

## **Teaching How to Learn: Reconsidering Architectural Design in Undergraduate Education**

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### **Abstract:**

This paper examines an architectural design studio, which puts a strong emphasis on the role of research in design process. The co-authors taught collaborative parallel architectural design studios consecutively in spring, fall semesters of 2001, and spring semester of 2002. An ongoing research tests the effectiveness of efforts made by the authors to re-examine the priorities for the undergraduate curriculum through the second level studio in architectural design offered to students of the Bachelor of Arts (BA) and Bachelor of Science (BS) degree programs. The efforts to refine and redefine priorities within the studio education were based on the following eight premises:

1. The main role of the studio teacher is to teach students how to learn.
2. Research is a crucial tool for design.
3. Learning about the environment and sustainability, in an elemental and direct way, is critical to design education.
4. Design is integrally related to and influenced by materials and methods out of which emerges a particular aesthetic.
5. Exposure to a diversity of ideas and viewpoints through guest speakers, reading assignments and other resources is invaluable to student development.
6. Creating opportunities for students to teach their peers and teachers accelerates their rate of development.
7. Learning through collaboration is a means of constructively harnessing student's energy and conveys an often-neglected reality of the architectural profession.
8. Building, documentation, and exhibition of student's work, both process and product, have the potential to positively engage the larger community

The methods employed to test the effectiveness of the teaching efforts are observation, documentation, and analysis of student presentations and projects by the authors. Informal interviews of students and of guest speakers invited to the course also contributed to the research. The main results will be illustrated through specific student projects and more generally in the paper. Research is ongoing through the current semester.

## Teaching How to Learn: Reconsidering Architectural Design in Undergraduate Education

### **Introduction**

“All the time my ideal of teaching has been to argue with people on behalf of the idea that they are responsible for their own activities, that they are really, in a sense, the question, that ultimately they *are* what it is they have to contribute. The most critical part of that is for them to begin developing the ability to assign their own tasks and make their own criticism in direct relation to their own needs and not in light of some abstract criteria. Because once you learn how to make your own assignment instead of relying on someone else, then you have learned the only thing you really need to get out of school, that is, you’ve learned how to learn.”

**Robert Irwin**

The studio course was developed collaboratively by Ali Heshmati, Virajita Singh, and Jennifer Yoos, for second semester undergraduate architecture design students. The backgrounds of the authors were crucial in the development of the course materials. Ali and Jennifer are both practicing architect faculty with interests in the process of design and the role research can play in that process. As a research fellow, Virajita’s focus has been on architecture and sustainability. Design process, as a creative endeavor, is rooted in consideration of major forces in any given context: material, historic, cultural, environmental, physical, and psychological. We are all preoccupied with the potential effects of structure, construction, materials, environment, and human factors on architectural design response.

Our common goal is to educate undergraduate students to become self-reliant learners with ability to think, make, and criticize. This we believe will prepare them to engage the contemporary world in any field in a relevant manner.

### **Course Basics**

The second semester curriculum in undergraduate design studio calls for examination of the concepts of materials, technologies, and details in the context of architectural design. Along with these concepts, the authors wanted to bring in a sharp focus on environmental forces and sustainable practices throughout the course.

In this studio, the students explore materials and methods of construction (**Textile-Tensile, Cast & Molded, Frame & Skin, and Modular Units**) in combination with the four elements of **Earth, Water, Wind, and Fire**. The material constructions provide inspirations for form, space, and use. This formal understanding of a building through varied procedures of construction is attributed to a theory of architectural production first articulated by Gottfried Semper in the 19<sup>th</sup> century. In his book, *Der Stil*, Semper identifies four procedures or “*building arts*” and types of material productions that are the basis

of all architectural form. His four methods were related to the technical arts and included the textile (fabric), ceramic (plastic), tectonic (carpentry), and stereotomic (stonecutting). This analysis of building methods moved the focus from supremacy of structure towards enclosure and surface of the space. It also allowed the study of portable buildings (textile or fabric) to be included within architecture.

Parallel to the exploration of materials and methods there is the introduction of nature and environmental forces to which architecture must respond. We express the major forces of nature through the four ancient elements of Earth, Water, Wind, and Fire. The current state of the world demands a deliberate inclusion of issues of our livable environment and sustainability in the education of architects. Yet, these ideas are often expressed purely in technical context of energy conservation, embodied energy of materials, and alternative energy as the focus. A more inclusive approach was selected to use the four elements of Earth, Water, Wind & Fire as a means to examine architecture's relationship to nature on the spectrum of possibilities between the natural and the artificial. A clear response to the elements is often already present in successful design and design thinking. This translates into issues such as economy in the use of material and labor, the understanding of natural processes, flexibility, and adaptability to fluid contexts.

There are eight projects assigned through the semester. Four of these are the **Body Prop** projects. A Body Prop is defined as a tool or device to mediate between the frail human body and the natural environment. Each of the Body Prop projects takes on one material procedure and set of appropriate building materials from the four procedures to be considered (textile-tensile, cast & molded, frame & skin and modular units). Students are asked to develop a thesis and design a prop that mediates between their body and one isolated natural element (Earth, Water, Wind, and Fire). After doing a preliminary research into the materials and method of construction at hand, they are asked to experiment with the set of materials belonging to the chosen method. Then they must explore and articulate their design concepts through sketches, diagrams, models, and full-scale well-crafted objects. Two projects one at midterm and the other before the end of the semester are full-scale objects. One is an **Icehouse** using water and ice, as the primary building material and the second is a **Sukkah**, a temporary shelter for the annual Jewish festival of Sukkot. Parallel to these projects we examine some significant contemporary and vernacular architectural works that are preoccupied with similar architectural issues. In this, project students select a project out of pre-selected list of examples. They work in groups of three or four to do an extensive research and in collaboration present their findings to the class in a multimedia format. The last project is the Reduce, Reuse, Recycle project in which all the work from the entire semester is reviewed, edited and re-presented in a CD format. This is accompanied with a hard copy "album cover" portfolio in a jewel case.

## **The main role of teacher is to teach students how to learn.**

“...With every lesson you teach, you take a learning opportunity away...”

**Magda Gerber**

Teaching in effect is teaching students how to learn. Through a process of discovery, in which the teacher plays the role of a resourceful guide, the students can become independent and self-confident individuals. Emphasis is placed throughout the studio on the students own take, read, and pursuit of a line of thought based on their particular interest within the framework of the assignment. Students are recognized and respected as individuals in different stages of their academic development, with strengths as well as weaknesses that need close attention through observation, guidance, and criticism from their teacher. Our role as teachers is not to shape our students in our image, but to help them to discover their own voices. At this early stage in their education, many students want to be told what to do. Some arrive with well-formed preconceptions about architecture that need to be questioned and reevaluated. Although somewhat resistant to it at the beginning, soon students learn a systematic questioning process, which helps them to arrive at a reasonable depth.

## **Research as a design tool**

As in the professional projects, research plays a critical role in the design process within our studio. Time and space is allocated for this endeavor. A third of the time scheduled for each studio project is spent on research of relevant topics. The **research wall** is a physical space dedicated to all collected materials, which become public property. Sharing of information across the studio helps the learning environment and accelerates the rate of interpretation and abstraction processes. Through each of the projects, the students discover inherent properties of building materials and appropriate methods of construction. They are asked to consider the mediation between their bodies and the natural environment as the major program for all of their projects. They are also asked to articulate a clear and concise conceptual **Narrative** or **Thesis** based on their research findings. This assures that students get into the habit of finding resources, pursuing related ideas and referencing them in a rigorous way.

The **Precedent Analysis** project in particular motivates the students to find reference material and research issues connected to the particular architectural project addressing similar issues. Some of the subject projects for their analysis are not widely published and finding material on them becomes a challenge. This encourages the students to look further and explore other sources of information including the Internet and even the architectural offices responsible for the project. Students in turn present their findings along with series of conclusions and questions to the class in a seminar format. This instills a sense of

responsibility and thoroughness towards the process of research since questions are raised during the presentation that the students have to address.

### **Environment and sustainability are critical to design education.**

“The shape of a tree is the history of the forces which were acting on it while it grew.”

**Julian Vincent**

Sustainability is a relevant and critical issue in architectural education given the extent of environmental degradation that is the direct result of building activities. The word sustainability can mean many things. A deliberate attempt is made to keep the concepts related to sustainability within the studio very elemental, simple, and direct. In the design studio sustainability becomes a way of thinking rather than a series of readymade techniques that can be applied to any building as an additive. The relationship of the architectural object to the natural environment is explored through the four ancient basic elements of **Earth, Water, Wind, and Fire**. The examination of these four elements as major environmental factors and their profound effects on the built environment becomes a way to compare, contrast and learn from a great variety of architecture objects from vernacular to contemporary. Throughout the course, the built object is considered as prosthesis.

The architectural object is a mediating technology that relates the frail human body to the natural and the artificial environments. The simple underlying program for all of the studio design projects is a sustainable relation to the natural environment. Before the advent of electricity and air-conditioning technologies and the development of climate rejecting buildings, all architecture had to relate to its natural environment in a meaningful way or cease to exist. Since then, many architects have simply forgotten how to integrate these effective forces in architectural design. Our hope is that the familiarity with these forces and their potential rational and emotional effects on formation of innovative architectural design, will become second nature to our students, as designers and users of architectural objects

Sustainable principles of lightness, temporality, reusability, assembly and disassembly, mobility, adaptability, and flexibility are explored throughout the course

### **Tectonics, material, and methods**

Design is integrally related to and influenced by materials and methods out of which emerges a particular aesthetic. The idea that materials and methods are the inevitable components of any architectural project is strongly emphasized throughout the semester. This studio considers the impact of building materials and methods in the formation of designed object. The *Architecture as procedure*

(course title) alludes to a theory of architectural production first articulated by Gottfried Semper in 1863. Semper identifies four **procedures** or **building arts** and associates four *material types* with these procedures that form the basis of all architecture. Experimentation with new materials is required. Students soon learn from the material behavior, what are the possibilities and challenges inherent in any given material. Many of the students have never worked with materials and methods of construction introduced in the course. Approaching architectural design from this perspective allows them to get over many preconceptions they bring to the class and learn through direct experimentation with building and modeling materials.

### **Multi-disciplines and the design studio**

Exposure to a diversity of ideas and viewpoints through guest speakers is invaluable to student development. Unlike our traditional studio structure, we started the integration of a seminar day into the schedule. The seminar format exposes the students to a variety of viewpoints through a guest speaker or video presentations, which follows with a class discussion. This happens every other Wednesdays and is complemented with our student analysis project presentations and few workshops on digital and shop skills, which follow the same format in alternating Wednesdays. These seminars provide a necessary structure for exchange of ideas and different viewpoints between students, their teachers, and the guest lecturers. So far speaker presentations have included the following: presentation on weaving textile by a weaver, on sustainable practices by a senior research fellow, on textile-tensile architecture by an architect and editor of a Fabric Architecture magazine, on the theoretical aspects of sustainability by architecture faculty, on the tectonics of frame and skin in small scale and ephemeral architecture by a technology professor, on architectural design in the context of the 1932 Chicago Tribune competition by an architectural historian, and finally on tensile architecture by a structural engineer. We have found that the students are energized by these discussions and usually raise intelligent, provocative questions that stimulate great discussion and learning environment for the students, presenters, as well as the teachers. A series of reading assignments and few video presentations provoke stimulating discussion amongst the class. While the reading assignments generally are directly related to contemporary architectural theory, the video presentations are from diverse genres.

### **Students as teachers**

Creating opportunities for students to teach their peers and act as teachers accelerates their development. In collaborative teams of three, the students are asked to conduct an analytical research of an architectural project to produce a lecture presentation in a seminar format. In this project they are required to

research and find all the material they are going to use in presenting their analysis and synthesis to the group. For all the group projects, students are encouraged to team with students from the other participating studios. Like our other collaborative projects, this produces group dynamic problems that are naturally present in similar situations. However, the outcome more often is very impressive. They have produced great lectures of sophisticated content, which take a full advantage of our wired classrooms. This not only validates their own points of view and supports their academic development, but also gives them a better perspective in questioning the authority of the authors they study.

The fact that students are responsible for producing and conducting a seminar gives them a great sense of direction and management of this research project. This in time becomes an automatic part of their design process.

Another important aspect of this exercise is the notion of public speaking, which we all need in our education. Theatricality of classroom presentation is not a mystery to anyone, but production of a good theater does take practice.

### **Balancing the individual and group dynamics**

Learning through collaboration is means of constructively harnessing student energy and conveys an often-neglected reality of the architectural profession.

The myths of the lone ranger and the hero architect like that of Frank Lloyd Wright, F.O.G., and other contemporary gods of architecture needs great reconsideration. Although anyone of these individuals would probably admit that none of their major projects had been possible in an insular manner, it appears that these supermen are all very singular in there ability to change the world and save the day. Outside architectural *comic* books, no building project in any stage is done by the might of an individual. Therefore collaboration is the norm not the exception. Although in an early stage when one needs to develop, his or her own vision of the world, isolation can be of value, we must emphasize the importance of collaboration in our profession.

In addition to the analysis project, we undertake two full-scale design-build projects in-groups of three students. These small-scale prototypical projects attempt to mediate between their bodies and the environment. Depending on the season and the region, these design projects engage climate, culture, scale, material, construction, and structure as they relate to the four major elements. In winter, the **Icehouse**, explores the possibilities of various states of water in combination with cold climate construction. Using the transformation of water into ice as building material and the experimental work of the engineer *Heinz Isler* as inspiration, we continue to elaborate on earlier studies of textile/tensile and cast/molded construction methods. The program for the **Icehouse** is for a portable and prototypical ice fishing structure to be used by one person. As such, it is inwardly directed and deals with basic issues of enclosure and light. Students are asked to incorporate textile/tensile with cast and molded structures using ice/snow as the primary material of construction. In Fall, they design and build a **Sukkah** in celebration of Sukkot, a Jewish holiday. Marking the harvest

time and in commemoration of wandering of Israelites from Egypt to the Israel this ephemeral structure must follow certain guidelines. This has been a valuable project for our students because of its simple but loaded program with and a wealth of spiritual and cultural issues.

## Process and Product

Building, documentation and exhibition of student's work, both process and product have the potential to positively engage the community. A major portion of the studio time is spent on documentation of the ongoing design process and exhibition of this process in conjunction with outcome in public realm. This plays two roles; one it gives a clear picture to the students of their own design process through material documentation of the work, two it provides a key into their thinking and making for a well informed and critical dialogue. They are asked to digitally document the process and the work and distill this documentation in a compact disk format as their final project. Titled, "**Reduce, Reuse, Recycle**", this electronic portfolio becomes their base portfolio for application to graduate programs.

## Conclusions

As an experiment in progress, we are constantly measuring the value and effectiveness of this course as an undergraduate design studio. We are also interested to know about our own effectiveness as teachers. Informal interview of students, guest lecturers who are invited back for review days, and other guests in addition to more formal student evaluations are all important tools for us. We have shaped and reshaped this course and its content each time we have taught. Like any design project, we see no end to this continual evolution, only deadlines and due dates.

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