusiasm, and elbow grease, often using interest on the part of the university's "customers" to advance projects that might have sat on the shelf otherwise. While the direct outcomes of student projects vary widely, and students often cannot articulate, in academic terms, their advancement in change management and leadership skills, both students and staff report high levels of satisfaction with skills and confidence acquisition as well as mutual understanding of stakeholder perspective.

The campus provides a near-perfect microcosm of larger-scale sustainability issues, raising the possibility of introducing and analyzing complex systems yet staying within the comfort zone and range of knowledge for students at all levels. Students can achieve an understanding of the campus at a deeper level, transitioning from a bystander in the campus community to an active member of a complex system embedded in larger ecological, social, and economic systems. By building skills and confidence in this setting, students who have participated in "Sustainability and the Campus" at the University of Michigan over the past 10 years are better prepared for challenging basic organizational structures and pushing toward the deep institutional changes necessary for the transition to sustainability.

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