THE PEDAGOGY OF PLACE AND CAMPUS SUSTAINABILITY

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Introduction

While those of us involved in the education profession pay great attention to the content and methodology of our lessons, rarely do we pay as much attention to the message or "lessons" of the physical spaces or environment in which we teach. We can probably agree that the place where we teach has tremendous pedagogical power, yet what are the lessons communicated by the structures and grounds of our academic institutions?

I would like to begin by offering a set of fundamental questions about the pedagogy of place. While these questions are focused on institutions of higher education, they apply to any type of educational setting, as well as to any grade level. These questions address some significant challenges for those of us who consider ourselves to be involved in education for sustainability.

Next, I have outlined our efforts at Sonoma State University to utilize the pedagogy of place, in part by creating a new facility -- known as the Environmental Technology Center (ETC). The ETC opened a few years ago and we believe that it embodies a new vision for a university campus, based on the integration of sustainable planning, design, operation and maintenance. After setting context, I have provided some specific examples of where we have so far succeeded and failed, providing essential lessons we have learned along the way.

The point of this chapter is to first assist others in conceptualizing the physical place we call campus by seeing it as a teaching tool for sustainability and then share one small story from our campus. We are one of a growing number of schools around the world who are actively engaged in demonstrating civic responsibility, saving significant amounts money and energy, reducing greenhouse gases, and teaching students an important message about our willingness as educators to invest in their future. (Sturgeon, 2001)

Setting Context

Tom Bender, in Environmental Design Primer (1977) wrote

We have drawn a distinction at our skins that is contrary to the most important relationships and processes that concern us and our well being.
WE ARE OUR ENVIRONMENT -- what lies outside shapes what lies within.
WE ARE OUR ENVIRONMENT -- the environment of our minds brings into existence both the conceptual and physical spaces we inhabit. What we are becomes our world.

This quote, written 25 years ago, had a profound impact on me as a young educator. It's a provocative idea: place shapes mind and mind shapes place. Most of us spend little time wondering or worrying about this dynamic. We might agree that at any campus there is a "built environment" comprised of buildings and landscapes, and there is a "learning environment" comprised of academic departments, classrooms, students and faculty. Bender's quote however speaks to the *relationship* between these two environments. It argues that both the built and learning environments of educational institutions fundamentally shape how students and faculty see themselves and how they see the world around them.

Whether looking from the outside in (landscape shaping mindscape) or the inside out (mindscape shaping landscape), the dynamic between the learning community and the places we call school is powerful, purposeful and pedagogic. Treating this relationship lightly, without careful attention and commitment, is a fundamental mistake that is being repeated each and every day at learned institutions all around the world, by highly respected administrators and educators.

Questions, Questions, Questions

I try to ask and answer several over-arching questions to use as a lens for viewing the pedagogy of our campuses. They address the basic "ecological footprint" (Wackernagel and Rees, 1996) of our campus facilities and grounds, the message communicated by the design and operation of our schools, and the impact that message has on our students. While I don't for a moment pretend to have all the answers to these questions, I do hope that the analysis which follows can serve as a touchstone to help each of us begin to explore how we can redefine or renew the teaching power of place within our own academic context.

The first question simply asks, "What lies outside?" The next two questions address the central notion offered by Bender, that "what lies outside shapes what lies within."

- What are the typical landscapes of higher education institutions (such as buildings, grounds and infrastructure)?
- What ideals and principles do these landscapes teach our students and us? In other words, if schools are models of something, what is it that they stand for, and how is that vision manifested in the design and operation of all aspects of campus planning, design, and operation?

In the pages ahead I also explore what these landscapes of higher education suggest about the preferred cognitive structures and intellectual paradigms for our interior landscape? In other words, how the form and operation of our teaching and learning spaces influence how we perceive, organize, and evaluate ideas, information, appropriate civic behavior, etc.

- How is the physical (and perhaps the curricular) landscape of our institutions of higher education congruous and incongruous with the basic notion of a sustainable campus? Where it is incongruous, how do we begin to align new practices within a historically entrenched institutional context?

These questions are very board, they overlap, they give rise to other questions, and they have many sets of nested questions within them. Nevertheless, they can serve as a framework within which we can begin to explore the pedagogy of place in higher education today, as well as the tasks that lie ahead. Let's take a look at these questions one at a time.

What are the typical landscapes of higher education institutions?

What do our students and faculty see each and every day, whenever and wherever they are on campus? They may see a set of consistent structures: large square buildings that house discrete departments (e.g., math, music) or academic units (e.g., natural science, humanities). These large square buildings hold large and small rectangular rooms in which square chairs are typically organized into rows, all facing one direction. Almost everywhere I have visited universities around the world, the structural landscape appears quite consistent.

What about the processes students see within these landscapes? Whether due to design or operation or both, they often see facilities that routinely are very wasteful of energy and other natural resources. The energy that is wasted is typically produced by fossil fuels, adding to the risks of climate change while depleting available fuels for future generations. In addition, educational facilities often generate tremendous amounts of solid and chemical waste.

It seems ironic that places designed to enlighten the mind are built and operated in a manner that often seems so mindless. David Orr, in *Earth in Mind* (1994), underscores this incongruity when he wrote:

> It is paradoxical that buildings on college and university campuses, places of intellect, characteristically show so little thought, imagination, sense of place, ecological awareness, and relation to any larger pedagogical intent..

What ideals and principles do these higher education landscapes teach our students and us?

First let's take a look at the lessons taught to us by the structure and layout of most universities, and then we will examine how campuses are typically constructed and operated.

When viewed as a whole, the structure and location of university buildings teach us that disciplines should remain separate. Discrete fields of study housed in discrete buildings suggest that interdisciplinary study is not a valid academic enterprise (because it is not physically represented). Campus design suggests that the most knowledgeable people in our society believe we should primarily specialize within isolated disciplines. The overall physical design of universities "teach" us this preferred epistemology.

The fundamental message of higher education landscapes also suggests that to understand the world, it is necessary to just understand the parts (or a part). In fact, those who teach in higher education typically have a doctorate, which means we learned a tremendous amount about a very small aspect of the world of knowledge. The curricular structure of most institutions suggest that to become more *knowledgeable*, we need to learn more about a specific component of knowledge, not more about the relationship between disciplines or about the paradigms of knowledge. Specialization is modeled and encouraged. Integration is rare or even discouraged. Unfortunately, this message clearly promotes and perpetuates the Cartesian, reductionist worldview that lies at the root of so many of our social and environmental problems today.

Specialization <u>is</u> a good thing, but it isn't everything. New integrated and applied structures of teaching and learning are needed. Learning communities, project-based learning, and service learning endeavors, for example, offer students formal academic experiences in which knowledge is primarily interrelated and experiential. When our academic institutions only dabble in interdisciplinary and applied approaches to instruction, and instead consistently reinforce the separation of and specialization within disciplines, then they continue to reinforce the reductionist view of *how we should think.* One can't help but wonder, is the environmental crisis more a crisis of mind than a crisis of behavior — and are institutions of higher education one of the primary perpetrators of this crisis?

What about how universities are constructed and operated? The typical design of university buildings, as well as the technologies and materials chosen to build them, often teach us that energy is cheap and that natural resources are unlimited. Inefficient structures, powered by fossil fuels and built from energy-intensive materials that are harvested and manufactured with little regard for the environment, are far too commonplace on university campuses. Even with the tremendous advances in sustainable architecture and engineering made in the last few decades, campus construction continues to reflect an inefficient, wasteful paradigm of the past. The operation of these facilities, once built, reinforces this paradigm. Energy, natural resources such as water and soil, and *especially* paper, are often treated as if there is no tomorrow.

Both the design and operation of university facilities clearly teach us how the "most educated people" build and run the places in which they live and work. In this way, our educational institutions teach us *how we should act*. The lesson is clear and convincing — albeit profoundly disturbing. Educated and responsible citizens pay far too little attention to their consumption of energy, their generation of waste, or the related impacts these behavioral patterns have on future generations or other living things.

How are our campuses incongruous with the notion of sustainability and how can we fix it?

This question brings the previous discussion home to roost. While it is easy to point a finger at other forces within the context of any educational institution, we should all take a hard look at what is happening on our own campus right now. While some university classes may address sustainable techniques and technologies, do buildings and operations demonstrate sustainability? If the design and operation of our facilities don't fully exemplify the fundamental application of the lessons we are seeking to impart, what then is the message that we convey to our students? If our students and fellow colleagues can't see clearly manifested on our campuses the principles of sustainability that we hope to see boldly adopted by all of society, then how can we ever expect our students to carry this vision forward?

A Long Journey Is Many Small Steps

Clearly it is time to place much greater effort on understanding how the physical landscapes of our schools impact our ability to promote a sustainable worldview. We must understand how the structure of educational institutions and their dominant paradigms impact the ways in which we see our world and act within it. While in school, the models of thought and action we see around us have a profound impact on our mental landscape.

Our challenge is to reshape or remake the fundamental structure and behavior of learning institutions so as to be in alignment with the lessons and rhythms of the natural world that supports us. And as we do, we need to share our visions, failures and successes, so that we present a bold new landscape for higher education. As the Senior Editor of *Building Design and Construction* (Flynn, 2001) noted:

> The evolution of sustainability from a fringe trend to a mainstream design principle has its challenges. Experts say communication and education are needed to spread the message that change is necessary and that sustainability can be performed affordably and in an integrated fashion.

This is a pivotal time in the (re)design evolution of schools. Over the next five years, the United States alone will spend almost $100 billion to build and renovate public schools (George Lucas Education Foundation, 2002). Fortunately, new ideas and examples, such as those in this book, are helping to bring forward a new vision for institutions of higher education, a vision based on the principles of sustainability. In the U.S., efforts such as LEED (Leadership in Energy and Environmental Design) within the U.S. Green Building Council have provided valuable aids in bringing principles of sustainability to school building design. This "whole-building design" concept now needs to be expanded to whole *campus* design so that our schools exemplify eco-efficient systems of thought and practice.

Practice What You Preach Where You Teach: A Look at Sonoma State University

At Sonoma State University, efforts to become more sustainable have taken a variety of forms. While there are dozens of examples I could offer, perhaps the six most significant recent accomplishments have been: our student-led Campus Environmental Audit; the installation of 100 KW of solar electrical generation; a building *retrofit* which dramatically improved the quality of the user experience (students, faculty and staff) while saving over 40% of the historical energy load; a new very "green" student recreation center, and our Environmental Technology Center. I would like to say a bit about the last of these efforts towards creating a more sustainable Sonoma.

The Environmental Technology Center (ETC) at Sonoma State University (SSU)

In an attempt to answer some of the questions I have proposed, about ten years ago we set out to envision and then create a place where much of what we *explored in our courses* could be *applied on our campus*. We started by reclaiming a one-acre parking lot that we labeled the EarthLab. Step-by-step, we transformed that parking lot into food, herb and flower gardens, a solar greenhouse, and a compost demonstration area. This volunteer-based project involved university students, elementary-aged youth, "youth-at-risk," faculty from several disciplines, community members, and local businesses. Our latest addition to the EarthLab site is a new "building that teaches" and serves as a model of sustainable building techniques and technologies. We call it the Environmental Technology Center, or ETC. For those of you interested in learning more about any aspects of the building or our educational program offerings, please visit our web site (www.sonoma.edu/ensp/etc).

In the hope that it might be helpful to others considering similar projects, below is our mission statement and some related analysis.

> To design, build and operate a dynamic, interactive and integrative facility where faculty, students and community members from a wide variety of disciplines can work together in applied research training, academic study and collaborative environmental projects.

By *dynamic* we mean a building that is constantly changing so as to accommodate shifts in the focus of curriculum, advances in technology, and changes in research methodologies. We knew we could never build a "state-of-the-art building" because by the time one designs, bids, and builds, it is anything but state-of-the-art. Flexibility was a fundamental design principle.

By *interactive* we mean that the building and its users are involved in a participatory exchange. The building is informed by the weather and it reacts accordingly. We as users are informed by the building, and we in turn interact with it so as to achieve the desired results in heating, cooling, lighting, and function.

By *integrative* we mean that the building is designed to bring together on and off-campus academics and practitioners from different disciplines so we can integrate our knowledge and experience. The point here is that this is a facility designed to connect: discipline with discipline, campus with the community, and sustainability with science and technology.

We also began with a commitment to *applied research*: research that promotes direct experimentation in the context of natural phenomena and contemporary applications. We believe students need to learn how to conduct valid research, but they also need this research to translate directly to what they experience in their everyday world. This approach gives context and meaning to the academic principles introduced in course work while encouraging critical thinking and heuristic problem solving.

Finally, we believe that the ETC should promote *collaborative environmental projects*: projects that bring together students, faculty and community members with diverse interests and backgrounds to focus on projects that can benefit from collaboration.

The objectives of the ETC included:

- to serve as a center for interdisciplinary environmental science education, demonstration and research training.
- to serve as a model for other campuses by addressing campus-related environmental technologies and techniques.
- to assist Sonoma State University in becoming a model of public sector environmental responsibility and sustainability.

When you add up the mission and objectives you can see that from both a philosophical and programmatic basis we are focused on a wide range of education, training and research efforts.

What about the building itself? In thinking about building design and operation, we tried to bring together the ancient wisdom of nature and culture with the latest advances in environmental science and technology, resulting in a building that renews lessons that our grandparents tried to teach us. That short cuts don't make it in the long run, treat the land and all living things with respect, don't be wasteful, teach through your actions and not just your words, and strive to make the world a *better* place for future generations. With a focus on science, synergy, and sustainability, we can have beautiful, functional spaces in which to teach and learn that has far less impact on the planet while saving significant amounts of energy, natural resources, and money.

That all sounds fine, but when it comes time to put pencil to paper, what does it really look like and how does it function when it is actually built and operating? When you move from rhetoric to reality, what comes out of these ideals and grand visions? Since we always saw the ETC as potential catalyst in sustainable building on campus, when we had to make choices we were always committed to utilizing technologies and design criteria that other campuses could afford, adapt and adopt. We labeled this approach as "state-of-the-shelf technology, with state-of-the-art design."

The resulting building reflects these broad ideals and has some interesting aspects, including a building that:
-- uses 80% less energy to operate than other new university buildings
-- generates, with a solar electric roof, more electricity than is required for all aspects of the building operations
-- was built with a variety of recycled and sustainable materials, including rammed earth walls, recycled plastic lumber, recycled auto glass tiles, cellulose insulation, and seaweed acoustical panels.
-- responds to the rhythms of nature and local climate to tap renewable sources of energy for almost all lighting, heating and cooling needs (with no air conditioner)
-- utilizes advanced optical coatings such as smart windows and low-e paint
-- has a brain (an interactive computer system) that monitors weather conditions and building demands, and then responds by adjusting building technologies such as shutters, light shelves, windows, and fans (more on this later)

Now that we can look back on our evolution and current endeavors, it is clear that to date the most important impacts of our Environmental Technology Center have nothing to do with technology per se. They are really about the teaching and learning that has occurred along the way.

From the outset, extremely important lessons were taught during the design process. For our students, helping to envision and design the ETC was a hopeful and empowering process. They saw a public institution that was for once not teaching hypocrisy and was instead attempting to "walk the talk." By participating in the process, they also learned directly about the complexity of sustainable design, the importance of knowing their "hard" sciences, and the critical role of economics in decision-making. Today, students take classes in a building that exemplifies the physics, architecture and engineering they are learning in their classes. Some of them are ETC tour guides for visiting schools and community groups, and some are employed through the center to conduct energy service projects in local schools.

We knew the ETC could be a catalyst for others who would like to build similar buildings at their school or community in the future. We have therefore sought to involve future and current building professionals from our region who could translate ideas demonstrated at the ETC into reality in other places. Initially students in the Energy Management and Design Program at Sonoma State University were involved in generating fundamental ideas for a new facility. Towards the end of the schematic design stage graduate students at UC Berkeley helped us analyze the impacts of wind flow on our building. Local architects, engineers, consultants, and manufacturers were used whenever possible throughout the remainder of the design and construction process. To continue in the role of community catalyst, today the ETC offers a wide variety of programs and projects. For example, we currently offer professional seminars and training programs as well as a community lecture series. We also give educational tours for school and community groups and we frequently host visitors from other institutions who are interested in exploring more sustainable design efforts at their own campus. Each June we also offer a major green building expo to showcase the latest tools, materials, and techniques as well as provide important networking opportunities.

One last note about the educational impact the ETC on our own campus and our campus facility personnel. It was extremely important to have the consistent involvement of our on-campus facilities personnel in our design and construction process. Facilities personnel can understandably see new efforts at sustainability to be just more work. By consulting and involving facilities personnel early and often, you'll have a far better chance of long-term support. This was especially true on our campus. Our facilities personnel were reluctant at first to be working on our "think outside the box" project. Today they have become strong advocates of sustainable building design on our campus. They have led several new sustainable building projects around campus that in many ways surpassed the accomplishments of the ETC. All of the campus buildings following the ETC have demonstrated extremely high levels of energy efficiency, renewable power generation, and environmentally-conscious design.

Lessons Learned and Still Being Learned

Perhaps there are two major lessons we have learned iin our pioneering efforts to create a learning laboratory model of sustainability on a university campus. The first lesson is that, compared to today's typical campus construction, sustainable building projects can cost more at the outset. A second major lesson is that highly complicated systems have a tendency to break down, while simple ones do not.

First let's look at higher initial costs. There are a variety of reasons for this. The planning and design costs of green buildings, especially in an academic context, can take extra time and money. For our building, we pursued an integrated design process that required additional early involvement of architects, engineers, contractors and end users. Then add in the additional layers of university facilities personnel, sub-contractors, various funding agencies, and other members of the academic community such as other faculty and students. Having all of these levels and layers of involvement in the design process can bring out some excellent ideas, yet it can lengthen the design process and therefore increase initial project costs. It's worth it in the end, but designing complicated green buildings in an academic environment can take more time. This is true not only for designing. It can also apply to rendering, bidding, and building.

Many sustainable materials also cost more. At present, many of the construction materials with lower embodied energy or recycled content are simply more expensive than materials that are not as "green." For example, when we choose shelving made from compressed sunflower seeds, we paid a premium for that. The same is true for most materials that use green or recycled content.

In our case, because we wanted our building to make a contribution to the field of sustainable design, we choose to take on additional initial construction costs through our research into new material options for concrete mixes. We were using slab-on-grade construction and lots of thermal mass, so our project was using a relatively large amount of concrete, which is very energy intensive to manufacture. Because we couldn't find in the industry what we felt was a reasonable effort to develop new concrete mixes, we made the commitment to spend almost $10,000 experimenting with various mix designs to replace energy-intensive cement with the waste products from coal and rice hull power plants. This mix would of course have to meet or exceed all engineering and safety tests for school buildings. The test results were very positive and the best mix was used to construct our building. Three years later, the final product has worked very well. The cost of this success was incurred early in the design process, but in the end it removed almost 50% of the cement from our building and the related CO_2 emissions from the air and provided stronger concrete while utilizing a current waste product.

This new mix design presented construction challenges as well. In order to properly cure this new mix design, it needed to set several days longer than what was conventional. Unfortunately, the contractor cutting the expansion joints in the slab didn't know that, so when they cut on a typical schedule they cut into concrete that wasn't fully cured, resulting in a jagged instead of a clean cut. New materials may require changes to traditional construction practices.

The ETC also utilizes roof-integrated photovoltaics to generate electricity with the sun. This is a new "peel and stick" technology that adheres directly to a standing seam metal roof. No racks or panels are needed and the manufacturer guarantees the electrical output for 20 years. The materials, installation, and control systems for this solar power system were not cheap. Initially we also had big problems with the inverters. Currently the system is performing well and we are pumping electricity into the grid. Most buildings don't factor in the cost of their future energy bills. Because our building produces more energy than it uses, it runs the meter backwards and saves money every month on the campus utility bill, especially on summer afternoons when electricity is most expensive. In the end, we know that it costs more up front to do all of this, but that the returns on our investment will come in many ways, only some of which are measured by energy savings and a lower utility bill.

The second biggest lesson we have learned is that complicated systems are hard to develop and sometimes easy to compromise. It is clear in our case that the current significant technical failure of the ETC is the highly computerized building management system or BMS. Because it was designed in part to be a laboratory for building energy analysis, the ETC is extensively wired with various measurement devices (such as light levels, air and mass temperatures, wind speed and direction). Unfortunately, the computerized system that takes in the data from these measurement devices has rarely worked. Our so-called "smart" building has been mostly brain dead for two years. We've never really had the ability to analyze the quantitative performance of the building. We can only gather the most basic of thermal performance data with the BMS. The relationships of these data points, which are primarily not being read, are suppose to determine much of how the building's air and light levels are adjusted — by ceiling fans and the opening and closing of windows, shades, and light shelves. Manual adjustments are all we have been able to do to date. We finally have a budget and plan in place to rewrite the software and hopefully begin to address this long-standing problem. When we do, we can begin to fulfill more directly the mission of this facility to serve as a building that teaches.

I would like to add that it is important to note that in spite of this limitation in building analysis and control (as well as having no air conditioner), we have maintained excellent thermal comfort and daylight levels throughout all seasons. This is a testimony to the capabilities of basic passive solar design, which has performed superbly without the aid of computer-controlled devices. Our window orientation, thermal mass, and building shell have worked so well that we have met most of our light and thermal comfort needs without the aid of a building management system.

As we continue to educate, demonstrate and research there will no doubt be many more lessons to learn. Public, working models of education for sustainability, such as the ETC, are instrumental in presenting new ideas and establishing new patterns.

Conclusion

Our academic campuses serve as a model of our human societies highest ideals. Students learn lessons from us not only though our lectures, texts and websites. They see what we believe and honor in the design and operation of our places of practices. That's the pedagogy of place that I hope we will turn our attention to in the years ahead. Since so many new school facilities are being planned, built, and retrofitted, this is an important time to redefine what is possible and permissible for an institution that has such an important impact on creating a more sustainable world.

The challenges ahead are many. Pioneering efforts often have to swim upstream and break through a variety of obstacles along the way. If a campus effort towards sustainability impacts multiple academic units (which it logically would), then the isolated, compartmentalized structure of most academic thinking and budgeting can be a significant problem. Integrative efforts are sometimes counter current in academic settings. Even if a building has no direct connection with particular academic units, the initial cost estimates are often higher for more sustainable projects. Unfortunately, they will be unevenly compared with conventional school buildings with smaller initial buildings costs, yet much higher environmental, social, maintenance, and operational costs. Conceptually limited and short-term fiscal accounting has to be addressed and overcome. We also learned that high technology is almost always promoted as the answer, yet simple, elegant design is often the most cost effective way to achieve energy savings and occupant satisfaction. In our case, smart design was far more important than computer-based energy management systems.

Every institution will of course have its' own unique challenges and opportunities. Budget, administrative perception, academic priorities, bureaucratic reluctance, and so on can all get in the way of any new effort. Fortunately, nany of the avenues to a more sustainable campus can save money, look good for administrators, advance academic endeavors in many disciplines, and even inspire some bureaucrats.

Every campus will also have its' own set of opportunities. Some campuses may succeed with campus-wide initiatives, some will focus on the efforts of a particular department or student organization, some will have building projects such as our Environmental Technology Center. Some will start small, some will think grand. Regardless of the specific approaches we take towards campus sustainability, we have to accept the responsibility that schools are models of how we think, behave, live. Further, it's our responsibility to promote and demonstrate a new form of design and operation at our schools that symbolizes a commitment to sustainability — a form that sends a clear message to our students about a commitment to their future through an investment in it today.

References

Bateson, Gregory (1979). *Mind and Nature*. New York: E.P. Dutton.
Bender, Tom (1977). *Environmental Design Primer*.
Flynn, Larry (2001). Sustainability Takes Root. *Building Design and Construction,* April.
George Lucas Educational Foundation (2002) Edutopia: (Re)designing Learning Environments. Fall, 3.
Orr, David. (1994) *Earth in Mind*. Washington, D.C.: Island Press, 112.
Sturgeon, Julie. (2001) The Green Schools Revolution. *College Planning and Management*, March. 22-29
Wackernagel, Mathis & Ress, William. (1996) *Our Ecological Footprint*. New York: New Society Publishers.