[First appeared in Proceedings of the American Solar Energy Society (ASES) National Passive Conference, Austin, Texas, June 2003.]

SUSTAINABLE ENVIRONMENTAL DESIGN EDUCATION (SEDE); A CURRICULUM MODEL FOR ARCHITECTS AND LANDSCAPE ARCHITECTS

Margot McDonald, AIA
Interim Director, Architecture Dept.
Cal Poly, San Luis Obispo, CA 93407
mmcdonal@calpoly.edu

Polly Cooper and Ken Haggard
San Luis Obispo Sustainability Group
Santa Margarita, CA 93455
Slosg@slonet.org

Cathleen Corlett
Lecturer, Landscape Architecture Dept.
Cal Poly, San Luis Obispo, CA 93407
ccorlett@calpoly.edu

ABSTRACT

In 2000, the Governor of the State of California issued an executive order (D-16-00) that seeks to reduce costs and improve environmental performance of state buildings in all phases of construction, operations and maintenance. The California Integrated Waste Management Board (CIWMB) has provided leadership in implementing this order through initiatives such as the Sustainable Building Task Force. In the realm of post-secondary education, CIWMB also sponsored the Sustainable Environmental Design Education (SEDE) program in collaboration with Cal Poly-SLO. The project will be used to survey and assess existing sustainable environmental design programs, generate a framework for sustainable design education of current and future building and landscape professionals, and assist the Board with dissemination of the resulting sustainable design curriculum. This project seeks to fundamentally change the existing paradigm for environmental design education that has limited the imagination and understanding of designers for the natural processes underlying environmental design. The benefits of this project will ultimately contribute to designers, owners, and operators who achieve higher efficiencies and reduced waste in energy, materials, and water cycles in their buildings and landscapes.

1. INTRODUCTION

There are several possible approaches to developing a curriculum for sustainability oriented environmental design. One is to start with existing details and work up to a whole, as we are doing with the survey of efforts in existing schools. Another approach is to start at the largest most idealized level and work down to details. This exercise tries to do both: simultaneously by sorting through the murky reality of existing conditions and, at the same time, by analyzing two past idealized curricula that were highly influential for their time and comparing them to our situation today. The

goal of doing this is to develop the aspects upon which to base a new idealized curriculum that can be translated and taught to design-related professionals, current and future. Since the main thrust of this paper is the idealized curriculum, analysis of existing sustainable design curricula will be discussed at the end of the paper.

2. METHODOLOGY

Two curricula were selected as case studies for this exercise. These are the curriculum of the Ecole Des Beaux Arts in France, and the curriculum of the Bauhaus in Germany. These two idealized curricula, plus our needs today, give us three situations within which to comparatively analyze ten aspects of any curriculum. (These three situations are referred to in the paper as models "A, B, and C", respectively.) Once this is done we may look at these aspects in regard to problems with the present conditions, potentials for change and what would be types of courses for a new curriculum.

We used this information to develop a possible flow chart of courses (Fig. 1) and sequences (Fig. 2) that could become the basis for further discussion for a new idealized curriculum for Environmental Design Programs based on the needs and promises of a sustainable worldwide society.

2.1 Ecole Des Beaux Arts Era

This academy, founded in 1733, defined Architecture as one of the Fine Arts and courses were structured accordingly. In the19th Century the Ecole became the most influential architectural school in the world. It became the model for schools in every western county. Most well known American architects of the 19th century studied there and most pre- WWII curricula in the U.S. were based on the Beaux Arts format [1] & [2].

2.2 Bauhaus Era

The Bauhaus was founded in 1919 by Walter Gropius as a counter to the established academies. It was based on the idea of Architecture and Design being a functional element as part of an increasingly industrialized society. It was extraordinarily influential in the Modern Movement. After World War II most American Schools changed to a Bauhaus inspired curriculum [3] & [4].

3. IMPLICATIONS OF ASPECTS OF A SUSTAINABLE DESIGN CURRICULUM

Any curriculum needs a grand organizing concept upon which to structure and focus its endeavors. For model A, it was the concept of western Civilization and Fine Art, as defined by its time. For model B, it was scientific progress and industrialization, as appropriate to its time. Each of these produced a powerful, cohesive theme upon which to structure their specific instructional sequences and course offerings. The cohesive theme and lens through which to focus our efforts in a sustainable (model C) curriculum should be sustainability.

3.1 Sustainability

To accomplish this we need to reevaluate the existing three categories of courses and their relationships to each other. These three categories are **core courses**, **design courses**, and **support courses**. Core courses provide the definitions, framework, and background the rest of the curriculum builds upon. *Sustainability and Environmental Design* should be the first of these core courses offered at the earliest possible date to all incoming majors. Most university design

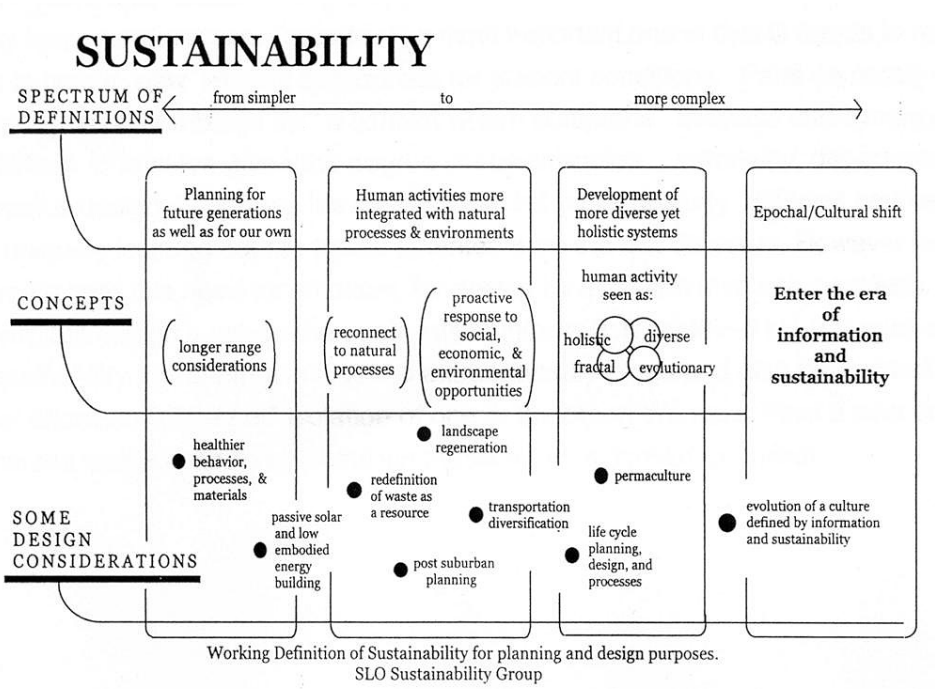

Fig. 1: Diagram of Major Curriculum Parts

programs offer sustainability courses as electives only taken by interested students after second year. This is too late and too scattered to serve as an overall organizing element as proposed above This course could serve as a university requirement for ecological literacy or as an introductory course to all of the majors in environmental design programs (i.e., planning, construction management, interior design, engineering, as well as architecture and landscape architecture). It should be given to all environmental design majors before specialization has begun to begin the development of a common language and ethic as well as setting forth the explicit context upon which the new cohesive sustainable design (model C) curriculum they are entering is based.

3.2 Holism

Holism implies integration of all the parts to develop a condition where the sum of the whole is greater than the parts, thus achieving synergy.

In hindsight we can see that, with age certain parts of any formalization becomes first emphasized, then exaggerated, then finally accepted as unquestioned dogma. Thus each movement contains the seeds of its ultimate demise and the need for renewal. We can see B's reaction to A was appropriate for its time, 80 years ago. Thus in many ways C's reaction to B needs to be similar in that it must reverse many basic assumptions. Probably the most important one in that C needs to reemphasize reintegration to create new wholes appropriate for present conditions. Parts so neatly separated by model B must again be combined into a context where comprehensiveness and synergy can occur.

This will be difficult to achieve given the degree of specialization, territoriality, departmentalization of the environmental design disciplines, as well as different years of study, different courses, different majors, and uniquely isolated course topics inherited from the last 80 years. However we must creatively wrestle with this need for holism, for design by definition involves synthesis. Analysis is a necessary part, but design involves the synthesis of information achieved by our analysis. For an era requiring sustainability this synthesis must be extraordinarily broad and also have great depth. We can no longer afford an "either/ or" isolation of one or the other. We must have a new emphasis on doing both careful analysis and thoughtful synthesis within a context of holism.

3.3 Context

In our present late model B curriculum, context is given too little emphasis. Many design projects given in the studios are artificially narrowed to the point of non-context to allow concentration on one very isolated aspect of design, such as structure, poetics, or some esoteric manifesto. In the model B context this attitude was a valuable leaning tool, allowing the student to concentrate and specialize on parts, but in a model C context this is destructive. It is destructive because too much of this approach, given without a clear framework, implies to the student that removing the design problem from its holistic condition is acceptable. It makes the problem easier to handle but also makes it artificial. The emphasis on this technique is no longer acceptable in that in sustainable design, context is far more important than just making problem solving easier. The pursuit of a design solution in an artificially abstract environment is counter productive since the synergetic connections to the immediate and even distance contexts are so crucial to achieving sustainable design. The student must continually be aware that problem solving is complex, and usually very difficult. That's why design is so important for our time and why our goal needs to be rigorous, informed investigations, not convenience. Context should be the basis for problem solving!

3.4 Setting of the Planet as a Whole

Industry and commerce have moved to a worldwide perspective as illustrated by the global commerce "free trade vs. fair trade" debate. Likewise our environmental problems have become worldwide due to global warming, ozone depletion, and global resource depletion. Worldwide sustainable development has become the subject of several international UN conferences. Thus its high time the Environmental Design professions also took on a worldwide perspective. This however, does not mean neglect of local conditions. On the contrary all must be seen as woven together as an integrated whole. If we are to recreate healthy conditions the planet must be viewed at a series of inter-nesting scales all connected and functionally related. This type of relationship is best described by fractal geometry hence the need for reform in support courses as described previously. Proactive environmental design has a big role to play in achieving and maintaining a planet that supports societies that are sustainable, just, and healthy, thus increasing security as defined as trust, based on cooperation.

3.5 Underlying Disciplines

With the shift emphasizing holism, sustainability, and context we need also shift the underlying disciplines that are the basis of our support courses. Already mentioned are

different forms of math. Others are ecology, and information theory. These disciplines deal with complexity much greater than the pure Euclidean geometry and mechanics of the model B curriculum. They are more complex because they are more life oriented, which is appropriate for a model C curriculum.

3.6 Achieving Expression

A model C curriculum should seek to develop expression by achieving diversity and connectivity in design. We do not discount the methods by which A and B achieved expression, but having mastered them and having made them easier by new techniques, we can use them while evolving beyond them. This new expression will still be visually composed, still functional and structural, however, in addition it will achieve expression by being more diverse and more connected. These two characteristics might be considered contradictory from a model B viewpoint, but as in nature, interconnected diversity is critical to the health of the whole.

3.7 Aesthetic Emphasis

Aesthetic tools are the devices used to achieve the expressions discussed above. Harmony, proportion, and scale were formalized devices used to achieve visual composition in model A. Pure Euclidean geometry, honest expression of materials, and clarity of structure were the tools for model B. In addition, complexity and fluidity are the tools to help achieve diversity and connectivity in model C. This can provide connection to a larger system, (the whole planet) by design in order to benefit our planet rather than degrade it.

3.8 Skills Emphasized

This is the aspect where we can get beyond reaction to absorb all the skills emphasized in the previous curricula. We can then utilize the depth of system thinking to achieve a greater breath of synthesis than previously possible. The goal of doing this is to accomplish ASPECTS 3.9 and 3.10.

3.9 Health

Achieving health is never one dimensional, as health implies wholeness and balance by definition. Thus environmental design should facilitate the triple bottom line of environmental health, economic health, and social health [5]. The scale of human development and our larger and larger impact on the earth allows us no other choice [6]. As in the discussion of achieving expression, these three need not be in contradiction, but in fact must are all necessary in order for humankind to move toward ASPECT 3.10.

3.10 Achieve and Define a Cultural Era of Information, Sustainability, Global Commerce, and Equity

The following is a quote from William Morris, the founder of the Arts and Crafts Movement in 1885, at the beginning of the Industrial Revolution:

Architecture embraces the consideration of the whole external surrounds of the life of Man. Thus 'tis we ourselves, each of us, who must keep watch and ward over the fairness of the earth and each with in his own soul and hand do his share therein.

It will be interesting to see how we can say the same thing in our own terms here at the end of the industrial revolution and the beginning of a sustainable evolution.

4.0 THE MURKY REALITY

In parallel with an exploration of an idealized solution, we are examining the current state of sustainable environmental design education including a survey and needs assessment of sustainable design education programs, exemplary case studies, and templates for teaching specific topics of sustainable design.

4.1 The Survey

The web-based survey is at it earliest stages as we start to collect information from California schools (a database consisting of 50 architecture and 38 landscape architecture related post-secondary programs) and North American architecture faculty teaching energy and environment courses (Society of Building Science Educators listserv). An inventory of preliminary survey results (from a small sample of 17 responses out of 58 requests, to date) reveals the following preliminary indicators:

• Student and faculty interest in sustainability is high.

• Survey respondents came up with an extensive list of resources for teaching and learning about sustainable design. Resources mentioned more than once included:

- Books and CD's by the Rocky Mountain Institute,
- *Heating, Cooling and Lighting: Design Methods for Architects* by Norbert Lechner,

- *Design with Nature* by Ian McHarg.

One valuable aspect of a "model curriculum" is perceived to be its ability to help educators keep up to date with resources and technologies that are rapidly evolving such as "green" materials and specifications, lighting, heating and cooling and certification programs like LEED. Most survey respondents also felt that sustainable environmental design education should be required for future landscape architecture and architecture professionals.

4.2 Analysis of Case Studies

Several published sources for case studies have been analyzed to better assess the range of information that should be included in our own examples [7]. [8], and [9].

4.3 Developing Topics for Sustainable Environmental Design Education

Assessing the needs of the existing educational programs in combination with developing an idealized curriculum model must be translated into realizable and teachable topics and course proposals that can fit a variety of educational settings. The main component topics of this the idealized curriculum are summarized in the flow chart on the next page. Related components can be selected from the matrix and recombined as the basis for individual courses. One example given is for the topic of solar geometry. (See TABLE 1.)

TABLE 1. OVERVIEW OF COURSE TOPICS FOR SUSTAINABLE DESIGN

Suggested categories of support courses	specific course topics a.	b.	c.	d.	e.	f.
1. Design & natural systems	planetary systems and dynamics geological ecological biological	ethical issues and theories environmentalism permaculture regenerative design	patterns and scaling biomes bioregions watersheds bio communities landscapes	natural history and resources climate microclimate materials resources	site analysis site planning site design issues approaches techniques	research methods sources G & S etc. techniques
2. Design & cultural systems	cultural ecology cultural history	social issues regarding the built environment planning growth impacts	history of settlement patterns	history of landscapes and landscape design	history of architecture and construction	programming objectives research techniques application
3. Design & economic systems	triple bottom line accounting integration of categories 1, 2 & 3	ethics and economic issues first cost life cycle cost life cycle design	introduction to professional practice EDES professions clients consultants etc.	regulatory conditions codes CEQA permitting etc	operations of professional practice organizations procedures	details of professional practice fees contracts etc
4. Design & information systems	communication and design verbal graphic written electronic	graphics pictures diagrams icons symbols ornament signs	electronic communication computer systems software etc	computer aided design and presentation various programs	drawing freehand perspective electronic working drawings	research methods sources techniques presentation
5. Design & aesthetic systems	history and philosophy of aesthetics	painting	sculpture	crafts	photography	computer art
6. Design & structural systems	structural integration history issues techniques	building structural systems	traditional structural materials calculations	new structural materials calculations	construction techniques	structural detailing and specifications
7. Design & material resources	issues regarding materials life cycle design health	aesthetics of material expression	water waste and supplemental materials	materials selection	materials assembly techniques	materials detailing and specifications
8. Design & energy resources	bioclimatic design principals history issues etc.	building metabolism scale comfort whole systems	passive heating and cooling	natural lighting, natural ventilation, electrical generation possibilities	calculations and modeling techniques	mechanical backup systems integration
Notes: This order does not mean to imply the order of courses in the curriculum.	Notes: Specific topics are arranged in the general order of definitions-history-social & ethical issues-regulatory conditions-present application techniques-future application potentials		Notes: Ethical questions are critical to sustainability. If MBA programs can add business ethics to their curricula surely sustainability design should consider ethics as an integral concern.		Notes: Individual topics shown can be expanded or shrunk to respond to needs of different Environmental Design majors. The ones shown here are most specifically related to architecture majors.	

Topic: solar geometry

5. SUMMARY AND CONCLUSIONS

Much like the revolutionary effect of the Beaux Arts and Bauhaus traditions, sustainable design is awaiting its debut as a cohesive, design pedagogy. The SEDE program is allowing for the description and testing of a curriculum to teach the essential lessons of our era of diminishing resources and environmental quality. It is anticipated that the "Idealized Curriculum" will be especially helpful as a starting point for generating specific curricula. As the survey data continue to come in, they will become more useful to inform the development of the final Sustainable Environmental Design Education Program.

6. ACKNOWLEDGEMENTS

Our thanks go to CIWMB staff member, Michael Leaon, formerly of the Organic Materials Division, and CAED Dean Richard Zweifel for conceiving of the joint project as well as the undergraduate student assistants, Rachel Aljlani, Scott Cochran, and Travis Hamera, and the host of advisors, formal and informal, on the project.

7. REFERENCES

[1] History of Architecture S. Kostof, 2nd Edition, Oxford University Press, 1995
[2] Architecture and Allied Design A. Antoniades, 3rd Edition., Kendall/Hunt, 1992
[3] Kostof as above
[4] Antoniades as above
[5] "The Bottom Line Redefined" Kathryn Ellison, Nature Conservancy, Winter 2002, Vol. 52 #4 (This article describes the triple bottom line concept and its implications that were developed by John Elkington, a British Business Consultant, in 1991.)
[6] Cradle to Cradle- How we make things W. McDonough and M. Braugurt, North Point Press, 2002
[7] The HOK Guidebook to sustainable design Sandra Mendler and William Odell, Wiley & Sons, 2000
[8] The Ecology of Architecture Laura Zeiher, New York: Whitney Library of Design, 1995
[9] Environmental Resource Guide American Institute of Architects, New York: Wiley & Sons, 1996