Sustainability: Designing a Pervasive and Integrative Curriculum

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INTRODUCTION

Sustainability is an elusive topic. Skeptics dismiss it as the "green wash" or fad of the early 21st century. According to Jason Vollen, faculty at Rensselaer Polytechnic Institute, teaching sustainability to architecture students requires the ability to tie credible concepts to improved building performance.[1] The authors contend that an effective curriculum must extend performance-based accountability to include site, landscape, and community, culminating in balanced, equitable resource use at national and global scales. To gain credibility from skeptics, assessments of design and planning decisions must be based on measurable indicators. However, achieving sustainable development will require more than design, planning, and engineering solutions, or advances in science and technology, or proper management. It will also require a transformation of social ethics and values. While there are no immediate answers or action plans that will insure global, national or even local sustainability, there are central organizing principles that can better guide development in a more sustainable direction.[2] Concepts and planning decisions should be guided by objectives that successfully negotiate each of the three major elements of sustainability including:

> "*Natural Capital*: Maintenance of clean air, water, soil, diversity of species and their habitats, and global climate stability and capacity to absorb environmental waste and pollution.
>
> *Economic Capital*: Production and distribution of wealth in a manner that provides access to the goods and services necessary for a good quality life for both present and future generations
>
> *Social Capital*: Development of a community or neighborhood to function as a safe, healthy, and viable setting for human interaction, education, employment, recreation and cultural development." [3]

OUTLINING A PERVASIVE CURRICULUM

Most architecture programs, through their environmental control systems courses, focus disproportionately on the science of energy conservation in buildings as the way toward sustainable architecture. Other important dimensions of natural capital conservation, such as higher efficiencies in land and water resource utilization, and social and economic determinants of healthy, sustainable communities may be overlooked. NAAB conditions for accreditation as specified in 2004 represent an initial attempt to include sustainable design as a required competency and to broaden its meaning. NAAB criteria #15 is expansive, though non-

specific, in its call for "understanding of principles to guide architectural and urban design decisions that promote healthier buildings and community".[4] NAAB's 2009 conditions are more specific but less inclusive in their call for the "ability to design projects that optimize, conserve or re-use natural and built resources…and reduce environmental impacts through means such as carbon-neutral design, bio-climatic design and energy efficiency".[5] This change indicates that NAAB's criteria for sustainability have become more narrowly focused, and concern with natural capital limited in scope to energy efficiencies. A more holistic curriculum in architecture that seeks to clarify the role of all three contributing elements is needed if program graduates are to adequately prepare for such a sustainability challenge.

What would a model curriculum look like? As suggested by the paper's title the curriculum must be pervasive, meaning students should be continuously exposed to sustainability pedagogy throughout the duration of their studies beginning with the first year. A variety of lecture and seminar courses should cultivate specific competencies in each sector of sustainability if graduates are to be positioned to help guide practice beyond LEED standards to higher levels of expectation and performance for community development. An effective curriculum must also be integrative by enabling students to synthesize acquired knowledge and skills at various stages throughout their studies. Design studios at all levels provide an ideal forum to apply acquired skills through experimentation, fabrication, transdisciplinary creative problem solving, and service-learning partnerships with external constituencies.

An outline of suggested curricular goals, and, in the spirit of suggestion, a summary of select courses within our program that are designed to support each goal, follows.

Goal 1: Introduce Language

Establish a language for sustainability so that beginning architecture students, (and a broader cross-section of the university community), may become conversant and literate about issues and challenges presented by the built environment.

Students should be introduced to sustainability issues during their first year. At the University of Idaho, beginning design students are introduced to key challenges presented by the built environment through a required lecture course on the subject and its multi-authored textbook entitled *The Built Environment: A Collaborative Inquiry into Design and Planning*.[6] The course coordinator engages faculty from inside and outside of the department to offer multiple viewpoints of cultural, social, and ecological sustainability along a continuum of the built environment which includes public art, interior design, architecture, engineering, landscape architecture, urban design and city and regional planning. The course provides a philosophical foundation for students that defines the built environment as "all human creations, past, present, and future"[7] and emphasizes the global impact of human activities on our environment.

The course structure is such that throughout the semester speakers are invited from a variety of design disciplines that our students may otherwise never encounter. This interaction helps students broaden their knowledge and understanding of issues that are critical to the working methodology of designers both inside and outside of their disciplines.

The Built Environment has sustainable practice as its primary focus, defining the term "sustainable" early on for the students as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." [8] This emphasis, paired with an understanding of the working methods of a wide range of disciplines, affords the students a basic level of knowledge and understanding that evokes questions about the methods of these disciplines within the context of creating a more sustainable built environment for future generations.

Goal 2: Expand Natural Capital Content

Re-configure required program lecture courses and elective seminars to incorporate an expanded view of natural capital conservation.

Thanks to the leadership of Society of Building Science Educators, most NAAB accredited programs enable students to develop proficiencies in passive solar technologies, energy conservation, and use of natural daylighting. Additionally other required courses dealing with technical dimensions of design can be used as opportunities to address the

importance of maximizing efficiencies for natural resource utilization. Our required course in Materials and Methods of Construction informs students about the importance of choosing materials and construction processes that reduce energy consumption, waste production, and stresses on natural capital. Lecture courses touching on the subject of historic preservation can serve to reinforce concepts for conserving embodied energy in the materiality of existing buildings and minimizing construction waste through re-purposing. Our required course in site planning, grading, and drainage is taught by landscape architecture faculty who introduce strategies for incorporating green infrastructure such as bio-swales, rain gardens and permeable pavements to treat and reduce storm water run-off.

Additionally, our program offers electives on natural daylighting, performance evaluation as well as internship opportunities at our Integrated Design Lab to engage students in experimentation and post occupancy evaluation, and performance modeling of proposed designs.

Goal 3: Expand Socio-Economic Content

Re-configure required program lecture courses and elective seminars to strengthen student understanding of the role social and economic capital play in building healthy, sustainable communities.

NAAB criteria for increasing understanding of both western and non-western traditions afford opportunities for courses to cultivate awareness of inequities in resource use and consumption and living standards between third world countries and developed countries. Content of our required Urban Theory and Issues course was recently re-structured to include lectures and readings about urbanization of the third world, urban poverty, and the nature of squatter settlements. Much attention is also given to the negative impacts of suburban development in developed countries.

Goal 4: Use Studio as an Integrative Tool

Utilize studio experiences at each level of the curriculum as opportunities for students to apply knowledge from supporting lecture courses into creative, integrative and sustainable solutions

Design studios provide an ideal forum for integrative thinking and application of concepts presented through lecture courses. Several of our studio courses, particularly at the senior and graduate levels, use service-learning and community outreach to forward goals in each dimension of sustainability, often in collaboration with other design disciplines. Challenges presented by community settings enable students to explore creative, collaborative solutions in a reality-charged atmosphere, and to adapt sustainability strategies to regional contexts.

Many of our partner communities face challenges surrounding economic re-alignment from traditional extraction economies of the old west to recreation resource economies of the new west. Local citizens and civic leaders generally embrace growth but fear transformative patterns resulting from new, intrusive development and corresponding loss of cherished small town atmosphere and cultural connections to place.

Our recent collaborative partnerships with the mountain amenity towns of Sandpoint and Driggs, Idaho, for example, address the social, economic and ecological impacts of rapid growth fueled by recreational economies. Inflated real estate prices, accelerating rates and ratios of land consumption, and lack of affordable work force housing characterize the social, economic and ecological pressures exerted on these intermountain communities and their fragile ecologies. In Sandpoint, interdisciplinary teams worked with the City officials and key landowners to assist with community visioning in 2003 and comprehensive planning processes in 2006. Students developed proposals for alternative transportation, park and open space systems, preservation, downtown revitalization, infill and densification, affordable housing and brownfield re-development. Through these projects students learned about the architect's role in helping to forward goals for sustainable development.

Our studios also partner with distressed communities seeking avenues for economic recovery. Student design responses help to interpret community memory and to reflect upon the role regional identity can play in attracting new, more appropriate development. In our current project site of Priest River, Idaho, a timber and mill town, interdisciplinary design teams are demonstrating how revitalization of existing resources can strengthen social

capital by reinforcing the strong sense of place afforded by the historic town's inherited morphology. Together student teams and community partners are seeking to weave relevant threads of historic and cultural continuity into new development adjacent to the historic district and to incorporate green strategies into economic development proposals for brown field sites. Community partners intend to profile student work as in kind match for grant proposals from state agencies such as the departments of environmental quality and commerce and to attract external investment. Economic development specialists serve as resources to help guide student teams and community members as they program project opportunities.

Community-based studio projects can heighten awareness of ecological stewardship in community settings by applying strategies for reducing carbon footprints. These projects allow the students to apply the full range of strategies that interlace environmental, social, and economic sustainability, because the focus is beyond the scale of the building—encompassing site, community, and regional scale decisions. Collaborative, interdisciplinary approaches to design studio teaching provide an important venue for teaching an expanded curriculum concerning the science of sustainability, particularly as it pertains to natural capital preservation. Interdisciplinary studio projects in the settings described above exposed architecture students to strategies for natural capital preservation beyond the building envelope. Architecture students learned about best practices in landscape architecture including use of native vegetation, natural systems approaches for storm water management and treatment and integration of important elements of green infrastructure into design and planning solutions. Through their work with the bio-regional planning program, students are encouraged to broaden the scope of sustainability even further by drilling deep into regional planning issues.

Comprehensive design studios afford the opportunity to focus intensively on application of technical strategies to forward sustainability goals. During fall semester 2006 the graduate comprehensive design studio accepted Ed Mazria's 2010 Imperative that, "the design engage the environment in a way that dramatically reduces or eliminates the need for fossil fuel."[9] The success of this experimental studio has encouraged the instructor to continue to offer carbon-neutral design themed comprehensive studios in successive years.

The 2006 studio used the McCall, Idaho, field campus and its elementary school learning center, the McCall Outdoor Science School (MOSS)[10], as the focus and client. The topic was planning and designing a new carbon-neutral field campus for the existing 11-acre site in a mature Ponderosa pine forest on the shores of Payette Lake. It would provide year round learning opportunities for elementary school children where the forest, the lake, and the buildings would all play a role in teaching them environmental stewardship. An interdisciplinary design team of about 40 architecture, conservation social science, bioregional planning, interior design, and landscape architecture students was assembled.

During the first phase (research, planning, and programming), students worked in seven interdisciplinary teams. In this phase the students bonded and performed trans-disciplinary work. We knew we had buy-in when in the first group at the first critique a Landscape Architect presented architectural concepts, an Architect presented interiors concepts, and an Interior Designer presented landscape concepts. The site and the client also inspired and motivated the students. While visiting the site, students were stunned by its natural beauty and rustic buildings, but also became aware of the potentials and limitations of the setting. The mature forest limits the use of active solar systems and wind turbines for producing energy, but provides opportunity for gathering building materials and on-site biofuel for energy generation. The forest and mountain location also dictates fire-safe construction and respect for deep snow. The client, MOSS, convinced the students that their work was valued and that eventually a carbon-neutral campus, inspired by their efforts, would be built. They were committed to David Orr's concept of architecture as pedagogy and wanted the master plan to show an integrated design approach. MOSS faculty and students served as tour guides during the site visit and critics during the planning and design phases.

Students worked in multi-disciplinary teams during the initial eight-week master-planning phase and then worked on developing an individual piece of the master plan during the final eight weeks. Student participants demonstrated exceptional willingness to analyze building performance during design

and to choose materials and construction techniques carefully. And neither creativity nor aesthetic impact was compromised. Our fall 2009 graduate studio continues the tradition by designing a zero-net energy building for the College of Engineering employing interdisciplinary teams of architecture, landscape architecture, and engineering students with weekly presentations to the project architects.

In the fall of 2008 a carbon-neutral design-build studio was formed to continue forwarding project goals established by the 2006 studio by focusing on the design and eventual construction of a carbon-neutral living facility at the university's field campus in McCall, Idaho. The field campus is operated by MOSS, whose mission is to use the outdoors as a context to teach students from the state of Idaho about science, place, and community.[11] This studio was a continuation of the 2006 effort While the 2006 studio focused on re-planning the existing campus facilities and a preliminary design of individual campus buildings, the 2008 studio concentrated on the comprehensive design of a carbon-neutral living facility that would house up to 16 students and 2 teachers. In addition, this building was to be used as a learning instrument, exposing the students to sustainable building practices, and aligning with MOSS' mission of using the campus itself as a teaching tool.

The McCall Carbon-Neutral Studio presented a number of challenges not found in a typical studio setting. The first and perhaps primary challenge was introducing students to carbon-neutral design as an emerging architectural paradigm rooted in contemporary appeals like the 2030 Challenge; an agreement between building industry leaders to have all new construction be carbon-neutral by the year 2030. The goal of carbon-neutrality in the McCall project forced the students to ask critical questions about the production and distribution of materials. It also evoked valuable dialogue about construction and performance based energy use. The carbon-neutral goal also required the use of energy modeling software to help test our design strategies. Our goal was to use passive design strategies in lieu of an abundance of embedded technologies to achieve our energy reduction aims. Energy modeling software became a critical tool that we used to test the efficacy of our design strategies. Strategies that included fundamental discussions of building orientation, amount of wall insulation, and glazing type, location, and quantities were bound in an iterative cycle that relied heavily on the feedback we received from the energy modeling tools. This allowed students to familiarize themselves with the software and also afforded a great deal of insight into the radical effect of every design decision on the building's eventual energy consumption.

In addition to the carbon-neutral focus in the McCall Studio, the design-build aspect of the course also made it a unique learning experience. The fact that we were asked to build the project and that it was to be built over the course of a single summer, brought a number of unique learning opportunities into play. We knew that the majority of students who would be asked to participate in the build portion of the project would have little or no prior construction experience. This meant that part of the design challenge was to find materials and building systems that were locally available and simple enough to help reduce the construction learning curve. We also had to keep the building size to a minimum, ensuring that we worked within a square footage range deemed appropriate for our summer construction schedule. Both the goal of using simple, locally available materials and reduction of building size seemed to align nicely with our primary goal of carbon-neutrality.

The McCall Carbon-Neutral Studio provided students with opportunities to learn emerging languages of sustainability. The comprehensive design aspect of the studio provided invaluable insights into the implications of the seemingly minute design decisions on the building's life-cycle energy consumption. The studio required collaboration amongst a number of design disciplines and relied on this trans-disciplinary dialogue to actualize a buildable and sustainable design solution.

Goal 5: Focus Capstone Experiences

Promote capstone courses and experiences, including graduate projects and seminars as opportunities for deep immersion into questions presented by sustainability.

Architecture and landscape architecture education may cultivate naïve expectations that sustainability can be achieved through design and technological fixes alone without any fundamental changes to

society. Topical graduate seminars provide an opportunity to focus on issue-based discussion and to cultivate critical thinking skills. A primary pedagogical goal of our 2009 graduate seminar on sustainable development was to challenge students to think outside of their disciplinary comfort zones by exploring the role that a capitalistic system and their personal behavior play in shaping unsustainable futures. Students were asked to draw correlations between behaviors, both individual and corporate, and the disproportionate and burdensome economic expectations that we as individual consumers and consumer based societies place on diminishing natural capital. Seminar discussion was supported by Gus Speth's book *"A Bridge at the Edge of the World: Capitalism, the Environment, and Crossing from Crisis to Sustainability".*[12] In the spirit of Al Gore's "An Inconvenient Truth"[13], Speth presents graphs outlining ubiquitous and accelerating rates of natural capital consumption. Based on what he terms a "descent into the abyss", Speth crafts a compelling case for the inevitable loss of natural capital in economic systems that use growth as the primary indicator for success. Economic growth of corporations and affluent nations is fueled by expenditures of non-renewable natural capital. Affluence is taking its toll on some disadvantaged social groups in the process.[14]

It seemed risky at first to ask architecture students to engage in discussions about corporate behaviors, capitalism and consumerism instead of the more familiar tools of our trade such as new urbanism, and transit-oriented developments. However, Speth's provocative chapters calling for a profound change in how nations and their citizenry view prosperity struck a chord with seminar participants. Through weekly discourse and writing a position paper students were encouraged to look internally as well as externally for capacity to reverse accelerating trends of imbalanced resource consumption and unsustainable economic growth among affluent nations. The required paradigm shift stimulated transformative thinking as students began to examine the very values that guide their daily lives. While few were ready to impose a federal gas tax at parity with European countries, animated discussion about fundamental shifts in life style and implications of a post growth society ensued well into studio nights. One student committed to a semester of living without generating any household waste.

The seminar also required students to work within conventional comfort zones and to apply and integrate knowledge acquired in other coursework to local community projects. Teams developed programs and appropriate performance indicators for guiding sustainable development in local urban renewal districts that are populated by brown field sites and "underperforming asphalt".[15] Through these exercises students enhanced their understanding of the role development plays in the mounting global crisis either as an instrument to accelerate environmental degradation and consumption of natural resources or as a potential instrument for repair and regeneration.

Each year one section of our graduate project preparation seminar is devoted to issues in sustainable architecture. Nonetheless, students in the other sections also choose to research and develop projects focused on sustainability. The seminar encourages readings, research, and opinion on sustainable architecture themes. Students develop a wide range of projects in scale from emergency shelters to community designs, from low–technology approaches to complex integrated design approaches for large buildings. Each student has the opportunity to research the basis for a design project and to program that project in preparation for a semester-long design inquiry.

Goal 6: Steward Institutional Engagement

Help to build institutional awareness of sustainability issues and support students in their quest for broader engagement and leadership roles in the university community.

Cultivation of a campus environment that is committed to sustainability is essential. Our university has formally committed to global initiatives including the Talloires' Declaration, Chicago Climate Exchange, and University and College President's Climate Initiative. Through campus collaborations such as the faculty and staff-led Building Sustainable Communities Initiative, Sustainable Idaho, and Waters of the West, and the student-led Sustainability Center, opportunities for education and engagement outside of the classroom abound. Next year's UI President's Sustainability Symposium will be focused on the built environment and will be facilitated by an interdisciplinary group of faculty.

Conclusion

Most development practices continue to undermine the earth's capacity to supply natural resources and absorb waste and pollution. They perpetuate social and economic inequities and the decline of urban centers. If architecture graduates are to play a meaningful role in shaping more sustainable solutions, they must be challenged to integrate and balance responses to environmental, economic and social pressures that are often conflicting. Additionally they must be positioned to assume a leadership role in shepherding significant paradigm shifts inside and outside of the profession. First, an effective curriculum in sustainability should provide beginning students with a language that they learn to implement throughout their studies. Second, studios, required lecture courses and elective seminars must both enrich global understanding of issues and provide discipline-specific skill sets to address them. The department context must be supportive by adopting the 2010 Initiative. Finally, through broader engagement, architecture students and faculty must recognize their educational responsibility to foster environmental stewardship within the university community and beyond; we must demonstrate the transformative powers of design and planning to forward sustainability goals; most importantly we must lead by example in our call for a paradigm shift in personal and collective values about built and natural environments.

Endnotes

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