

Sustainable Architecture that Teaches: Promoting Environmental Education through Service-Learning

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Abstract

The University of Maine at Farmington (UMF) has undertaken a commitment to establish a culture of environmental sustainability. With two new Leadership in Energy and Environmental Design (LEED) certified buildings on site, a green building curriculum has been developed. This multidimensional curriculum involves university faculty, students, K-12 teachers and students, and regional community members. One focus area of this curriculum is to empower university students to teach sustainability to others through a variety of service-learning projects.

Imagine a university where caring professors work side by side with students—in research, creative endeavors, in the classroom and outside; a university where faculty members collaborate and reach out to the community with their students to promote environmental stewardship through education and action; a university that goes above and beyond “simply adding a few classes on environmental issues and sustainability” (Shriberg 2004). The University of Maine at Farmington (UMF) is such a place. David Orr (1994), a strong advocate of using green buildings as models of sustainability, states, “We have assumed wrongly I think, that learning takes place in buildings, but that none occurs as a result of how they are designed or by whom, how they are constructed and from what materials, and how they fit their location, and how well they operate.... academic architecture is a kind of crystallized pedagogy and buildings have their own hidden curriculum that teaches as effectively as any course taught in them” (113). As a public liberal arts university and the state’s leading teacher education institution, UMF has used two architectural resources as the focus of a curriculum that is developing an educated citizenry and influencing teachers who have the critical role of inspiring future generations to take their place in a sustainable society. The campus has been moving forward to establish a culture of environmental sustainability, including the design and construction of two new buildings, the Francis Allen Black Residence Hall and the UMF Education Center, both certified by Leadership in Energy and Environmental Design (LEED). This commitment is illustrated in UMF’s Green Campus Vision Statement:

Sustainable practices will be an integral part of our campus management and operations, in building and renovating, in reducing pollution and waste, in using appropriate energy resources and materials, and in protecting and

incorporating the native environment in our campus spaces. Indoor and outdoor environments should be healthful and aesthetically pleasing. Committing to environmental responsibility means that we will also set goals for ourselves and monitor our progress towards them. (UMF 2010)

At UMF, substantial progress has been made in implementing this vision. The Sustainable Campus Coalition (SCC) is a group of students, faculty, staff, and community members that promotes environmental sustainability on campus and in the regional community. The organization started in 2001 with a focus on the green design of the UMF Education Center, which was completed in 2006 with a LEED Silver Certification (USGBC 2010). The mission of the SCC has broadened considerably since that time to include public education; collaborations with community organizations, municipalities and schools; assessment and mitigation planning associated with greenhouse gas emissions; improvement of recycling on campus; development of a campus organic garden and orchard; encouragement of local food and institutional composting; and reduction of automobile idling (UMF 2009). The SCC provided the framework for UMF's green building curriculum project. Numerous members stressed that we needed to use our LEED-certified buildings as teaching tools to reach out to the community. The Society of College and University Planning reports, "Few institutions make it clear to students that they are modeling sustainability in campus operations.... In recent visits to 6 campuses with new LEED-certified ... buildings, 2 of which were freshman residence halls, there was no way, in 5 of the buildings, for students to even know that they were living or studying in a model building. Also, there were no organized systems to explain what was green about the buildings and how they were different from traditional buildings" (Calhoun 2005).

During the spring 2008 semester UMF was awarded a U.S. Green Building Council Curriculum Incentives grant to develop and implement a multilevel "green" building curriculum. The goal set for this curriculum was to use these buildings as teaching tools and to reach out to K-12 schools, university faculty and students, and regional community members. One main area of focus throughout the new curriculum is service-learning—a means through which students take ownership of this curriculum so that they not only learn about LEED certification but also learn to teach sustainability to others. "Service learning unites research, teaching and service; combines community work with classroom instruction; and prepares students to participate in public life, thus integrating theory and practice" (Speck 2001). The theory behind service-learning is what all higher education institutions want for their students. The challenge is helping the faculty find the time, resources, and the necessary pedagogy that will motivate students to participate. This article will describe the benefits and challenges of UMF's efforts towards institutionalizing a green building curriculum through service-learning pedagogy.

UMF's Green Building Curriculum Incentives Grant

The curriculum project has five phases: research, implementation, assessment, institutionalization, and dissemination. This was a one-year grant intended "to provide

monetary support to develop innovative curricula that advances green building education across the spectrum of educational levels and contents areas” (USGBC 2007). The funding provided by the grant enabled the principal investigator (Eason) to hire two student leaders, a statistician, and two elementary educators to begin this project. Their roles are outlined in each of the five phases of this curriculum.

Phase 1: Research

At the beginning of the project, the principal investigator (PI) researched each of the Leadership in Energy and Environmental Design (LEED) certified elements in the Francis Allen Black Residence Hall and the UMF Education Center. This research began by meeting with the UMF facilities management director and the architects responsible for building design. The products of this research consisted of two outlines, one for each building, highlighting the LEED features in each of the buildings. Once the two student leaders were hired, they were given a tour of both buildings and were asked to add their questions to the tour outline. Those questions prompted them to continue researching various aspects of both buildings. These tour outlines have now become highly sophisticated online tour protocols. These protocols will continue to be developed as tours continue and new student leaders come on board with the project. The student leaders will be responsible for continually modifying and updating the tour protocols each year and for training each other to give tours. The education center tour protocol can be viewed at <http://edcenter.umf.maine.edu/>.

Phase 2: Implementation

The implementation phase includes numerous aspects to provide the project with coherence and continuity. Those aspects are interdisciplinary collaboration, student leader training, technology integration, service-learning, and community outreach. By including certain key partners in the project the PI can rely on them to implement a variety of project goals.

Interdisciplinary Collaboration

This curriculum needed to transcend disciplinary boundaries, a daunting task in the academy. To address this challenge, two colleagues were recruited (Andrea Freed and Rebecca Berger), who were already implementing service-learning projects in their courses and who were team-teaching an elementary science and social science methods course. This curriculum provided them with a fairly smooth transition from a strictly science or social science methods service-learning project to projects that had an environmental focus, specifically involving our LEED-certified education building. Once the elementary education professors were committed to the project, the next step was to hire the student leaders and allow them to mentor and work with elementary science and social science students on their projects.

Student Leaders

One secondary education earth and space science major (Stephanie B.) and one environmental science major (Pam G.) were hired as student leaders. The student leaders were told that they could make this project their own, and that the more

creative they were the better. They were responsible not only for the tour protocol of the building but also for conducting building tours and mentoring elementary science and social science elementary education majors. After giving several tours, they decided it would be extremely beneficial to have the green building materials that were discussed on the tour available to tour participants. They developed a “tour kit box” that included samples of numerous green building materials used throughout the Education Center—segments of porcelain tile floor, marmoleum flooring (a natural flooring product made from linseed oil, wood flour, cork flour, rosin, jute, and limestone), recycled carpet tiles, Dakota burl wall segments, fluorescent vs. incandescent bulbs, and a teaching poster of the geothermal system. Tour participants were thus able to handle numerous green building samples as the student leaders discussed them. In addition, a display board containing each of these samples was created so that the tour guides could use it as a reference when discussing various samples. The tour guides also developed an Education Center “wiki” site, which is found at <http://umfedctr.wikispaces.com/>. This is a “working” website where the tour schedule is posted as well as background information on our LEED-certified buildings. Most importantly, this wiki site serves as a student work site for their service-learning projects. The student leaders helped the elementary science and social science education students post their projects online. Students who participated in the project used the wiki site to present their work at the end of the semester. This wiki site was also shared with regional teachers, university professors, and community organizations so that they could schedule tours.

Technology Integration

The wiki discussed above addressed several technology challenges faced by the PI in this project. What was needed was a simple website where everyone who wanted to take a tour could access this information without overloading the PI’s inbox with inquiry e-mails. The word “wiki” is short for the Hawaiian word wiki-wiki, meaning “quick.” Ward Cunningham, who was hoping to design an easy authoring tool to facilitate publishing, created the first wiki in 1995. Our project made use of the wiki concept since it is a website that can be easily created and continually edited (Richardson 2009), and teaching students how to use this tool is quite simple. There are several additional benefits to using wiki sites: students learn to publish well-researched content, in this case information about the Education Center; they collaborate with the PI and each other regarding correct information, relevance, and meaning; and they also have a site that they can easily teach future student leaders to use and be responsible for (Richardson 2009). In spite of these benefits, one challenge remained before allowing student leaders to post information on the World Wide Web—how to prevent someone from anonymously going into this wiki site and vandalizing it by erasing content or adding inappropriate information. The solution was to teach the student leaders how to protect their sites so people can view the information but would not be able to change the content unless they get permission from the site’s editor(s). A tour calendar was developed and the students entered in the days and times they were available to give tours. They also posted their e-mail addresses so that potential tour participants could contact them. A tour time that is highlighted in green is an open time/day slot; a time that is highlighted in red is a

closed slot. Once the calendar was posted and student leaders were familiar with wiki site development, they were given permission to fully design the site.

The site has evolved to include a number of pages: one devoted to the PI's introductory environmental science students, for their online Education Center service-learning projects; a K-8 Teacher and Student Resources page containing projects created by elementary education students (i.e., online activities and lesson plans); a 9-12 Teacher and Student Resources page used by UMF's pre-service secondary science teachers to post their online activities and lesson plans; and a page for U.S. Green Building Council and LEED certification background as well as Education Center history. Over the course of one year the site became a wonderful working website where the PI's introductory environmental science students and elementary education students could post their work, and where the student leaders could keep their tour schedules organized and manageable.

This wiki site has given rise to an official UMF Education Center website. This website is overseen by one student leader who is familiar with Wordpress software and who corresponds regularly with the university webmaster. Wordpress software is a free publishing platform that is an easily accessible blogging tool. The website was developed to provide a more high-profile look to the project as well as a tool for recruitment for potential students interested in sustainability efforts. It is also used to highlight the most high-quality student projects that teachers can use. Both sites are used for community outreach: the wiki site to schedule tours and for civic engagement projects, and the official UMF Education Center website to profile the project both regionally and nationally. The official UMF Education Center website can be found at <http://edcenter.umf.maine.edu/>.

Service-Learning Implementation

The PI and student leaders attend one class period of the elementary science and social science methods course each semester and introduce the project. The elementary pre-service teachers learn about the green features of the Education Center by going on a tour, and are then provided with several choices on how to contribute to the project. Initially there were three choices: the first was to serve as grade K-8 tour guides for regional school groups in the area; the second was to create online age-specific activities, such as a green building webquest, that K-8 students might engage with before or after a tour; the third was to create pre-tour and post-tour Maine state standards based lesson plans that the teachers could use with students. Some of the challenges encountered while implementing these service-learning projects were issues related to the quality of the projects. For example, some of the elementary education pre-service teachers did a wonderful job of providing tours to K-8 students. Others had misconceptions about certain building elements, such as how the geothermal system works. To address this issue a student leader was always paired with an elementary education student to address any misconceptions that might arise. The next challenge was to address online activities and lesson plans that needed further development. The elementary education instructors and PI decided that not all projects would initially be exemplary and that future students can build on the work that other students began.

Less-than-exemplary projects were used as building blocks and students were told that these projects needed further development. Students could then modify these projects and improve them. Throughout the year of the grant this model worked fairly well and based on student feedback, new projects emerged. For example, some students wanted to incorporate podcasts of third grade students' impressions of the green building tour, while others have suggested interviewing building donors to share why they contributed to the project. By allowing students the freedom to determine how they wanted to contribute to this project, we have discovered that they are quite creative and this has led to greater student engagement and investment in this project.

Elementary Educators

The effect of this project on elementary science and social science students has been transformative on many levels. From the beginning, the planning committee's vision for UMF's LEED-certified Education Center involved its use as a teaching tool. Unlike other LEED-certified buildings on campus, which are used for student housing, the Education Center is accessible to the public. As an educator in both K-12 and higher education, Berger understood the building's potential use, particularly with regard to field trips. The possibilities for the integration of science content were obvious, but the question remained of how to make relevant a "green building" curriculum for the elementary education majors in the social studies methods courses.

Several factors contributed to Berger's decision to incorporate issues of sustainability into her social studies methods course. Students were encouraged to engage in the process of social science inquiry as they created units that included both science and social studies lessons. Through contacts at the Maine Department of Environmental Protection (DEP) and the Maine Energy Education Program (MEEP), students learned about issues of air quality and then devised service-learning projects where they visited classrooms in local schools to present lessons on the topic. This approach to social studies went beyond the parameters of the typical social studies curriculum of history, geography, economics, and government to encompass a broader definition of social studies as active participation by citizens in addressing the issues of the day. This approach received an official boost from the state of Maine when the 2007 Maine Learning Results (Maine's current state standards) were introduced. In addition to civics and government, history, geography and economics, the 2007 Learning Results also included a standard with a strong civic engagement component that encouraged the use of an inquiry approach. The heading of Standard A is "Applications of Social Studies Processes, Knowledge and Skills," and it requires students to (a) research and develop positions on current social studies issues; (b) make decisions using social studies knowledge and skills; and (c) take action using social studies knowledge and skills. Thus, the 2007 Maine state standards reinforced the curriculum being used for the pre-service teachers (Maine Department of Education 2007).

Early in 2008, the PI proposed a collaborative effort to bring to fruition the idea of using the Education Center as a teaching tool. She applied for and received a grant from the US Green Building Council (USGBC) that has enabled professors, education students and environmental science students to work together for several semesters,

building on the previous semesters' work and continuing to refine both face-to-face and web-based curriculum and information. This continuity has also enabled us to be more systematic in contacting teachers and others in the local community about what the Education Center offers with regard to curriculum with a focus on environmental sustainability. Because of the pre-service teachers' work with MEEP and DEP, and the emphasis on service-learning as a part of social studies, issues of environmental sustainability were already a part of classroom conversations. In order to encourage students to envision the Education Center as a teaching tool, an addendum to course syllabi was developed collaboratively, and the kinds of projects that students could undertake for this assignment were listed.

Then all of the pre-service students were taken on an extensive tour of the building and all of the green features were pointed out and discussed. Pre-service teachers were encouraged to think of curriculum possibilities based on grade level. That first semester, UMF pre-service teachers produced brochures, informational coloring/activity books and developed age-appropriate tours of the building. Products from this first semester, while adequate, drew on strategies for elementary-age learners that did not tap into complex levels of thinking. More could be done. Over the course of the next two semesters, the pre-service teachers in the science and social science methods courses continued to develop "green building" curriculum, both face-to-face and web-based. In the spring of 2009, one group put together a virtual tour of the Education Center while another group conducted on-site tours with all of the local third grade classes. Pre-service teachers conducted follow-up interviews with some of the third graders for a podcast. This helped the pre-service teachers assess what the third graders learned as well as the effectiveness of the activities on the tour.

Students of all ages have benefited from the use of the Education Center as a teaching tool. First, anyone who tours the building becomes more aware of issues of environmental sustainability, and this carries over to campus and community life. Farmington is in the planning process for the construction of two new schools, and both will be "green" buildings. The LEED-certified buildings on the UMF campus as well as UMF alumni and faculty who are involved with the local schools have influenced this decision. Second, the ongoing collaborative nature of this project has afforded pre-service teachers the opportunity to build on the work of students from previous semesters, thus ensuring that issues of environmental sustainability have been woven into the methods courses to a greater degree than would have been possible otherwise. The ongoing nature of the work has also been responsible for the increased cognitive complexity of the curriculum developed by the pre-service teachers, since they do not have to "reinvent the wheel" every semester. This is also an opportunity for them to contribute to the professional teaching community, and they take that responsibility seriously, like the professionals they are becoming. Third, this work has contributed to a greater understanding on the part of the pre-service teachers about the importance of civic engagement. Their work with elementary students in the context of sustainability issues makes Standard A (above) of the Maine Learning Results come alive. Learning about the Education Center and then extending that knowledge can help us envision new ways to minimize human impact on the environment.

Student Leaders' Perspectives

One of the goals of this project was to emphasize the importance of leadership, which is why two student leaders were hired to facilitate the knowledge and skills necessary to not only impact UMF community efforts but to also demonstrate that no matter what one's major is, service-learning transcends disciplinary boundaries. According to Ehrlich, "Faculty who support this approach emphasize that the knowledge and especially the skills of leadership are best gained in a real-world environment, where students must practice 'in role.' And where effective leaders can be observed first hand" (2007). Below is a summary of the student leader's involvement in this project.

This project offers the opportunity to integrate hands-on application of natural science course work with sustainable building techniques and materials in a way that encourages and empowers the UMF campus and surrounding community to explore and implement sustainable practices in their own homes, schools, work, and daily activities. Working with faculty, fellow university students, area teachers, K-8 classroom students, and community organizations is a shared effort, proving that environmental sustainability is an interesting and important issue to a broad-based population of varying ages, experiences, and backgrounds. A curriculum using the built environment as the classroom provides a unique perspective for the collaboration of science, science education, and community outreach.

The built environment is a significant component in the conversation surrounding environmental sustainability since we live, work, and recreate in and around buildings for most of our lives. As an environmental science major, it is important to understand the connections and impacts that buildings, neighborhoods, and communities have on ecosystems from the backyard to the world. Many aspects of environmental sustainability are reflected in the variety of degree programs that use the building in their discussions and research, including physics, geology, business and economics, sociology, philosophy, biology, chemistry, the arts and more.

The researching of materials and techniques, conducting of tours to all age groups, and collaboration with faculty and the community have generated conversations and questions about environmental sustainability—most positive, some negative, and all thought-provoking. Direct contact with the materials, discussion of construction techniques, and conversations about behaviors and practices fosters dialogue and a new perspective through which tour participants can then re-view their homes, schools, and offices. We hope they will have gained a new awareness and motivation to approach those areas and integrate small steps such as replacing standard incandescent light bulbs with compact fluorescents, or to implement larger changes, such as choosing a new home site that has long-term sustainability, approaching a renovation project through a "green" lens, or accepting an employment position with alternative transportation for the commute.

A tour experience at UMF's LEED-certified Education Center is far-reaching. Young tour participants learn about environmentally sustainable building materials and techniques used in the UMF Education Center. They share that information with their

family at the dinner table, with other students during lunch, and with friends or extended family members over the weekend. Parents share that information with coworkers or friends; fellow students share the information with their parents; family and friends share it with other family members, coworkers, and friends. Likewise, adult tour participants share their experience with their spouse, coworkers, family, and friends. Environmental sustainability and the built environment stretch far beyond the campus limits.

Working on this project has not been without its challenges, however. Conducting tours in the LEED-certified Frances Allen Black Hall would have compromised resident students' privacy, so the tour protocol was amended to include a verbal component about that building's sustainable features. Budget constraints prevented many K-12 school groups from visiting the UMF campus; to address this challenge, a variety of alternative tools were developed, such as a "Tour to You" PowerPoint presentation using photos to explain sustainable features, a portable tour kit with material samples to be passed around, and a tabletop display that features sample materials. The "Tour to You" will be transported from the UMF campus to area schools in an energy-efficient Prius from the university fleet. Once the students and their teachers have received a virtual tour, the goal is that they will be able to visit the campus for a live tour of the facility. The "Tour to You" PowerPoint can be found on the UMF education center website: <http://edcenter.umf.maine.edu/tour-protocol-2009-2010/>. Another challenge was coordinating schedules with UMF Elementary Education majors and other fellow UMF students to assist them in their methods and service-learning classes. A wiki site providing instant access to tour times and contact information has made scheduling easier. Two websites have been developed that highlight tour information, photographs, and projects as well as video tours.

Classrooms in the Education Center are often occupied during the day, thus restricting access to some "green" features. This problem has been overcome by using a tabletop display and sample materials to demonstrate key features. Disruption to classes is minimized by informing instructors to close their doors and by reminding tour participants that classes are in session—questions and comments are held until reaching an appropriate site later in the tour. Since exterior features are inaccessible or invisible during the winter months, a dry-erase board is used to diagram structural components.

In summary, this program has enhanced the student leaders' studies in natural sciences, deepening the understanding and appreciation of the complex relationship between ideal best-practices in resource conservation and environmental sustainability and the human component that is impacted by time and resource restrictions relative to budget and schedule constraints. Reaching out to a variety of age groups with varied backgrounds, experiences, and perspectives on the environment and on sustainability has enriched the discussion and heightened awareness for all those participating in the tours, and for the organizations with which we interact. Professional development through presentations and interactions with legislators, educators, and industry professionals increases students' confidence and self-esteem as well as increasing knowledge of the subject.

Service-Learning Suggestions

Service-learning, civic engagement, and other terms with a “service” component are ubiquitous in educational circles right now. What follows are a few caveats based on our experiences in this project. Educators should not succumb to pressure to institute service-learning in a particular course. Importance should be placed on finding a project that is truly worthy of the time and effort, and one from which both college students and the community will benefit. The term “community” has many meanings. Most university-wide service-learning projects involve regional or state community stakeholders. For our purposes, community initially meant the UMF campus community. By focusing on the UMF community, the instructors involved in the project had a greater sense of control regarding the quality of student projects. This enabled greater flexibility in our timelines and eventually allowed students to improve previous projects that were of lesser quality. Later, the definition of community was expanded to include outreach to K-12 classrooms in the region. It also was important to have various choices available for the service-learning projects (e.g., giving tours and creating lesson plans), and this worked well for classes with no more than twenty pre-service teachers. For much larger classes, one should consider making a service-learning project optional. Students who choose to do service-learning projects tend to do so out of personal interest. As word of their success spreads, more students will become engaged in these efforts.

University Courses and Community Outreach

The Education Center tours were also made available to UMF faculty, staff, and members of the community. Last year during grant implementation, tours were given to university students in the following courses: introductory environmental science, introductory geology, introductory biology, humanities, and first year seminar. Community organizations that participated included the one hundred Maine state legislators tour, Western Maine Mountains Alliance, and the Teachers Advisory Council. Initially, during the fall semester, there were only a few tours conducted, mainly with K-12 school groups. However, as word spread and faculty instructors understood what the tours involved, faculty, administrative, and community interest increased.

On numerous occasions faculty and community members contacted us after the tours and expressed their appreciation. Tom Eastler, UMF Professor of Geology sent this e-mail after one of the student leaders took the Farmington Lions Club for a tour:

Twenty members of the Farmington Lions club were treated to a very informative and professionally presented tour of the new LEED certified Education Building on the UMF campus. Pam was everything that we collectively wanted in a tour leader, and the tour itself was everything we wanted in such a tour. All aspects of the planning, construction, and operation of the new building were discussed and no leaf was left unturned. Our Lions membership consists of Real Estate brokers, bankers, construction business owners, retailers, funeral home operators, well drillers, farmers, lawyers, veterinarians, and many other occupations who were all very impressed with the depth of information given and the ease, confidence, and knowledge

demonstrated by the tour leader. We collectively support the efforts of the University of Maine at Farmington to educate all of us in the community to the degree to which alternative approaches to construction and operation of such a magnificent building. Town/Gown (relations between the town folk and the university) relations have never been better. Thank you very much for your able assistance.

Phase 3: Assessment

A UMF statistician participated in this project and helped develop two online assessments. The assessments were intended to measure tour quality and impact. The first assessment was designed for PreK-12 teachers whose students participated in the tours. This was an online survey where teachers would comment on tour quality, educational online activities, and lesson plans. Teachers would also be afforded the opportunity to provide suggestions for improvement of all educational materials. The teacher survey was not ready in time to have the teachers complete it during the grant year (fall 2008 to spring 2009). However, the original teacher survey (see Figure 1) is currently being completely revised based on the results obtained from the community survey (see Figure 2). The community survey was the second type of assessment and it was given to university students, faculty, staff, and regional community members during the spring 2009 semester. This survey was given on-site in hard copy form to insure a greater survey return rate. The biggest challenge faced in survey development was the amount of time required to actually create an instrument that would provide the needed information. The surveys continue to be modified as more feedback from tour participants becomes available.

Figure 1. Teacher Survey

Did the tour guide . . .

Provide you and your students a comprehensive and organized explanation of the LEED certified features in the Education Center?

Select one: 5 Yes, great job 4 3 2 1 No, not at all No answer

Answer your questions effectively?

Select one: 5 Yes, great job 4 3 2 1 No, not at all No answer

Relate to you by actively engaging you in the tour through good eye contact, discussing the features at a reasonable pace and maintaining a professional, yet friendly, attitude?

Select one: 5 Yes, great job 4 3 2 1 No, not at all No answer

Were the brochures/activity booklets . . .

Age appropriate: Your students were able to easily understand the content presented in the booklet/brochure.

Select one: 5 Yes, great job 4 3 2 1 No, not at all No answer

Informative: Your students were provided with information to help them understand the main concepts discussed on the tour.

Select one: 5 Yes, great job 4 3 2 1 No, not at all No answer

Filled with Helpful, Practical Ideas: Your students were able to conduct some follow-up research and use ideas from the tour both at home and at school.

Select one: 5 Yes, great job 4 3 2 1 No, not at all No answer

Figure 2. Community Survey

Did the tour guide . . .

Provide you and your students a comprehensive and organized explanation of the LEED certified features in the Education Center?

Select one: 5 Yes, great job 4 3 2 1 No, not at all No answer

Answer your questions effectively?

Select one: 5 Yes, great job 4 3 2 1 No, not at all No answer

Relate to you by actively engaging you in the tour through good eye contact, discussing the features at a reasonable pace and maintaining a professional, yet friendly, attitude?

Select one: 5 Yes, great job 4 3 2 1 No, not at all No answer

Was the brochure . . .

Informative: Were you provided with the information you need to understand the main features discussed on the tours?

Select one: 5 Yes, great job 4 3 2 1 No, not at all No answer

Clear and Concise: Was the information organized and easy to follow?

Select one: 5 Yes, great job 4 3 2 1 No, not at all No answer

Filled with Helpful Practical Ideas: Ideas that you feel you can use at home?

Select one: 5 Yes, great job 4 3 2 1 No, not at all No answer

Preliminary Survey Results

Community surveys were implemented toward the end of the first year of the project and distributed as time allowed. Most respondents (n=40) were from the local area (49 percent from the local community, 29 percent from the university, and 22 percent visiting from other areas of Maine). Most participants (68 percent) had heard about tours directly through the University of Maine at Farmington, either through the university Listserv discussion list, UMF faculty, or a UMF-sponsored event, while 32 percent listed their source as “other.” The ratings for the tour guide and the brochure (a condensed two-page version of the tour protocol discussed earlier) were all 5s (“Yes, Great Job”). Although this feedback was greatly appreciated and provided us with an indication that the tours were being well received, what was most interesting were the comments that participants provided in the open-ended section of the survey not included in the figure. The tour guide asked the following question: “Out of all the features that were discussed on the tour, which did you find the most interesting?” Of the many sustainable design features, most participants found the geothermal heating/cooling system especially interesting (see Figure 3)—several requested that a tour of the pump room be incorporated into future tours. When environmental health impacts were discussed, respondents indicated that products made from formaldehyde-free, rapidly renewable products and No VOC (Volatile Organic Compounds) paints and adhesives were the most interesting (see Figure 4).

Figure 3. When asked which building design aspects were most interesting, 98 percent of respondents chose the geothermal heating/cooling system. Automatic lighting was chosen by 76 percent, and window features (south-facing and double-paned) were each chosen by 61 percent of respondents.

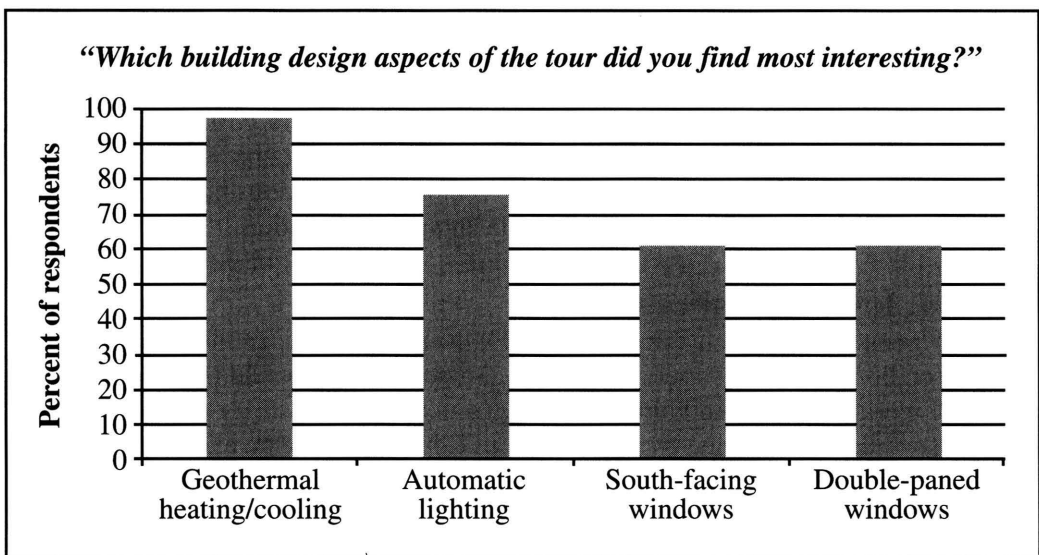
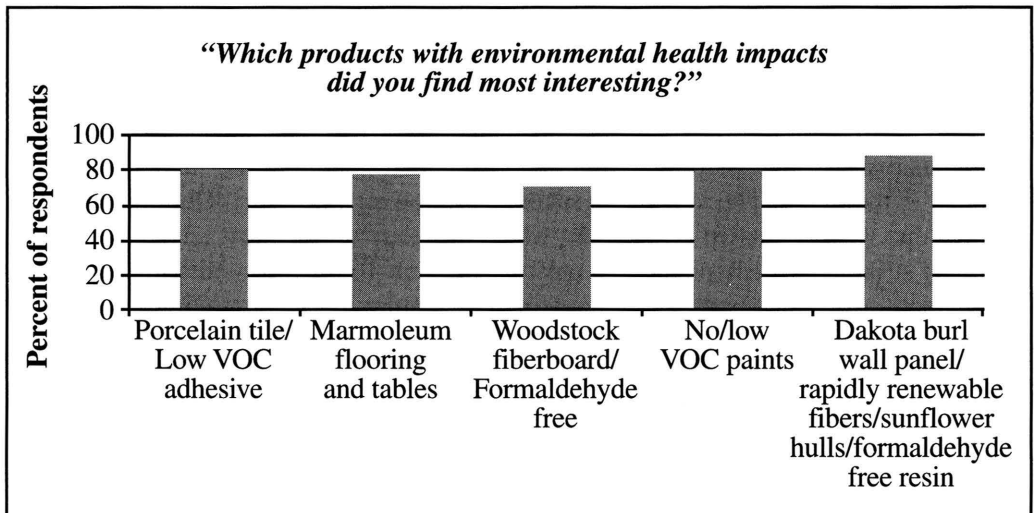


Figure 4. Of five featured materials with environmental health impacts, products composed of rapidly renewable materials and formaldehyde-free resin were deemed most interesting by 88 percent of respondents. Porcelain tiles with low VOC adhesive and no-low VOC paints were each chosen by 80 percent of respondents, while wood-stock fiberboard was chosen by 71 percent of those surveyed.



When asked how the UMF community could provide additional resources for sustainable alternatives, 98 percent expressed interest in steps to decrease energy use, 93 percent thought tips on home weatherization would be useful, 90 percent wanted to know how to save money while driving, and 88 percent said knowing how to grow their own food in a small space would be important information. While the anonymity of the surveys could make it easy to simply check off boxes, 64 percent of the surveys had handwritten comments and requests that were generally very positive, with several suggestions to incorporate cost and economic data into future tours. Both surveys are currently being modified to incorporate more open-ended questions because they provide greater feedback for tour modification and implementation.

Phase 4: Institutionalization

Once the grant was completed in August 2009, the plan was to continue curriculum implementation through a variety of avenues. Student leaders would be paid as part of the UMF work initiative and work-study programs. Printing costs for educational materials would be supported by the College of Education, Health, and Rehabilitation. Faculty members would continue to collaborate and work with pre-service teachers using the Education Center, now that this project was part of their curriculum. Some aspects of the institutionalization process have changed since the original grant proposal was written. University work-study and work initiative funds have supported student leaders. These positions are applied for by individual faculty members and approved by the university Financial Aid and Provost’s Office. However, in order to

save resources, time and money, print materials are being replaced by online alternatives (online activities, lesson plans, etc.). Brochures will continue to be part of the tour, since many teachers and community members have commented that having something tangible in hand allows them to share this information with others. Student leaders who were part of the project from the beginning will train future student leaders to conduct tours and provide support for service-learning projects.

Phase 5: Dissemination and Community Impact

This curriculum has been presented at regional, national, and international conferences. The regional conference was the Maine Science Teachers Association Conference, a statewide conference intended for Maine pre-service and regional science teachers. The national conference was the USGBC Green Build Conference in Boston, where the student leaders presented a poster describing the curriculum. The international conference was the Association for Science Teacher Education International Conference in Hartford, Connecticut, whose audience included university-level science educators, teachers, and pre-service teachers. Student leaders also presented this project at the UMF Michael D. Wilson Symposium. First held in February 1999, the UMF Symposium has grown into a wonderful tradition. Each spring a full day is devoted to sharing the work of students and faculty through papers, performances, and poster sessions, thus honoring our values as a public liberal arts college.

The U.S. Green Building Council (USGBC) has highlighted the UMF SAT Curriculum. The PI continues to work with the USGBC in a variety of capacities and this has provided the PI with numerous opportunities to expand the original project that the USGBC funded. Below is a comment from one of the grant evaluators:

Of the 300 plus submissions extensively reviewed and awarded by the US Green Building Council in the past two years of the program, University of Maine-Farmington's Sustainable Architecture that Teaches curriculum has risen to the top as a model of excellence for schools looking to use the built environment as the context for learning.. It provides others with a clear example of how to engage students from multiple disciplines with green buildings on campus for curricular credit. With ambitious goals, a tight timeline and proactive participants, all of their targets were achieved. USGBC's principles of transparency, inclusiveness and promoting the triple bottom line are matched by this program's extensive evaluative and multidisciplinary elements. It represents the full package— student learning, quality of life improvement, and community building through student engagement. We look forward to continuing to share University of Maine Farmington's success story in the future. (Julia Feder, Manager, LEED Education Systems, U.S. Green Building Council)

UMF's president and provost provided institutional and funding support during grant implementation and a commitment was made to continue support once the grant was completed:

From its inception, the vision for the Education Center at UMF included utilizing the facility itself as a teaching tool. This was important in our fundraising and it has been equally important in our efforts to develop broad understanding and commitments to environmentally sustainable practices. As a participant in Education Center tours, I can testify to the value these have had for area school children and community members. The success of this project has led to an important follow-up initiative. UMF recently applied for and received funding for an energy efficiency demonstration project in two of our older wood frame buildings. These are structures that resemble much of the local housing stock. We anticipate that educational tours of these facilities, modeled after the successful programs in the Education Center, will have much practical value for the local community. (A. Berger, UMF Provost, 2009)

A framework was already in place for student leaders to continue working on the project through the university work initiative program. In fall 1998, the university president created the Student Work Initiative program to bolster the interaction between students and faculty at UMF. It is a campus-based work and learning program that is not based on financial need (no FAFSA required). The PI was also supported in continuing with this project, which is considered a service to the university equivalent to serving on a major university committee.

Regional schools have also been profoundly impacted. The following comments are from an elementary school principal and the regional district superintendent highlighting how this building and the curriculum have influenced decisions pertaining to building renovation and construction of regional schools in the area:

The fact that the building was being finished and celebrated as we began our process (of talking about what we want for our school) helped make the green concept tangible and much more a part of our early conversations. Had it not been completed and functioning so nearby it may have been easier to categorize a green facility as something for a more urban area—out of our ‘realm’ ... or something a bit more off in the future. As a committee we’ve become much more ‘fluent’ in green terminology in part because various members have visited, researched and/or know someone with a bit of info about the Education Building. It’s a common reference point. (T. Williams, Mallett Elementary School Principal, 2009)

The UMF Education Building did influence both of our construction projects and other retrofit projects throughout the district. The new elementary school in Farmington will be using a wood pellet boiler system, passive solar, and daylight harvesting. The district plans to apply for LEED certification. The high school/tech center renovation and addition will include some geothermal, passive solar, photovoltaic, daylight harvesting—where possible, wood chip boiler, and small wind turbines. That project will also apply for LEED certification. On many occasions I was asked by members of the public if there were green components included within both projects. (M. Cormier, School Administrative District 9 Superintendent, 2009)

As these quotes suggest, universities can have a tremendous impact on the regional community in a variety of ways. What has been most rewarding for the project team are the numerous additional projects that have resulted from the implementation of the SAT curriculum. The feedback provided above illustrates that universities can effectively model environmental sustainability for their community.

Conclusion

Overall, this project has been very successful on multiple levels. It provides university instructors with a venue to incorporate service-learning in their courses, and it provides undergraduate students an opportunity to take on real-life leadership roles. Student leaders benefit not only by mentoring other university students but also by taking charge of how the project evolves, providing new directions. Pre-service teachers benefit by connecting environmental sustainability to state and national teaching standards, as well as by influencing K-12 students and teachers. Faculty members involved in the project have greater confidence in implementing a service-learning component in their courses, in part because of the quality control they have over student projects. There are many areas that need development in this curriculum, but the fact that the faculty, students and even university administrators view it as a dynamic work in progress enables those involved to have greater creative flexibility. Administrative buy-in has been crucial to this project. From department chairs to the president of UMF, our efforts towards collaboration, shifting academic research focus, and community outreach have been well supported. Without this support for faculty to “think outside the box” this project would not have come to fruition. Our students have been inspirational—when given the opportunity, they rise to the occasion and strive to contribute to the university community. Their creativity, hard work, and dedication make such endeavors worth the required effort.

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