

Integration of Sustainability: Course 502 - Design and Technology Studio

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Abstract:

The students in the Design and Technology Studio had the task of designing an office building that must meet the basic outline of functional requirements in a highly creative and environmentally sensitive manner, while proposing design responses to the changing technological milieu. As a part of this design studio students were introduced to a workshop where they developed the insights required to understand the elements required to make their projects sustainable. The 23 students explored in the studio and seminar open vs closed offices; IT impacts; integration of cutting edge ecological and environmental processes (day lighting, heating, ventilation, water, glazing, waste water, power production, orientation, ecology of the actual site, etc); integration and logic of structural system, environmental control systems and design concept; expression of design through construction materials and systems; and embodied energy and indoor quality. The students also conducted research on sustainable issues and produced a handbook as a guide to developing their projects. Our observations about this studio experience are shared in the sections on Successes, Problems and Lessons. We hope these observations generate discussion, debate and advice.

Introduction/Overview

The Design and Technology Studio at the University of New Mexico School of Architecture & Planning is one of three required graduate design studios. The other two are also defined by general topic area and are: History/Theory and Community Design. All students in either the 2 Year or 3 ½ Year graduate programs must take all three of these studios. However, at this time, they may be taken in any order before they complete their Master's Project in their final semester. Several years ago, the standard 6-credit studio format was changed to a 7-credit format for these studios in order that 2 credits would be reserved for a seminar component with 5 credits assigned to the design studio. This change was made in the effort to enliven the intellectual content of the studio and expand discussion and investigation into topics related to the design problem at hand.

In the fall of 2001, a large enrollment of 23 students allowed co-teaching by Stephen Dent and Kuppu Iyengar. As we are both committed to sustainable design, we seized the opportunity to define a problem that could be developed over a full semesters' work and be enriched by addressing a variety of appropriate energy efficient and sustainable techniques and principles. The problem was the design of an office building within the context of the rapidly developing "Uptown" area of Albuquerque on a site midway between, and within walking distance, of two large shopping malls. We were further influenced to investigate this particular site and program by an inquiry from one of the owners of the land. He was interested in seeing the potential for this site and how it might better connect to adjacent developments. The office building program appealed due to its'

relatively simple program and the initial feeling that the students would be able to spend a bit less time on solving the program relationships and could thus spend more time in developing the design to address essential technological issues of system integration and the incorporation of sustainable design concepts.

From previous experience in teaching the studio with a single topic for the entire semester, Prof. Dent had developed a strategy for having presentations almost every week in order to prompt and guide the students into a more inclusive and integrative design process. Together, we developed a schedule for the semester that started with a detailed site analysis (in teams), precedent studies, program development, and an urban design study to place their project in the overall context of the community and site (also done in teams). This preliminary phase was followed by conceptual design, directed investigations coordinated through the seminar component, design development, and then production and presentation.

At this point it is useful to note several factors that influenced the overall output and results of the semesters' work. First, the students were a very "mixed bag" of experience and skills. For many of the students, it was their first graduate studio and they had not had three graduate courses that would have been extremely helpful: Environmental Controls II (HVAC, etc.), Structures III (overall systems), and Construction II (construction documents). Second, very few of the students had enough background in Urban Design to engage this phase of the project quickly and with insight. Lastly, we changed the program from a speculative office building to corporate offices with an exhibition space and day care center. This was in response to a number of students that wanted more definition to the office building so that they could get more fully engaged with the design. The impact of these three factors will be discussed in our observations at the end of the presentation.

Course Description

A relatively large building (over 50,000sf), but with a fairly simple program (an office building) will provide the framework for students to explore issues of design expression, systems integration, context, and the new digital work environment as critical determinants of architectural form – while working within the constraints of creating a building that meets the highest standards of the "LEEDS" environmental rating system.

Course Objectives

- ?? To explore, in depth, the interface between the humanistic imperatives of architecture and the technological means by which they can be achieved.
- ?? To develop skills in comprehensive conceptual design and design development.
- ?? To begin to understand the profound impact on building design of the application of specific technological solutions.
- ?? To develop a theoretical framework for building design in which design technics are integral at all stages of the process.

- ?? To develop a solid understanding of how basic sustainable design practices and techniques influence the design of more complex buildings and their requisite "support" systems.

Key Design Issues

- ?? Development of comprehensive design concepts that are richly responsive to their context (physical, social, environmental, economic).
- ?? Provide for the creative expression and integration of technological systems at all stages of the building design.
- ?? Continued emphasis on the "crafting" of a building based on a thoughtful statement of design intentions.

Key Skills Addressed

This course made efforts to address three basic skills: a) comprehensive design conceptualization process; b) expressive design based on a clear statement of personal design intentions for this project and on project based research; and c) complete and coherent presentations at all phases of the project.

Seminar Component

The objectives of this seminar are: a) enrich and expand design studio topic; b) teach architectural sustainability; c) guide the students to integrate sustainability and energy issues; and d) encourage development of alternate design solutions for the selected site and the building.

Sustainability

This seminar component offered an opportunity to assess the level of understanding of students in the area of sustainability and energy issues. A workshop format was used to elicit areas of interest that were important to students. In the workshop they were asked to list randomly the energy and sustainability issues. They came up with nearly thirty elements for consideration. From this list the class developed major groups for further study. They were:

1. Lighting (daylighting, atriums, controls and shading)
2. Water Use (conservation, reuse and rainwater)
3. Cooling (towers, HVAC)
4. Glazing (glass, fenestration)
5. Thermal Mass and Insulation
6. Recycled Materials (concrete, steel, aluminum, glass, embodied energy)
7. Solar Systems (active, passive, PV, site planning)
8. Innovative Systems (cogeneration, waste, IAQ, Fuel cells, Geothermal)

This offered an opportunity for the class to research these major topics. Each topic had a team of four students to develop the researched material into a teaching presentation for the rest of the class. This process assisted the studio to be introduced to 24 major sustainability elements. The students did the teaching and the result of their effort generated a **handbook** for their use in their professional careers.

Also, as a part of this seminar Dr. Baruch Givoni gave a school wide lecture, attended by all studio participants, on cooling technologies applicable to arid climates (Albuquerque). In the studio, he consulted with most of the students on their integration of cooling technologies into their projects.

Electronic Office / IT issues:

This course attempted to inform the students about the major rethinking taking place in the design of office space. This evolution is being driven principally by the massive technological changes in communications, computing, and information technologies. Globalization is influencing the way offices operate along with changes in life style and value systems of employees (flextime, digital offices and satellite home offices). Students were alerted to these issues in informal studio gatherings and web searches. This created an opportunity for the students to explore these issues and also review precedents in this area. Students exchanged a great deal of information on building types with each other regarding emerging office types including IT industries. They also explored a number of conceptual design issues including:

- ?? Open vs. closed offices
- ?? IT impacts
- ?? Integration of cutting edge ecological/environmental processes
- ?? Embodied energy and indoor air quality
- ?? Integration of structure, environmental controls and materials

Structures

One of the assignments in this course is to develop structural understanding of the project by analyzing and exploring framing plans for all floors; columns and vertical support systems; fenestration details; preliminary dimensions and sizes of structural members and materials; and connection details of critical design components. Prof. Iyengar presented the essentials of structural layout and integration of structure as a design tool for several well known buildings in the USA and Europe. The materials discussed focused how the architect used the structure as a organizing tool. The selected projects were by Sir Norman Foster, Cesar Pelli, Richard Rogers, Renzo Piano, Thomas Herzog, Helmut Richter, Snohetta and others. Students also received handouts illustrating structural information and connection details for typical buildings.

Daylighting

Prof. Dent presented a detailed analysis and methodology for daylighting design for several building types applicable to the region and also showed illustrative examples and student projects. A separate presentation assisted the students in developing scale models of a portion of their building for daylight analysis and in making detailed design decisions.

Observations

Studio Successes

- ?? All final projects exhibited concern for and integration of a number of sustainable design techniques. Most students felt that they got “much further along” in developing comprehensive designs than in any other studio.
- ?? Very positive feedback about overall quality of studio work from Director of Architecture program, fellow design faculty, outside reviewers, and – most importantly - from students.
- ?? The best projects from the three graduate studios for the fall are entered into a scholarship competition sponsored by a local architectural firm. Four of the six selected were from the Design & Technology Studio as was the winner (Jose Zelaya).
- ?? There was a positive attitude and camaraderie established early in the studio and this was maintained throughout the semester. Most students worked in the studio or in the adjacent computer room. We have been less likely to have a “critical mass” of students working on site in recent years due to issues related to access to computers and output devices. More and more students have equipment at home or have access at places of work.
- ?? The seminar format for the investigation of related issues was generally successful. The quality of the investigations into sustainable design topics was of good quality largely due to competition between teams and the growing availability of informative web sites.
- ?? The requirement of a comprehensive daylighting model of a critical space in each project was highly valuable. Sun shading is essential in our climate for internal load buildings and light level control is now mandatory in work environments dominated by computer use. The models force the students to integrate structural and mechanical systems and also allow them to see, for the first time, how spaces they have designed really feel.
- ?? The requirement of weekly reviews/pin-ups for a series of structured assignments generally kept students moving forward, especially in the areas of design development and systems integration that are not considered in most of our design studios. Many students did complain that this process caused too much work and that they didn't have enough time for exploration of each topic, especially in form making.

- ?? The precedent studies of environmentally sensitive office buildings were highly informative for both their environmental features and their innovative designs. When pinned up at each desk, they became a visual “library” for continual reference by one and all.

Studio Problems

- ?? When confronted with the requirement to document their building’s envelope, structure, daylighting, and a preliminary layout for HVAC, many students seemed to “tone down” their more exuberant design efforts. They may be limiting themselves because of their inexperience at developing integrated designs.
- ?? The mix of students’ background and skill levels meant that we had to introduce a number of topics in the seminar component that were introductory or remedial in nature, required a number of extra “handouts”, and the overall depth of exploration in the sustainable topics was less than optimum. On the positive side, having a mix of educational and cultural backgrounds – foreign students were from India, Afghanistan, Costa Rica, and local students were Native American, anglo and Hispanic – created a lively mix of attitudes and conceptual approaches. Interestingly, many of the least experienced students had some of the best ideas for integration of concepts into their buildings.
- ?? The lack of general class experience in urban design caused us to extend the time for teams to complete overall site concept plans. We had a meeting with the city planner for this area who is in the process of preparing a new master plan. This new information made for better solutions, expanded the scope of their investigations, and further increased the time allotted to this phase. The positive side of the site design phase was that it “anchored” buildings to their selected sites in a way that would not have happened if sites were simply assigned and demonstrated the value of seeing the design in a larger context.
- ?? The change to the program allowed many students to find a specific design idea or image that they could focus on and develop rather than the more abstract speculative office space for the information age of the original program. Unfortunately, this added some complexity to the space planning and, of course, made it more difficult to keep to our original schedule.
- ?? Due to the combination of the above factors, and the addition of extra time for the daylight modeling phase, we eliminated the energy modeling phase. We intended to utilize Energy Plus and LEEDs software by breaking the class into two large teams and conducting workshops on their application in design development. We did, however, introduce the Green Building Advisor software which was an excellent reference resource for several students.
- ?? Only a few students engaged the IT issue as a critical factor in their buildings. And these were limited to raised flooring systems and daylight controls. Were we asking too much to be considered?
- ?? Shared teaching. This issue should be listed as both a success and a problem. We did not split the class into two sections, each with a responsible instructor. In this way we could both meet with all of the students (together and separately) and share our “wisdom” in desk crits and more formal presentations. This aspect

worked well, however, it necessarily led to less intense and, perhaps, less rigorous reviews as we spent half as much time with each student compared to a regular distribution of faculty and students.

- ?? Insufficient space. The Design and Technology Studio had to compete with three other studios for the single open room in our leased building, four blocks from our main buildings. Consequently, we usually reviewed all 23 students in a single afternoon. This led to efficient, but somewhat abrupt critiques.

Lessons

- ?? A “tight” program or problem definition limits time on peripheral issues and focuses effort on the primary studio intention – in this case, the integration of sustainable and technical concepts. It is very helpful in getting past the studio approach that generates schematic design without sufficient tectonic content to inform the solution.
- ?? Keeping to a tight, structured schedule with a number of progress reviews ensures that the essential processes of integrated design are covered. If you want to cover a topic, make time for it!
- ?? Having appropriate prerequisites for this studio format is generally desirable.
- ?? Easy access to computing equipment is very helpful in maintaining the intensity of the studio.
- ?? Establish high expectations early in the semester - and don't ever let them creep downward.
- ?? Having a separate seminar component to studio can be of great value. It allows a format for group discussions and debate. It changes the perception of the studio format – design also includes research, analysis, discussion, etc. This format also allows separate grading – a boon for those who are thoughtful contributors, but whose design and/or presentation skills are weaker.
- ?? For team teaching, it may be better to have assigned students for each instructor. This allows for continuity and greater depth of criticism during project development, while still allowing for instructor exchanges and all other formats for expanding the students' experience in both desk crits and reviews.
- ?? Find the space, or make space, for group discussions and reviews for no more than 10 –15 students. If you expect in-depth work – give the reviews sufficient time.

