SUSTAINABILITY THROUGH TEAMWORK: USING SOCIAL MEDIA TO DRIVE COLLABORATIVE ECO-PROJECTS

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Abstract. Digital technology amplifies our ability to reach goals. Computer experts excel at examining multiple facets of complex questions and illuminating possibilities to generate better solutions. Focusing these efforts towards the crucial problems of global warming can give meaning and purpose to the work. This paper discusses how technology-facilitated teamwork enables more robust considerations of environmental design problems. It documents a personal journey towards ecological design through a series of teaching and research partnerships. And it illustrates how collaboration technologies and organizational structures can contribute to greening the architectural curriculum. Opportunities for involvement in eco-projects and development of new expertise are discussed along with key principles for successful partnerships.

1. Purpose

Computers amplify our ability to reach our goals. They allow us to examine multiple facets of complex questions and illuminate possibilities to generate better solutions. Focusing these efforts towards the crucial environmental problems can give meaning and purpose to the work.

This paper discusses how technology-facilitated teamwork enables more robust considerations of environmental design problems. It documents a personal journey towards ecological design through a series of teaching and research partnerships. And it illustrates how collaboration technologies and organizational structures can contribute to a more ecological architecture curriculum. Opportunities for involvement in eco-projects and development of new expertise are discussed along with key principles for successful partnerships.
2. Social Learning in Virtual Design Studios

I learned how collaboration could extend my horizons in my first teaching position at University of Hong Kong. Working with former classmates, I developed a series of online design partnerships joining schools from North America, Europe and Asia. We experimented with a variety of communication technologies, jumping into the Web at its infancy and different kinds of student team structures. This helped us understand how to orchestrate the social factors with technology.

In a primitive form of crowd-sourcing, we learned that all of us could benefit from the collective intelligence and varied specialties of the large group. If we hit a technical challenge, one of our technical experts could find the answer. If we needed to summarize results in a paper, we had plenty of authors to give ideas and refine the text. And if we wanted to tell the story, we could find a few very evocative images even if many were not. As in watching a marching band, the eye is caught by the most attractive individuals.

Personalities went a long way to determining how well the collaborations worked. While digitally savvy students were able to design useful pieces, the most successful overall design partnerships included extroverted students who really enjoyed interacting with foreigners. They had a strong motive to conquer technical impediments and they were adept at getting help from friends. They got other students excited about the project.

Common learning objectives and jointly valued products were enough to bring together teams with different backgrounds, levels and schedules. We could limit the synchronous portion of our projects to two or three weeks, with some teams starting background work earlier, others could develop concepts begun in the Virtual Design Studio into more comprehensive projects.

Providing multiple communication channels allowed novices to use easy, direct methods like conference phone calls while others could explore advanced virtual worlds.

Overall, Virtual Design Studios showed me how social motives could enliven education and how attending to individual abilities and needs could make more successful classes.

3. Telling the Green Building Story

Collaboration skills from the Virtual Studios transferred smoothly into a green building website. Every sustainable building needs to tell its story so that its occupants become aware of how their actions can advance the sustainable mission. Raising occupants' awareness about how the building works can be a start in inspiring sustainable behavior. If they understand the
economic and health advantages of helping the building operate efficiently at the office or school, it can give them the mindset to decrease waste and conserve resources in other arenas.

In 2008, I led an interdisciplinary group of students in documenting the green renovation of a historic building for our university's new Portland center. We got the opportunity to create web and print educational material about the building because it earned an innovation point in the Leadership in Energy and Environmental Design (LEED) certification system. In this case, the material was particularly important because many of the new occupants would be students. To begin the project, we visited the building in process and learned about the major challenges and decisions from key players including the developer, contractor, architects, engineers and green consultants.

The class needed to act like a small company in executing and producing the educational material. So the students worked in small groups to report on LEED categories of site, water, energy, indoor air pollution, and material reuse. The range of student abilities was particularly wide because the class included graduate and undergraduate members from planning, historic preservation, journalism, digital arts and architecture. We found that it was important to create a fallback contingency plan to account for limitations in team member ability or time commitment. For example, because only one student could program electronics, we needed to scale back concepts for an interactive installation.

I was surprised to learn that group dynamics can work well in very different ways. Some groups like to make many design decisions as a consensus; others like to delegate parts and then resolve the boundaries or pass along the project like a baton, with each person taking a turn.

Even more surprising was the idea that work need not be shared equally. Group facilitator Tree Bressenii says that sometimes households are divided between Slackers who avoid work and members who do work and are obnoxiously Righteous about doing it. So I was amazed that the Web design group was extremely successful despite having several novices on the team. The team leader did a remarkable job providing each member with a manageable task and then praising the partners when even a small amount of the task was completed. Even though the team leader had to rework much of the preliminary work done by his partners, all members of the team were invested in the product and felt they contributed even if their efforts were strongly revised. While the efficiency was lower than with a skilled team, the leader gave group members a positive attitude that made them eager to help.
Figure 1. The White Stag Block website includes historical photos, interactive maps and LEED points for sustainable aspects.

Sustainability Lesson: Under the guidance of professors, students can create valuable information about buildings in documenting sustainable features prior to completion or critically evaluating building performance in post-occupancy evaluations. In both cases, students learn about the synergistic connection between people and place: how built facilities shape inhabitant experiences and how the inhabitants shape building performance. For me, analyzing this building provided a good background for taking the LEED accreditation test.

4. Sustainable Communities Studios

I brought techniques from distanced collaboration into team teaching and external partnerships when I came to Oregon in 1996, where I was quickly immersed in ecological awareness. The Pacific Northwest economy was built on forestry and agriculture, so there is often a tension between harvesting natural resources and preserving them for future generations. Our School of Architecture and Allied Arts students have hosted an annual HOPES Ecological Design Conference for the last 16 years, and our university has a top Environmental Law program and programs in sustainable business and green chemistry.
Years of attending HOPES conferences in support of the students gave me the background to take the plunge to lead green studios. I began a series of studios on intentional communities when a friend asked my class to look at how to develop some land into a sustainable co-housing community, that is, co-operative housing based on the Scandinavian model of smaller individual homes with common facilities for sharing. I was intrigued to find that by changing the focus of my studios from digital technology to ecological design, I could get more interesting students and still build their digital techniques. Naturally this transition was enabled by bringing in experts in aspects such as passive solar, natural building and community conflict resolution. I learned along with the students through visiting experimental structures and regional communities and researching aspects of interest.

TEAMWORK IN THE CLASSROOM

In these co-housing studios, I required the students to design in small groups to reinforce the challenges and rewards of working in a community. This experience helps prepare them for team work demands of a professional office. The teamwork structure ameliorates the challenge of widely varying abilities in vertical studios, which mix undergraduates and graduate students. Whereas individual projects illuminate the weaknesses of more junior members, who can be perceived as holding back the class by advanced students, group projects benefit from complementary skills that can compensate for individual shortcomings. Team projects give experienced students more incentive for teaching junior members, requiring them to reflect on their design methods. The partnerships require students to constantly communicate their ideas and provide a natural sounding board, reducing the frequency needed for instructor feedback.

The class as a social learning community provides new opportunities. For example, not everyone has to play the same role. Rather, we could take advantage of an individual’s expertise to give them additional responsibility. For example, one person could be in charge of documenting the site location through photography, another would lead interviews with the clients, others would measure existing structures and create the digital and physical site model.

SOCIAL SUSTAINABILITY: KEYS TO STRONG TEAMWORK

Team size: A design team composed of three or four people has a better chance of working well. It is relatively easier to delegate and then bring together a small number of component tasks. While a well-matched two-person team can be extremely effective, it can also become polarized and intense as the whole collaboration is completely dependent on a single
relationship. An odd number includes a natural tie-breaker and mediator, although sub-group pairs can distort the balance. Within my design studios, five or more students in the same group made it more difficult to ensure that each student received a significant area of responsibility, as the one or two most talkative make it easier for other students to be more passive.

Figure 2. Trang Nguyen, Adam Franch and Tommy White challenged each other to ramp up design quality with iterative revisions, leading to a high level of development.

SOCIAL OPTIONS

Because U.S. students prefer to have a strong sense of individual authorship, we often do initial stages of a project in groups and then allow the individuals to choose whether to carry on as an individual or as a group. In those classes where teamwork is mandatory, students are given the option to change groups after every phase. Almost no one has taken this option, it reassures the students who are asked to take the risk of working with new acquaintances.

RESULTS

While the students often struggle during the term, at the end they appreciate how much more comprehensive the research, design development and presentation the project becomes through teamwork. Group collaboration was considered the most valuable part of the Fall 2007 cohousing studio, where 8 of 13 course evaluations (total 16 students in the class) mentioned the collaboration as a valuable challenge. While 6 students expressed that the production expectations were too high, four had balanced that with comments such as “I worked hard but I feel I accomplished a lot!” in course evaluations, students wrote that they enjoyed envisioning ideas for real sites with supportive community members as clients.

5. Developing the Context: a Green Curriculum

While each person’s realm of autonomy is limited, by working with others, one can influence the larger picture. Collaboration provides the chance to
link both vertically within a discipline and horizontally across disciplines. For myself, this is happening vertically within the architectural design studio sequence, and horizontally with integration of architecture support courses and a new interdisciplinary initiative.

While I teach my own intermediate studios, I also have had the opportunity to shape the larger curriculum by coordinating the team-taught required second year undergraduate core studio (~80 students in 5 sections). We focus one of two second-year studios on building in the landscape, and focus the other on a building in the city. For the former, students learn site design with attention to solar orientation. For the latter, they address daylighting and natural ventilation with the development of sectional relationships in a multi-story building. We added the explicit requirement to address rainwater in Spring 2009.

![Figure 3. Form and Performance: Jon DeLeonardo designed an exterior sunscreen for an existing west-facing façade and analyzed its effect on interior light levels with Ecotect software.](image)

Our department has particularly good integration of specialty knowledge into the studio because all of our architecture professors teach in the design studio. As time allows, we coordinate assignments from the support courses, for example, having students create framing models or specific computer representations for their design studio projects. Our students develop sustainable design expertise from the beginning of their program.

For their initial Environmental Controls Systems class, they perform a post-occupancy building evaluation of lighting, acoustics or thermal comfort. They hypothesize about the reasons for building problems, measure actual performance and then prescribe a design solution. In the following term, students find a space with an illumination problem and then design and construct a luminaire that addresses that specific environment. From this strong grounding, they students can work with other faculty in upper level studios that reinforce the use of ecological principles, often concentrating on specific aspects such as rainwater or habitat.
CIVIC ENGAGEMENT IN THE SUSTAINABLE CITIES YEAR

Beyond the department, our campus has developed an interdisciplinary Sustainable Cities Initiative. It brings together faculty and students from planning, landscape architecture, architecture, business, law and journalism to work on teaching and research. For teaching, the group is selecting a new client city every year and directing the course content to address the city’s needs during its Sustainable Cities Year (SCY). “While SCI has a specific focus on sustainability and the built environment, it also was designed to help redefine the role of public education in serving the public good”

Figure 4. SCY information sharing: Erik Hegre’s water flow analysis created in Brook Muller’s studio(l) informed Kate Kandell’s design of a station canopy that collects rainwater in Nancy Cheng’s studio.

Within the large consortium of 22 classes, I blended my personal interest in daylighting and digital fabrication with the city of Gresham, OR’s need for new commuter rail stations in the Shaping Light studio Fall 2009vii. The train waiting area provides an opportunity for active engagement with sun, wind, water and vegetation. We focused on the optical phenomena of light and shadow and their influence on the emotional impact of architectural space. Students worked on three projects of increasing scale, progressing from material studies of a light modulating screen, to a sun-shading device for a west-facing façade and the design of the light-rail station. We sampled Ecotect software for analyzing how the sun-shading affected heat gain in an effort to develop the link between the aesthetic form and energy performance. At the urban level, we found that the suburban setting allows us to reinterpret successful urban precedents to take advantage of natural amenities and more space.

The main challenge as a participant in such a promising consortium is to keep true to personal goals when working opportunistically. Our class learned about transit-oriented development and nature in neighborhoods along with the site’s cultural context. While the SCY’s many partners make it harder to keep true to a singular goal, they provide invaluable connections. Interspersing focused individual research with periodic group projects or interdisciplinary consultations can provide a productive balance. The multi-
faceted studio activity inspired my ongoing project around dynamic lasercut sunscreens based on origami folds.

Figure 5. Variable sunshade cut from a single sheet: ovals rotate along diagonal folds created by Jeffrey Maas and Nancy Cheng.

6. Communication tools for engaged education

For all these projects, communication skills have been essential. The complexity of environmental situations demands interdisciplinary interaction. As our environments are constantly in flux, realtime communications are going to assume a larger role. In explaining how data needs to work dynamically, BIMStorm author Kimon Onuma says, “Cities are dynamic like the weather.”

Being a successful communicator, Paul Laseau explains, requires not only a passion about something and the skills to convey that passion; it also requires the empathy and respect for another person to want to engage with them to produce results. Emerging professionals need to understand the importance of communication. By working with teammates and external clients who appreciate their ideas, they can learn communication processes and skills, gradually building the confidence to know their voice can make a difference.

OBSERVATION

A big part of being an insightful designer is careful observation and research to understand an existing situation. This skill is particularly important for diagnosing problems, whether it is reading the landscape for previous mistreatment or seeing building settlement due to seismic conditions. Natalie Jeremijenko points out that as pollution can invisibly seep into our spaces, we can to harness the power of networks to gather and consolidate efforts by distributed individuals acting as data collectors for analysis. Through describing, analyzing and interpreting information for others, designers can shape what is perceived as reality.
EPORTFOLIOS

To help students develop communication and interpretation skills, I have been using a kind of work-in-progress electronic portfolio or ePortfolio for reflective writing. The purpose is to help students think about their work, learn types of online expression and demonstrate achievement towards learning goals. Colleagues on campus and in the InterNational Coalition for Electronic Portfolio Research have helped me understand how powerfully electronic portfolios can support learning. Following Helen Barrett, our Oregon faculty group has shifted our emphasis from presentation “Showplace” to also include the developmental “Workspace”. The no-cost Wordpress online publishing system supports polished portfolios, reflective blogging and feed aggregation to support a learning community. We adopted Barrett’s “No one size fits all” approach of customizing technology to fit specific learning contexts.

We want our students not only to create beautiful design solutions, but also to understand how today’s work relates to last year’s class and how it contributes to long term goals. My aha moment came from reading how much students understood about the problem, even though they couldn’t generate strong designs or graphical solutions. I had assumed that the level of their drawings showed their competency, but many who couldn’t draw could vividly write about their design ideas. The reflective writing can reveal cognitive understanding hidden by poor graphics. Furthermore, writing can help design ideas advance by keeping geometric form fluid.

The habit of thoughtful writing can be developed. "At first I wasn't particularly excited about the idea of writing a post or two each week throughout the year about my progress in the class. However, looking back I can see how important it has been for my development as a person, student and leader. Now I have the ability to look at posts from earlier weeks and see the progress I have made."

![Figure 6. Performance criteria (l) are mapped onto learning activities and Curriculum Map (r) defines how course objectives will be met.](image-url)
First, assigning blog reflections required us to be more thoughtful about the mapping of assignments to accreditation performance criteria. Second, we use Curriculum Maps to be explicit about WHAT skills and knowledge need to be demonstrated and HOW they could be shown and evaluated. Third, we clarify performance expectations for our Pass / No Pass design studios with Rubrics.

EPORTFOLIO SURVEY

Our 2009 survey of 43 students using a Web based ePortfolio Content Management System revealed that even though 93% rated themselves as at least "somewhat comfortable" with technology, 55% found interacting with the system "somewhat difficult" or "difficult". What students really liked was what made it easy. They appreciated being able to access information easily and liked the idea of immediate feedback. Peer and tutor feedback can supplement what a single instructor can provide.

Students valued the personal expression of creating a customized website. It is a way to declare one’s identity – especially crucial for art and design students. “I liked having the opportunity to create and design a space that is my own, reflecting my personality and interests. Within this environment, it has been rewarding to post information that I would like to share with my peers.” So there is a natural tension between plug-and-play ease of use vs. robust functionality. Across the institution, we have to find what to standardize and what to keep flexible.

Recruiting other teachers to adopt the same approach provides more consistent technical requirements of the students. We want the skills they learn in one class carry over into their other classes, and foster a lifelong learning habit. We want students to develop an online personal learning network that extends outside the campus to external professionals.
Figure 7. Class website receives RSS feeds from individual blogs, faces personalize links to student home pages.

ORGANIZING ONLINE INFORMATION

Online sharing of project information can give everyone in the project the same advantages. Both the raw site and program data and later the interpreted analytical information need to be carefully organized so that the right information can be found when needed. Everything needs to be linked from a single access point that acts like the project dashboard so that team members know where to start.

We found that Wikis, or shared online documents, are a convenient way to share information. Wiki software facilitates group editing because any member can drop in raw text, graphics and files to be shaped by others. Because each person carries a different cognitive map, the structure of information hierarchies and meaning of category labels should be discussed early among the team members. Wikis need to be periodically cleaned up because of their open nature. Individuals react differently to the free-form dynamics of group authoring, in the way that some people like improvisational jazz more than following a set score. As in many group situations, three things can make it easier for individuals to contribute successfully to shared information: an initial organizing structure, behavioral guidelines, and a guideline enforcer. Within a larger structure, defining individuals’ areas of autonomy within clear guidelines can empower individuals to have more creative expression.
PRESENTATIONS

For design presentations, we have steered away from a single projected sequence of images because they require viewers to hold the series in memory - it is much easier to connect simultaneous images. Printed supplements and concurrent overview images can make reading architectural schemes easier. Controlling the digital production workflow is essential for creating a successful presentation. Digital media is an expedient choice for bringing together scanned drawings, digital drawings and renderings into a unified product.

EXPERIMENTATION VS. STABILITY

The range of communication tools is always growing. Tool adoption requires a balancing act between experimentation and stability. The smaller the collaboration, the more room for experimenting with emergent shareware that may be buggy or whose developers may fold. In working with others across campus for the adoption and support of Wordpress, we found it useful to set up a second installation for testing plug-ins and settings that could be migrated to the active service installation. The institutional adoption cycle means that as a piece of software reaches broad dissemination, it naturally fails to meet the needs of the wider audience, spurring new seeds of experimentation with alternatives.

7. Summary: Principles for successful sustainable partnerships

We can achieve successful sustainable collaborations by cultivating social rapport and by using technology to organize logistics and supporting information flow. We can minimize teamwork problems through appropriate team size, task organization and fallback options.

The complexity of urban sustainability issues requires interdisciplinary perspectives for robust solutions. Aspects such as water, waste, vegetation need a series of focused research studies. Government, transit groups, planning agencies and design firms invest a great deal of time and money into researching complex issues and developing possible solutions. For these studies, design students can gather data and synthesize information for better decisions. Their student designs can illuminate facets of a problem and provide visual references for debating alternatives. Sharing the professional interpretations with students is a low-risk, low-cost investment in the future.

Group projects can turn the challenge of diverse participants into an asset. We need to release the idea that everyone will do the same amount of work and all participants will have the same experience. Instead, each person’s
unique talents can contribute in different ways, and the person learns through considering contrasting perspectives. These lessons are applicable to all collaborations that involve shared information about complex problems. Digital technology can help consolidate and coordinate individual ideas into richer, more comprehensive solutions.

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4 White Stag Block sustainable historic renovation. http://pdx.uoregon.edu/leed/index.html Web Design was lead by Cody Evers.

5 Kwok, Alison. Agents of Change http://aoc.uoregon.edu building performance case study program at University of Oregon was developed from Cris Benton’s Vital Signs project at University of California at Berkeley http://arch.ced.berkeley.edu/vitalsigns/.


7 University of Oregon Sustainable Cities Initiative, http://sci.uoregon.edu

8 Cheng, N. Shaping Light studio. http://ufolio.uoregon.edu/shapinglight


11 Laseau, Paul. Graphic Thinking for Architects and Designers, p. 204. Discusses empathy in Architecture by Team by William Caudill. The idea that Passion, Skills and Empathy are key components for a strong communicator was included in private presentation Sept 17, 2010.

