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Enhancing sustainability curricula through faculty learning communities
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Enhancing sustainability curricula through faculty learning communities

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Abstract

Purpose – Although the number of higher education institutions adopting sustainability-focused faculty learning communities (FLCs) has grown, very few of these programs have published evaluation research. This paper aims to report findings from an evaluation of the University of Vermont's (UVM's) sustainability faculty fellows (SFF) program. It discusses how utilization-focused program evaluation is an important tool for developing and improving sustainability-focused FLCs. The SFF program aims to enhance sustainability education by bringing faculty members together to expand their knowledge of sustainability concepts and offer pedagogical support for integrating those concepts in higher education curricula.

Design/methodology/approach – A utilization-focused evaluation framework guided the evaluation's design and implementation. Multiple methods were used to collect evaluation data, including in-person interviews and an online survey with SFF program participants.

Findings – The evaluation's findings suggest that UVM's SFF program expanded faculty understanding of sustainability concepts, encouraged curricular and instructional reform and made progress toward developing a community of faculty interested in sustainability education. The evaluation's utilization focus was instrumental in providing useful information for improving the SFF program.

Originality/value – Evaluation findings expand what we know about the potential effectiveness of sustainability-focused FLCs, as well as challenges institutions might encounter when adopting such an approach to faculty development. Findings also point to ways in which utilization-focused evaluations can inform program development and improvement efforts.

Keywords Sustainability education, Faculty development, Faculty learning communities, Program evaluation, Sustainability-across-the-curriculum

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Nationwide, higher education institutions are taking steps to infuse sustainability principles in their curricula. A key challenge with doing so has been expanding faculty understanding and capacity to teach sustainability-related concepts. Many faculty members require additional professional development around sustainability concepts and teaching strategies (Barlett and Rappaport, 2009). Among possible professional development models, faculty learning communities (FLCs) have been identified as a promising strategy for sustainability-related faculty development, curricular change and community building (Eisen and Barlett, 2006).

FLCs are cross-disciplinary groups of university faculty members who come together and participate in extended discussions and learning opportunities that enhance their knowledge and teaching related to a topic of interest, such as sustainability education (Cox, 1999). As an in-house professional development model, FLCs have the potential to be a cost-effective strategy for achieving the kinds of curricular changes envisioned as necessary for meaningful sustainability education. Yet, despite their promise and increased use by higher education institutions, very little is known about institutions' experiences with implementing sustainability-focused FLCs or their effects on faculty knowledge and teaching practices (Barlett and Chase, 2012; Rowe, 2002).

This paper reports findings from an evaluation of the University of Vermont's (UVM) sustainability faculty fellows (SFF) program. The SFF program was designed to cultivate a sustainability-focused FLC, where faculty participants become part of a faculty network committed to learning how to incorporate sustainability concepts into their curriculum and teaching.

Evaluating sustainability-focused faculty development models, such as UVM's SFF program, is important not only for helping host institutions refine and improve existing models, but also for adding contributions to the larger conversation about the extent to which such programs achieve their goals and how they might be replicated (Patton, 2008). Overall, there is a shortage of evaluations of environmental and sustainability education programs, particularly in higher education contexts (Carleton -Hug and Hug, 2010; Zint, 2013). Furthermore, in the case of sustainability-focused FLCs models, there are very few published evaluations (P. Barlett, personal communication, 2015). This paper responds to the need for evaluation evidence supporting higher education institutions' use of sustainability-focused FLCs and serves as an example of how institutions might use program evaluation for program development and improvement.

The remainder of this paper is organized as follows: first we discuss existing literature on FLCs and sustainability-focused FLCs and introduce program evaluation as a program development and improvement tool. We then describe UVM's SFF program, the evaluation design and the data collection methods. This is followed by a summary of what was learned about the SFF program's enactment and effects on faculty behavior. We conclude by discussing insights to the field and the importance of utilization-focused evaluations of higher education institutions' sustainability education initiatives.

Literature review

The evaluation of UVM's SFF program holds potential for contributing to two distinct bodies of literature:

(1) what is known about higher education institutions' sustainability-focused FLCs and their likely effects on faculty behavior; and

(2) program evaluation as a tool for program development and improvement.

Faculty learning communities

FLCs are a frequently used strategy for curricular and instructional development among higher education faculty (Richlin and Essington, 2004). Unlike other models that rely on external consultants for faculty professional development, FLCs bring faculty together to explore concepts and instructional strategies through an extended, facilitated process. The intended result is to:

- construct faculty knowledge and skills around a specific issue or topic through cooperative faculty learning; and
- develop a network or community of faculty who not only support one another's efforts to build knowledge and skills but also serve as a catalyst for growth and involvement around a particular topic (Cox, 1999).

Existing research suggests that FLCs are an effective strategy for improving instructional practice, building knowledge and confidence around new topics and developing faculty networks (Glowacki-Dudka and Brown, 2007). FLC participants are more likely to collaborate across disciplines, create more active student learning environments, and support a campus culture focused on teaching and learning (Cox, 1999). Moreover, being part of a learning community can be an effective way to reduce faculty resistance to new teaching strategies (such as service learning) (Furco and Moely, 2012).

Sustainability-focused faculty learning communities

Given their promise as an effective faculty development strategy, higher education institutions have increasingly used FLCs for sustainability-related professional development. Most sustainability-focused FLCs share a common purpose – to build a community of faculty members with the capacity to incorporate sustainability concepts and increase the quantity and quality of sustainability courses available to students.

Sustainability-focused FLCs date back to 1990, when Cortese and others at Tufts University implemented its Environmental Literacy Institute (TELI) (Barlett and Rappaport, 2009). As part of the TELI program, faculty members participated in a weeklong workshop and collaborated to make changes to their teaching. The TELI program paved the way for other subsequent faculty development efforts, including Ponderosa at Northern Arizona University. Starting in 1995, and lasting five years, the Ponderosa Project offered a two-day summer workshop that provided opportunities for faculty to learn how to integrate environmental concepts into their course content. Under Chase and Rowland's leadership, the workshop's format emphasized small discussion groups and experiential learning activities. In 2001, Barlett and Eisen (Emory University) consulted with Chase and Rowland when developing and implementing their sustainability-focused FLC, the Piedmont Project (Eisen and Barlett, 2006). Piedmont Project participants attend a workshop that includes presentations, outdoor explorations and faculty discussions.

While the sustainability-focused FLC model continues to evolve, common program elements have emerged among existing programs. FLCs incorporate a multi-day

workshop that introduces faculty members to content and strategies for sustainability education. Following the workshop, faculty members are provided opportunities to come together to further their sustainability knowledge and seek support in reforming their teaching (Barlett and Chase, 2012).

Since 2005, Barlett and Chase have offered workshops for campus leaders on how to develop and implement sustainability-focused FLCs. The Association for Advancement of Sustainability in Higher Education (AASHE) sponsors these workshops. Over 400 individuals, representing 275 higher education institutions, have attended (Barlett and Chase, 2012). Variations of Barlett and Chase's sustainability-focused FLC model can be found at the University of Southern Maine (Maine Watershed Project), Auburn University (Fall Line Project), Santa Clara University (Penstemon Project), the University of Florida (Prairie Project) and the University of Wisconsin-Oshkosh (Winnebago Project) (Barlett and Chase, 2012). However, there are sustainability-focused FLCs that have been developed independent of the Barlett and Chase model and workshop (MacGregor, 2013).

While sustainability-focused FLCs have been identified as a potentially promising practice and adopted by a large number of higher education institutions, very few of these programs have published evaluation results. Participants in Emory University's Piedmont Project reported they were most satisfied with the program's networking opportunities and exposure to new teaching strategies (Eisen and Barlett, 2006). Similarly, nearly all TELI and Piedmont participants reported that as a result of the program they:

- felt a greater sense of community and connection to peers;
- changed their curriculum and teaching practices; and
- increased interdisciplinary collaboration and sustainability-related research (Barlett and Rappaport, 2009).

These past efforts to assess faculty satisfaction and program effectiveness represent important first steps toward assessing sustainability-focused FLCs effectiveness. Nevertheless, additional evaluation evidence is needed to help decision makers understand the FLC model's strengths and weaknesses and to provide insight into ways to improve and develop new sustainability-focused FLCs (P. Barlett, personal communication, 2015; Rowe, 2002).

Program evaluation for program improvement

Program evaluation is an important tool for improving program performance and informing decisions about future programming (Stufflebeam *et al.*, 2000). Evaluations systematically examine program activities, characteristics and outcomes and can take on both formative and summative roles (Patton, 2008). Formative evaluations examine early-stage programs and provide information on how they might be revised or modified for improvement. Summative evaluations identify programs' short-term and long-term benefits and seek to explain to which activities these benefits might be attributed (Patton, 2008). While summative evaluations are most frequently reported in environmental education publications, formative evaluations can play an important role in efforts to improve and refine program models (Carleton-Hug and Hug, 2010).

Among possible frameworks that can guide evaluation work, utilization-focused evaluation stresses the importance of designing and executing evaluations with the end user in mind. Utilization-focused evaluations are grounded in the idea that intended

users are more likely to find evaluation findings useful if they are involved in evaluation planning and design (Patton, 2008). Stakeholder involvement is viewed as critical to an evaluation's success, and end users play authentic and meaningful roles in planning evaluation activities. In doing so, a utilization-focused evaluation framework supports a learning process through which stakeholders are equipped to use evaluation findings and experiences in their efforts to develop and improve programs (Patton, 2012).

It is important to note that while program evaluation draws on a broad range of social science research epistemological perspectives and methods, it differs from social science research in its orientation and the standards by which it is assessed (Patton, 2008). Social science research seeks to make conceptual and empirical contributions to a body of knowledge and is judged on the basis of the quality of these contributions (Zint, 2013). In contrast, evaluation is oriented toward understanding programs' implementation, processes, outcomes and impacts and is judged according to its usefulness to program-related decision-making (Patton, 2008). As such, both research and evaluation can make important, albeit different, contributions to improving programs and practices.

The University of Vermont's sustainability faculty fellows program

In 2009, UVM established its SFF program after two key campus leaders attended a Chase and Barlett workshop on developing sustainability-focused FLCs. The SFF program was established with three goals in mind:

(1) creating a community of faculty who are committed to integrating interdisciplinary approaches to sustainability in UVM's curricula;

(2) enhancing the understanding of sustainability concepts among faculty and students, particularly those not trained in environmental fields; and

(3) exploring teaching and course design strategies that will engage students in sustainability, from a multidisciplinary perspective (Kaza *et al.*, 2016; Rowse, 2013).

The SFF program's content and activities are grounded in the "Twelve Big Ideas of Sustainability" as identified by Shelburne's Farms' sustainability schools project:

(1) community;
(2) systems;
(3) diversity;
(4) cycles;
(5) interdependence;
(6) limits;
(7) change over time;
(8) fairness and equity;
(9) place;
(10) ability to make a difference;
(11) long-term effects; and
(12) equilibrium (Cirillo and Hoyler, 2011).

The program also emphasizes the social justice implications in sustainability issues.

Over the course of an academic year, SFF participants engage in multiple activities intended to expand their understanding of sustainability concepts and increase their capacity to effectively integrate sustainability content in their teaching (Table I). The two-day institute is the program's cornerstone. During the institute, participants engage in a mix of dialogue, reflection, writing and critical thinking that helps them explore sustainability concepts and teaching practices. On the institute's first day, SFF participants explore five major topics:

(1) place, as a learning framework;
(2) outdoor exploration, looking for signs of systems and patterns;
(3) definitions of sustainability;
(4) systems thinking; and
(5) issues of diversity and privilege.

A key activity during the institute's first day is the "sustainability buffet" where participants view images, policy statements and quotes reflecting different sustainability definitions and subsequently discusses the complexities in defining sustainability (Kaza *et al.*, 2016). The institute's second day introduces participants to UVM's sustainability initiatives and UVM's center for teaching and learning discusses course design and teaching strategies.

After attending the institute, program participants are expected to design or enhance a course to integrate sustainability concepts. In addition to the institute, participants attend four faculty luncheons, each with a different theme. Participants also have access

Program components	Program activities
Two-day institute	Day 1 (Shelburne Farms): dialogue, reflection, writing and critical thinking that aid participants in exploring sustainability concepts and teaching practices
	Day 2 (UVM campus): course design for sustainability integration presentation, peer mentoring workshop and meeting representatives from local organizations
Faculty luncheons	Four luncheons during the academic year (October, December, February and April)
	Luncheon 1: faculty discussions focused on exploring critical elements of sustainability, possible course connections and challenges incorporating sustainability content
	Luncheon 2: Shelburne Farms' 12 big ideas presentation, discussion of "A-Ha" moment regarding the importance of sustainability
	Luncheon 3: on-campus sustainability tour
	Luncheon 4: participants present their revised courses
Professional materials	*Online resources for faculty*
	Sustainability content
	Teaching strategies
	Course redesign resources and syllabi examples
	Other sustainability education resources
Professional development stipend	$400 per UVM participant for course materials, conference attendance costs, books or research support

Table I. SFF program components

to an online repository of professional materials to support their work and receive a $400 professional development stipend after completing the two-day institute.

UVM faculty and staff may apply to participate in the program and, starting in 2012, the program also accepted applications from faculty and staff at other higher education institutions. Each year the program accepts 15-20 individuals, and, by 2015, 103 individuals completed the SFF program (including seven external participants). Program participants represent a broad range of disciplines that adds richness to the discussions and reflects the interdisciplinary nature of sustainability issues. The majority of SFF program participants have been faculty members (93 per cent), representing 35 academic disciplines – including 28 per cent from arts and sciences; 6 per cent from business administration; 5 per cent from engineering and mathematical sciences; 8 per cent from medicine, nursing and health sciences; 17 per cent from environmental and natural resources; and 9 per cent from education and social services.

The program operates as a partnership among four UVM organizations – the environmental program, the center for teaching and learning, the office of sustainability and the greenhouse residential learning community. In addition, the SFF program partners with Shelburne Farms, a local nonprofit organization whose mission is to educate for a sustainable future. Representatives from each organization comprise the SFF program's coordinating committee.

Having reviewed what is known about FLCs, generally, and UVM's SFF program, more specifically, as well as the role played by evaluation efforts in program development and improvement, the following sections describe the framework, methods and data used in our program evaluation.

Methods

Evaluation perspective and questions

A utilization-focused evaluation framework guided the evaluation's design and implementation (Patton, 2008). The evaluator worked closely with the SFF program's coordinating committee to develop a shared vision for how evaluation findings would be used, especially in future program development and improvement. The coordinating committee also worked closely with the evaluator to design the evaluation's data collection approach and interpret and draw conclusions based on the evaluation's findings.

In determining the evaluation's scope and purpose, the SFF program's coordinating committee was most interested in whether the program was successful in achieving several key goals. Three questions were developed to guide the evaluation:

(1) To what extent does the SFF program contribute to SFF participants' knowledge and understanding of sustainability principles?

(2) To what extent does the SFF program result in SFF participants integrating sustainability principles into their courses and adopting instructional practices that enhance student learning about sustainability?

(3) To what extent do SFF participants constitute a multi-disciplinary faculty learning community who are committed to integrating sustainability into UVM's curricula?

The coordinating committee was also interested in understanding which program characteristics were more or less successful in fostering behavioral changes in faculty. For instance, what aspects of the SFF program did faculty find most helpful to their efforts to design new or redesign existing courses?

Data

Multiple methods were used to collect evaluation data. Drawing from commonly used social science research methods, evaluators conducted in-person interviews and an online survey with SFF program participants. Interviews were conducted prior to the online survey, and interview data were used to develop the evaluation's online survey and contextualize survey data where appropriate. In the following sections, we describe how these methods were applied to this evaluation.

Semi-structured interviews. Interviews with eight former SFF program participants were conducted to better understand their motivations for program participation, perceived benefits, course redesign efforts and ongoing connections with other SFF participants. The average interview duration was 33 min.

Purposeful sampling was used to select SFF participants for interviews. Criteria were established in cooperation with the SFF coordinating committee, and interviewees' cohort year and disciplinary perspective were the primary selection criteria. Based on these criteria, the SFF committee nominated faculty for interviews. Purposefully selecting interesting cases through nominations is a common qualitative sampling technique (Miles and Huberman, 1994). Four interviewees were from the 2009-2010 cohort, two were from the 2010-2011 cohort and two were from the 2011-2012 cohort. Professors from geology, environmental sciences, philosophy, plant and soil science, geography and business were interviewed. A member of UVM's office of sustainability conducted the interviews, and interviews were recorded and transcribed. Interviewee names were redacted from interview transcripts.

Online survey. SFF program participants from the 2009-2014 cohorts ($n = 73$) were invited to participate in an online survey about their experiences. Given the evaluation's interest in assessing change in curricular reform at UVM, SFF program participants from other higher education institutions and UVM staff were not invited to participate in the survey. The survey's content expanded upon the initial semi-structured interviews and included questions on:

- faculty knowledge and understanding of sustainability concepts;
- course content and teaching strategies;
- courses taught;
- sustainability-related research;
- faculty networking and professional activities related to sustainability; and
- program satisfaction.

The survey was developed in collaboration with the SFF coordinating committee and according to the tailored design method (Dillman *et al.*, 2008). First, necessary constructs and data elements were identified. When drafting questions, careful attention was paid to how each question was linked to the evaluation's objectives. SFF stakeholders provided input on question wording and response categories where appropriate.

UVM faculty and staff who were familiar with the SFF program tested the online survey. The testing process was both developmental – with respondents answering questions about readability, understanding and overall content and flow – and procedural, where respondents provided feedback on potential difficulties with the survey's online format and administration. Because of the relatively small number of SFF past participants and concerns about future response rates, we did not pretest the survey with SFF program participants. Additionally, for similar reasons, a formal reliability assessment of the questionnaire's items was not conducted (e.g. there was an insufficient number of potential respondents for tests, such as split reliability, etc.).

The survey had a 52 per cent response rate ($n = 38$). Responses were evenly split between female and male SFF participants, represented faculty from a variety of different ranks (e.g. lecturers, assistant professors, associate professors and professors) and consisted of faculty from a wide-range of disciplines and colleges. Survey responses were uniformly distributed among SFF cohorts (44 per cent), with the exception of the 2011-2012 and 2013-2014 cohorts – who were in the former case underrepresented – (27 per cent) and in the later overrepresented (67 per cent). A non-response analysis was conducted to assess the extent to which systematic bias because of non-response might be present in the data. Given the relatively small sample size, non-response analysis was limited to cohort year. No systematic differences were found between survey respondents and non-respondents based on the year in which they participated.

Survey data were analyzed using SPSS statistical software. The small number of responses constrained analysis to descriptive statistics and frequency tabulations.

In the following sections, we present key findings from the evaluation's online survey and, where appropriate, use data from in-person interviews to further contextualize survey findings.

Findings

Our discussion of the evaluation's findings is organized according to five key themes:

(1) faculty knowledge and understanding;

(2) curricular reform;

(3) instructional practice;

(4) community building; and

(5) program satisfaction.

Faculty knowledge and understanding

The online survey captured information on the extent to which SFF program participants felt the program expanded their understanding of sustainability concepts. The "Twelve Big Ideas of Sustainability" were used as a framework for assessing SFF program participants' knowledge and understanding of sustainability concepts (Cirillo and Hoyler, 2011).

Overall, survey respondents reported that the SFF program expanded their understanding of six sustainability concepts "to a great extent" or "somewhat":

(1) defining sustainability;

(2) systems thinking;

(3) place;

(4) diversity;
(5) feedback loops; and
(6) community (Table II).

However, the program was less successful in expanding SFF program participants' understanding of other sustainability concepts. At least one half of survey respondents reported that the SFF program expanded their understanding of four concepts just "a little" or "not at all":

(1) long-term effects;
(2) equilibrium;
(3) cycles; and
(4) change over time (Table II).

Not all aspects of the SFF program were equally helpful in building participants' knowledge. Survey respondents indicated that activities offered during the first day of the two-day institute were most useful in expanding their understanding of sustainability, especially through:

- presentations that explored place as a sustainability framework;
- outdoor explorations at Shelburne Farms that focused on observing cycles and changes;
- the "sustainability buffet" that introduced multiple perspectives on sustainability; and
- presentations on systems thinking and its application to sustainability.

A majority of survey respondents (two-thirds) also reported that that the program's luncheons enhanced their understanding of sustainability concepts.

Sustainability concepts	To a great extent (%)	Somewhat (%)	A little (%)	Not at all (%)
The definition of sustainability	49	24	19	8
Place	30	35	24	11
Systems thinking	32	35	19	14
Diversity	22	30	27	22
Feedback loops	16	43	16	25
Community	21	30	30	19
Interdependence	16	32	30	22
Cycles	16	30	22	32
Change over time	16	30	24	30
Limits	16	32	22	30
Fairness/equity	30	21	27	22
Ability to make a difference	19	35	27	19
Long-term effects	22	21	27	30
Equilibrium	16	27	24	33

Notes: Survey question: To what extent did your participation in the Sustainability Faculty Fellows program expand your understanding of the following concepts?; $n = 37$

Table II. Extent to which SFF program participation expanded understanding of core sustainability concepts

Curricular reform

In this evaluation, curricular reform was defined in terms of the extent to which the number of courses incorporating sustainability concepts increased and whether faculty used instructional practices that supported students learning sustainability concepts.

As of fall 2014, survey respondents reported teaching a total of 84 courses that incorporated sustainability content with three respondents who had not taught such a course. Administrative data for the 2009-2013 academic years suggests that for this time period 13,152 students enrolled in UVM courses that contained sustainability content taught by past SFF program participants.

However, courses taught by survey respondents incorporated sustainability concepts to greater and lesser extents (Table III). For instance, 80 per cent of survey respondents reported covering the definition of sustainability "to a great extent" or "somewhat", whereas three-quarters indicated they covered topics related to systems thinking, long-term effects and fairness and equity to a similar extent. In contrast, respondents were less likely to discuss other sustainability concepts, such as place, cycles and equilibrium. In these courses, survey respondents relied most heavily on a subset of strategies for incorporating sustainability content. Adding one or more distinct modules that covered sustainability concepts was the most frequently used approach followed by adding sustainability-related assignments and readings to the course syllabus.

Yet, efforts to implement curricular reforms were difficult. Not unexpectedly, survey respondents indicated that institutional factors posed challenges to integrating sustainability content into their courses (Table IV). Nearly three-quarters responded that a "packed curriculum to teach in a semester" posed a challenge ("to a great extent" or "somewhat"), and a similar share indicated that "lack of planning time" made integrating sustainability content in their courses difficult.

Sustainability concepts	To a great extent (%)	Somewhat (%)	A little (%)	Not at all (%)
The definition of sustainability	51	29	14	6
Place	42	9	30	18
Systems thinking	43	34	17	6
Diversity	33	30	24	12
Feedback loops	32	29	21	18
Community	38	21	21	21
Interdependence	35	24	35	6
Cycles	24	18	41	18
Change over time	41	18	29	12
Limits	38	29	18	15
Fairness/equity	46	29	14	11
Ability to make a difference	43	23	28	6
Long-term effects	43	34	17	6
Equilibrium	35	24	23	18

Table III.
Extent sustainability concepts were covered in recent course

Notes: Survey question: To what extent were the following sustainability concepts covered in your most recent course?; $n = 35$

Half of survey respondents also reported that large class sizes posed some challenges ("to a great extent" or "somewhat") to integrating sustainability concepts in their courses. One interviewee commented:

> Large class size makes it hard to teach in a way that you have that kind of recursive learning, where you teach, students express what they learned, and you express back to them your sense of learning. In my mind that is the ideal learning model, where there is a lot of exchange back and forth.

Interestingly, survey respondents also pointed to two areas related to their own capacity as potential barriers to teaching sustainability content. More than half reported that they encountered challenges ("to a great extent" or "somewhat") making "content connections", and a similar percentage perceived a "lack of learning activity resources" as limiting their ability to integrate sustainability content into their courses. Content knowledge related to sustainability concepts was not a significant challenge for most respondents with 86 per cent reporting that content knowledge was "a little" or "not at all" a challenge.

Instructional practice

The SFF program also sought to improve participants' instructional practice. Almost two-thirds of survey respondents reported formally adding sustainability learning outcomes to their course requirements ("to a great extent" or "somewhat") (Table V). Among teaching strategies, almost all respondents reported using class discussions about sustainability ("to a great extent" or "somewhat") in their courses; nearly three-quarters assigned sustainability-related readings to a similar extent, and 60 per cent assigned group projects related to sustainability concepts. Conversely, survey respondents were far less likely to bring in guest speakers or ask students to engage in service learning projects or ask students to journal or write research papers about sustainability concepts.

Survey respondents also reported on the extent to which SFF program activities helped them change their teaching practices (Table VI). Nearly two-thirds of survey respondents indicated that presentations on course design strategies helped them change how they taught sustainability content to students "to a great extent" or "somewhat". Around half of the respondents indicated that faculty luncheons and course presentations offered by their peers at the final luncheon helped changed their teaching practice "to a great extent" or "somewhat".

Challenges	To a great extent (%)	Somewhat (%)	A little (%)	Not at all (%)
Packed curriculum	50	21	29	0
Lack of planning time	21	50	29	0
Lack of department support	7	7	14	72
Hard to make content connections	14	43	14	29
Lack of content knowledge	7	7	50	36
Lack of learning activity resources	21	36	29	14
Class size	21	29	7	43

Notes: Survey question: To what extent have you encountered the following challenges to integrating sustainability content into your coursework?; $n = 14$

Table IV. Extent challenges were encountered integrating sustainability into coursework

Teaching strategies	To a great extent (%)	Somewhat (%)	A little (%)	Not at all (%)
Sustainability-related readings	48	26	17	9
Class discussions about sustainability	49	37	11	3
Group projects	43	17	3	37
Added course learning outcomes about sustainability	40	23	17	20
Case studies about sustainability	37	14	23	26
Using essential questions about sustainability	37	17	32	14
Service learning projects	34	3	3	60
Paper about sustainability-related concepts	26	23	14	37
Guest speaker about sustainability	8	17	6	69

Notes: Survey question: To what extent did you incorporate the following teaching strategies in your most recent course?; $n = 35$

Table V.
Extent teaching strategies were incorporated into recent course

Program activities	To a great extent (%)	Somewhat (%)	A little (%)	Not at all (%)	Did not participate (%)
Faculty luncheons	17	32	34	14	3
Campus as a learning lab	12	26	32	15	15
Course design strategies presentation	22	45	17	8	8
Course design mentoring and peer consultation	20	34	26	9	11
Course change presentation	17	36	25	14	8

Notes: Survey question: To what extent did the following program activities help you change your teaching strategies?; $n = 35$

Table VI.
Extent program activities changed teaching strategies

Community building

Survey program participants were asked about the extent to which they remained in contact with other SFF participants and in what ways they remained connected. Overall, 45 per cent of survey respondents indicated that they maintained contact with other members of their SFF cohort "somewhat" or "to a great extent". But another 37 per cent indicated that they had "little" contact with cohort members, and 18 per cent had no contact. Among respondents who remained connected with other cohort members, the majority reported that the nature of their contact was through collegial interactions or friendships (86 per cent). Additionally, about one-third of survey respondents (35 per cent) served on a thesis or dissertation committee with a cohort member, and 10 per cent of respondents reported collaborating on sustainability research or guest lecturing in a course taught by a cohort member.

Survey respondents also described the nature and extent of their participation in sustainability initiatives on campus since participating in the SFF program. Nearly half of respondents reported that they sat on a committee related to sustainability (49 per cent) or advocated for sustainability courses in their department (49 per cent).

Program satisfaction

Overall, survey respondents reported high levels of satisfaction with their experience. The majority (61 per cent) indicated that they were "very satisfied" with their SFF program experience, and another one-third were "somewhat satisfied" (37 per cent). Interviewee comments, and the survey's open-ended questions, provided opportunities for SFF program participants to describe, in their own words, how they benefited from the program. Interviewees shared:

> I think the two main benefits were developing a network of people who had similar interests and then getting to spend time with these people thinking about some of these issues.

> The culture of sustainability on campus being supported and being expanded through the program made me come to my own teaching with a sense of unity and a sense that this is a value at the university.

> I really enjoyed meeting people from a variety of disciplines across campus to find out how they were incorporating sustainability topics in their teaching and just hearing about all the different perspectives from cohort and leaders/organizers.

When asked an open-ended question about SFF program's strengths, 66 per cent of survey respondents mentioned the faculty network, 29 per cent mentioned program structure, 21 per cent mentioned improved teaching and 16 per cent mentioned improved understanding of sustainability. One survey respondent listed as strengths, "Culture and capacity building among faculty members, networking, sharing ideas, [and] discussions about sustainability".

Survey respondents also identified several ways they thought the program could be improved. Of particular interest were more opportunities to learn sustainability content and course redesign strategies, including model teaching and exemplar course syllabi. They also suggested using a tiered program format with one tier having an introductory exploration of sustainability and another concentrating more heavily on teaching strategies. A desire for networking opportunities that included members from past and present SFF program cohorts as also suggested. For instance, one survey respondent commented, "I would like to have more opportunities to mingle with other SFF cohorts as I do not feel that this factor is being exploited to its fullest potential yet".

Discussion

Evaluation findings expand what we know about the potential effectiveness of sustainability-focused FLCs and shed light on the challenges that institutions might encounter when adopting such an approach to faculty professional development. Findings also point to ways in which utilization-focused evaluations can inform program development and improvement efforts. We discuss each contribution in the following sections.

Insights for the field

Higher education has an obligation to prepare students to work toward positive change, equipping them with the ability to understand and solve complex problems (Shephard, 2008). Sustainability is an ideal framework because it focuses on the interaction between societal, ecological and economic systems (Vincent and Focht, 2009). To meet this obligation, higher education institutions have adopted different approaches to build

capacity for sustainability education, including FLCs (Barlett and Chase, 2013). Our evaluation of UVM's SFF program contributes to existing evidence that sustainability-focused FLCs can be a useful strategy for helping higher education institutions achieve these goals. Overall, the evaluation's findings suggest that UVM's SFF program expanded faculty understanding of sustainability concepts, encouraged curricular and instructional reform and made progress toward developing a community of faculty interested in sustainability education.

Among program goals, the SFF program was most successful at building participants' knowledge around sustainability concepts. Nearly all SFF participants reported that the program helped them better understand core sustainability concepts. This translated into participants incorporating sustainability content into more than 80 courses at UVM.

SFF program participants found the two-day institute most useful to their learning about sustainability concepts, especially those activities and exercises provided on the institute's first day. While still meaningful, SFF program participants found the institute's agenda for its second day, and the faculty luncheons, somewhat less useful. Survey responses seemed to suggest that faculty most valued opportunities to come together as a group to discuss and explore sustainability concepts.

The evaluation also brought to light some challenges facing the SFF program as it continues its efforts to build the university's capacity for sustainability education. Some sustainability concepts have received more attention than others in coursework. Some respondents reported that they struggled making connections between sustainability concepts and their disciplinary perspectives or course requirements in their teaching.

Evaluation findings also suggest that the SFF program was somewhat less successful in influencing how faculty taught students about sustainability. For the most part, faculty continued to rely upon direct methods of instruction most typically used in higher education settings (e.g. learning modules, readings and assignments). Competing demands for faculty time and attention were problematic, and the effect of limited time to prepare and teach sustainability content appeared to result in more superficial treatment of sustainability content in coursework. For instance, faculty were more likely to incorporate separate modules about sustainability and standalone readings in their courses rather than take steps to integrate sustainability content throughout the course. Adding sustainability readings or assignments could qualify a course as having sustainability content but, at the same time, would not provide students with opportunities to develop a deeper understanding of sustainability concepts. While efficient, such approaches to course redesign and instruction may not reflect the types of systemic changes to teaching and learning envisioned by the program.

SFF program participants valued the network of peers they built through interactions with fellow cohort members. They remained in personal and professional contact and, in some cases, solidified professional relationships through advising, teaching and shared research. Program participants described the importance of feeling part of a community of inquiry, particularly one that transcended their disciplinary connections. In fact, survey respondents noted that they were interested in the program offering more and different types of opportunities for faculty networking. These findings are consistent with past research on the benefits of FLCs and faculty interest in opportunities to further develop personal and professional networks (Chase and Rowland, 2004; Eisen and Barlett, 2006).

Utilization-focused evaluation in practice

In an attempt to incorporate discoveries, the program's evaluator discussed findings with the SFF program coordinating committee. The committee found data pointing toward areas in which the program could be improved particularly useful. Armed with these data, the committee is modifying the SFF program in a number of ways. For example:

- The coordinating committee reconsidered the topics covered during the two-day institute's second day and the faculty luncheons. Survey findings suggested that participants needed additional professional development and support for course redesign and teaching. In the future, the institute and luncheons will include additional training on teaching strategies and opportunities for faculty to view and model good teaching practice.
- In the future, the SFF program will incorporate peer mentoring. For example, faculty members with more teaching experience and less knowledge of sustainability concepts will be paired with faculty members with less teaching experience and more sustainability knowledge.
- Program participants will have the opportunity to receive individual consultation to support their syllabus development with an eye toward infusing sustainability concepts throughout courses and drawing connections between disciplinary perspectives and sustainability concepts.
- The coordinating committee intends to organize alumni events to provide networking opportunities among program participants from different SFF program cohorts.

The evaluation's focus on providing useful information that the coordinating committee could use to further refine and improve the SFF program has the potential to be instrumental to establishing a process that supports organizational learning and change.

Limitations

The evaluation's design and findings are subject to several important limitations. First, the evaluation's timing limited the amounts and types of data that could be collected. Post-test designs can look retroactively at program enactment and participants' experiences and behaviors. As such, data reliability may be bounded by participants' ability to recall and relate relevant information, especially when longer (multi-year) recall periods are involved. Second, while the evaluation holds promise for contributing to the larger body of knowledge around the potential effects of FLCs and curricular reform related to sustainability education, findings are not necessarily generalizable to FLCs in other contexts. Rather, the evaluation provides evidence in support of program characteristics that are likely to be successful or unsuccessful in building institutional capacity for sustainability education. Finally, it is important to note that SFF program participation is voluntary. As a result, self-selection by participants into the program has the potential to bias study results. Faculty with greater knowledge and interest in sustainability may be more likely to participate in the SFF program, seeking a community of faculty interest in similar issues and new teaching ideas. Conversely,

faculty with less knowledge might be more likely to participate, seeking additional information and professional development.

Recommendations

There is a continued need for future research on FLCs possible role in supporting higher education sustainability initiatives. More information is needed on other possible FLC models, including their effects on faculty learning and curricular reform. Pre-post designs that capture actual, as opposed to perceived, changes in faculty knowledge and behavior could add to knowledge of program effects. Additionally, content analysis of faculty syllabi to better gauge the scope and quality of efforts to incorporate sustainability in curricula could be insightful. It may be helpful to explore ways to sustain lasting communities after the FLC program experience. Future research might benefit from an increased focus on the processes – institutional, social and cognitive – at work in FLCs and how these processes facilitate or impede faculty learning and program development. For instance, social network analysis among faculty participating in FLCs may be a productive course of study.

Implications

While FLCs are an appealing strategy for faculty development around sustainability education, very little research exists on different sustainability-focused FLC models and their effects on faculty learning and curricular reform. In light of existing limitations in the research literature, this study makes three important contributions.

First, the study describes UVM's SFF program – one possible model for developing a sustainability-focused FLC in higher education contexts. The SFF program structure builds on the Piedmont and Ponderosa model, including a two-day workshop, faculty discussion workshops, online resources and a professional development stipend (Barlett and Chase, 2012). Additionally, the program is implemented through a unique partnership with Shelburne Farms, a community-based organization focused on sustainability education.

Second, findings from this study extend what we know about the potential effectiveness of FLCs, generally, and about the SFF program model, specifically, as a strategy for sustainability-across-the-curriculum faculty development. Given financial challenges faced by higher education institutions, FLCs may provide a low cost (approximately $3,000 for food and meeting space plus faculty stipends), in-house option for improving faculty development efforts.

Finally, this study demonstrates the role social science research, especially program evaluation, can play in continuous program improvement. Findings from this study reveal both strengths and opportunities for future program development and improvement. This information is both useful and important to decision-makers faced with the task of implementing and improving efforts to support sustainability-focused curricular reform.

Conclusions

Although the number of higher education institutions adopting sustainability-focused FLCs has grown significantly in recent years, very few of these programs have been evaluated (P. Barlett, personal communication, 2015). Moving forward, greater attention should be paid to implementing utilization-focused evaluations of sustainability education programs, as well as broadly disseminating evaluation findings. Lessons

learned from programs are important for identifying aspects that are more or less successful in building institutional capacity for sustainability education and developing a better understanding of how programs might be replicated. The SFF program serves as an example of one university's sustainability-across-the-curriculum effort to facilitate curricular change to prepare students to solve complex problems and work towards positive change.

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Further reading

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