Ciao! Penn State:
A Scaffolded Learning Environment

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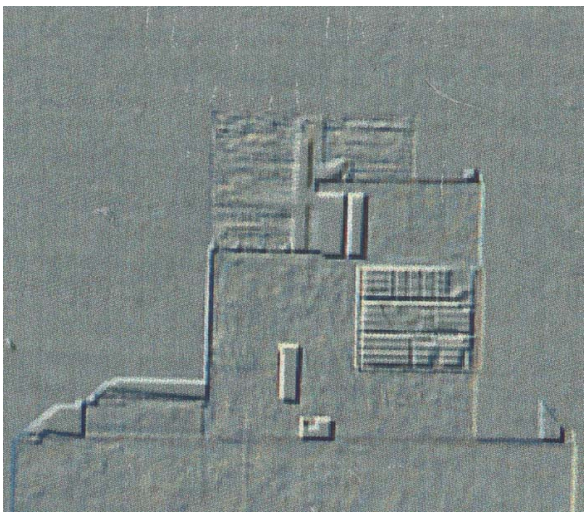
Introduction

In "Technics and Architecture," Cecil D. Elliott tells the stories of building materials and systems development, regardless of time and place, to include a variety of solutions used simultaneously. Politics and social events impact advancement as much as any need or inventive problem solving. And because work is also a human activity, the eventual improvements are only that because of the noteworthy share of failures, misjudgments and vainglorious efforts along the way. In Elliott's words, "A building is at the same time an object, an investment, and a cultural and personal expression of beliefs. Any change in the way buildings are built or the way they look must be tested against a variety of standards, their relative importance being somewhat different for every project. This truism explains why certain technological aspects of architecture have been readily adopted and others have been long delayed. For instance, elevators were a vital factor in the economic and social changes related to the great sweep of urbanization, and therefore elevator technology was immediately accepted and quickly developed. No similar urge spurred the development of a more rational system of plumbing and waste handling" (Elliott, 1993).



(Figure 1. Strategy in synthesis impression))

Teaching these development stories as a *strategy* for meaningful design invests in the understanding that the built environment ought to be a product of architecture-as-art and architecture-as-praxis. Architecture for the built environment, then, is meant to be experienced, meant to be physically inhabited, meant to be used, and meant to co-exist with other buildings within its context. That context is one that includes current and local labor and economies, a respect for the earth and sky that sustains us, and a work that intentionally does not distance itself from its constructed and material inheritance. Work that is decidedly wise about the circumstances that surround health, safety, welfare, construction, and systems integration is work that doesn't compromise itself within the category of some personally reflective and

creative muse. Rather, it celebrates the resultant translation and synthesis of critical design decisions as *an architecture,* a representation, if you will, of wisdom, strategy and choice.

Background

The work presented here is the result of a collaborative effort investigating this *representational* approach to design decision making and the teaching delivery system that might encourage it. As Boyer and Mitgang point out in their report on architecture education and practice, "Architecture education is really about fostering the learning habits needed for the discovery, integration, application, and sharing knowledge over a lifetime" (Boyer and Mitgang 1996). A summary of the research includes the recognition of the problem learning process requiring effective information (Bazjanac 1988). The acquisition of accumulated knowledge impacts the cyclical, iterative, rethinking of the problem (Alexander 1971). Confusing or "wicked problems" compound the process because the solutions, like the problems, aren't easy to identify. There are hierarchies and consequences to problem definition and design solutions (Rittel 1972). In fact, there may be evidence supporting contradictory or opposing opinions for which no single, correct solution can be determined (Kitchner 1983). Only when ill-structured problems can be celebrated as part of a conceptual process can they help frame the problem (Schon 1986), (Jonassen 1997). When problems can be conceptualized as realistic situations domain-specific knowledge is sought, i.e. disciplines (Bransford 1993). Disciplines gather an expertise and experts contribute to effective problem definition. The inheritance of a repository of context-specific information informs learners of precedent attempts at similar problems (de Jong & Ferguson-Hessler 1986). Learning theories have moved away from objectivist ideologies and towards practice and reinforcement to provide an overview of the process of problem identification (Jonassen, Peck, Wilson 2000). Constructivist learning environments facilitate learning by doing through knowledge representation. Problems, even when virtual, will take on an existent quality because learners are engaged in meaningful projects requiring them to explore, experiment, construct, converse and reflect (Jonassen & Land 2000). First developed during World War II as a mechanism for producing reliable training, its origin is in behavioral psychology and communications theory. By applying feedback and practice to the basic communications model, knowledge transmission and reception meant a "strategy" for application was learned. It was this quality that seemed especially important to introduce to the student hoping to know when and how to use a particular kind of information as how daylight will impact supplemental heating to a room or when occupancy use group rethinking can effect an overall building configuration. Particularly when it came to hard thesis questions, *strategy* would allow an investigation of the "attachment" or the process of the "edit", even a particular gesture involving a "graft" to be translated in a meaningful way and applied through the praxis intentions of the work.

Figure 2.(Andrew Lefkowitz Student thesis work)

Context

Each thesis student in Architecture at Penn State is required to work on an independent thesis their fifth year. Because the thesis is student driven, the topic and emphasis of one project may be radically different from any other in the class. What is expected, however, is that each thesis project investigates an issue or dilemma in an architectonic way through a thoroughly considered building problem. Therefore, each design thesis will feature components of a thoroughly considered building problem, i.e., siting, structure, materials, environmental systems and a building envelope along with sustainable practices and energy conscientious design. Students register for two semesters (Fall and Spring) to complete the requirements of the Architectural Thesis.

Attachment: home and the urban non-place

The traditional city suffers from the adaptation of reductivist tools of organization (districts, corridors, networks, zones) not only in its physical form but also in the manner in which it is seen and acted upon by its inhabitants. In particular the transition spaces effected by circulation corridors erode a city's richness into banal diagrams denoting private and public interest both in scale and in texture. This wasn't always the case. Paul Groth's work on urban housing before the "Cold War" notes a time when a local café augmented a small private kitchen or a sidewalk chess table shared the respectable social status of any private parlor or club. Density compromised national security and there was in invested interest in decentralizing the urban place.

The intention of this thesis is to investigate the architectural nature of *home* not as an object of the individual separate from the urban, but as a process of *attachment* in both a construed and constructed way intent on the eventual assimilation of the private into the public.

(Figure 3. Excerpt from student thesis)

Systems Integration

Students also register for a support course in the spring semester of their thesis year. This course, Integrated Building Systems, was created to "scaffold" the Architectural Thesis as a guidance tool in the process of decision making for multiple systems, for example, those linked to labor and construction, finance and economies, research and consultant expertise

The content for Integrated Building Systems, the support course to the thesis, consists of six modules. These modules recognize decisions in a holistic process as consequential and linked to each other. The individual thesis determines the emphasis and order of application in the project.

Module 1: Occupancy and Use Designation

- Historic context for public safety
- Developments in fire prevention
- Proximity, separation, zoning

Module 2: Siting, Daylight, Program Zoning

- Siting and the zenith of the sun
- Room proportions and natural light

- Developments of artificial light

Module 3: Massing and Lateral Stability
- Stable Configuration
- Structural components to bracing
- Circulation systems, egress
- Accessibility

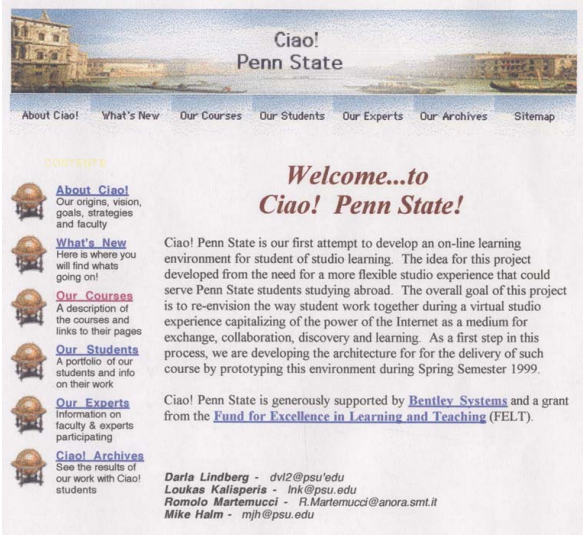
Module 4: Structural Criteria for Selection
- Historic context for construction
- Labor stories and economies
- Inventions, innovations
- Decomposition, resultant forces

Module 5: Supplemental/Alternative Systems
- Utilities and operations
- Spatial and health qualities
- System criteria and configuration
- Alternative and innovative systems

Module 6: Building Envelope
- Technology and the wall section
- Poche, structure, space
- Contiguous systems
- Climate mediation

The uniqueness of each thesis demands this support course can not be taught in a traditional linear way. The course contents need to be accessed as a resource while instilling the "wisdom" of layers in decision making as consequential and linked. And since each thesis tends toward multidisciplinary issues, it seemed appropriate that students learn to guide decision making as a corresponding responsible and responsive act potentially linking community and technical expertise.

Herein suggests a potent opportunity for an asynchronous teaching environment. Therefore, course delivery would not be linear and separate, but linked directly to the specific process of the student and problem of the thesis. The potential expansion of contributors to a learning situation would promote debate, rebuttal and challenge the hierarchy of traditional content delivery.



(Figure 4.Web site introductory page)

Ciao! Penn State

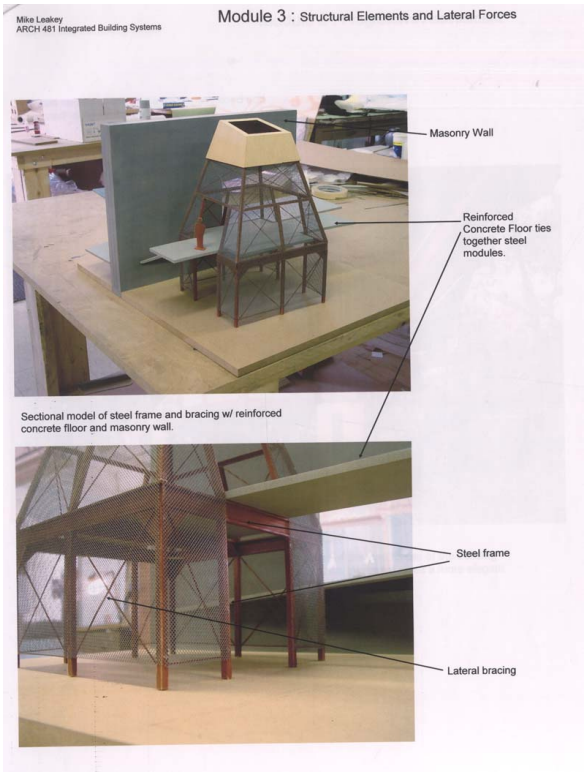
http://ciao.arch.psu.edu is an electronic environment as the result of Ciao! Penn State, a research project funded by the Center for Excellence in Learning Technologies at the Pennsylvania State University to explore this potential. A particular goal of the research would be to investigate problem based learning for remote sites (a study abroad program in Rome, Italy or distance learning programs in the United States). *However, questions critical to the research centered on the substantial and qualitative use of information and expertise to significantly effect the design outcome, whether local or remote.*

With this in mind, the research focused on the ontological relationship between the content systems of a discipline (found in the curriculum in academia) and their ties to a particular design problem. In other words, course material and expertise are rendered relevant based on the relationship they have (perceived or actual) by the design problem. On the surface this appears appropriate and reasonable and remains a

teaching model few challenge – the problem drives the investigation. The dilemma exists not in the didactic importance of the problem, the level of involvement or complexity, but in the *place and nature of the problem*. Consequently, material that may be critical in an existent or real world is very different from the material necessary for a non-existent or ideal world. This articulation doesn't become problematic except the results teach a "strategy" to decision making that ignores the relationship of other criteria to valid and critical judgments in design. It is any wonder Architecture is an 'old person's profession.'

This isn't the case with other disciplines where strategy, even those requiring quick response decision making, is recognized as a critical part of the learning outcome. Physicians have a series of protocols for litigiously defensible practices. Medical students are taught to use those steps as they record symptoms and determine diagnosis. Business students analyze case problems to see the strategies used in decision making. Undercover police work relies on an instinctive knowledge of the legal parameters they need to work within for split second judgments in action.

The importance of this research project, then, was to locate the place and nature of important "strategy" (choice, judgment, and wisdom) in design decision making.

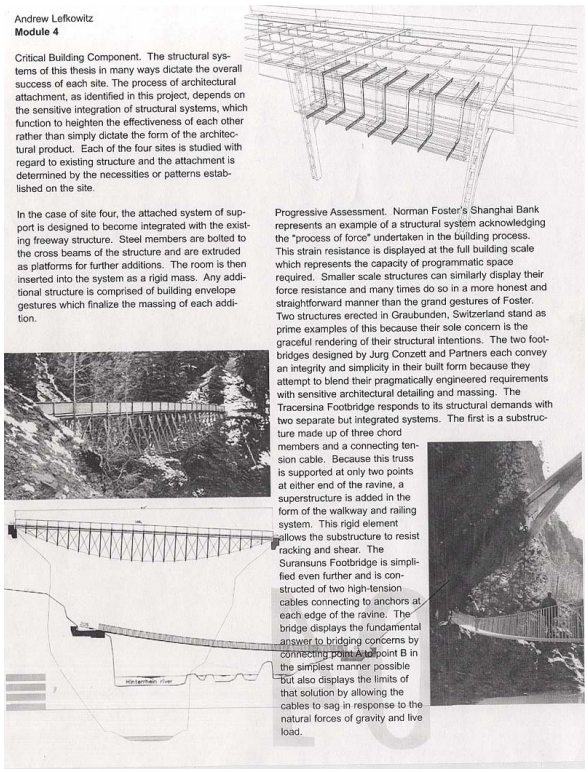


(Figure 5.Student integration module: Michael Leakey.)

The Scaffolding

The first thing the modules require of the student (the thesis student in this study) is to consider each one as it relates to their particular design problem. Since these students have taken building site, materials, structure and engineering courses prior to entering this year, the modules prompt the students to consider aspects of design that have implications to other systems in the building. Students read, examine expert links, are presented exemplar works and are asked to consider through the isolation of each module topic some of the particulars associated with the eventual integration. It begins to connect to the thesis problem when a student can identify ideas for conceptual beginnings enhanced by aspects in the modules (i.e., program zoning of particular massing enables the building configuration to be

inherently stable, or the entire building is zoned to work as an egress system.)

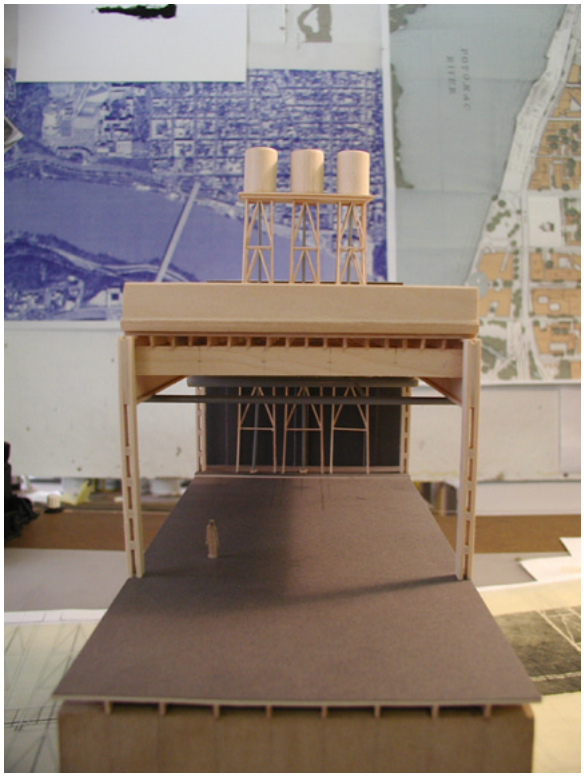


(Figure 6. Student integration module: Andrew Lefkowitz)

Students are guided to readings that describe inventions or developments of systems and they interpret context, economies and political climate as critical determiners in the resultant opportunities and challenges in design. As a resource each module tracks the development of historical contributions (implications, consequences, regulations) in order to invite the opportunity for change. By applying the information of each module to the thesis, feedback is taken into the conceptual understanding of the project. The next module is layered onto the previous one and the accumulated knowledge persuades or contradicts the validity of those earlier decisions. Depending on the nature of the thesis, the preferences of the student or the goals called up by the problem, some decisions are judged preferable over others in the representation of the knowledge gained through the modules. This is quite different than the expectation that a student will apply the knowledge from a course in structures or a course in heating, ventilating and air conditioning to the thesis problem. In a similar way, the progressive assessments (essay feedback of concepts discussed in the module) provide students with a way to think through the theoretical issues espoused by the thesis problem and translated through the work.

The thesis students work on all the modules independently and apply them to their own thesis problem. Expert links allow the student to work at a level of expertise they find appropriate or significant to the work. Archives of past student work give critical guidance to students because the work is purposefully addressing the issues (for example, creative occupancy use group interpretation and consequences) instead of blurring those wise professional decisions in a glossy journal photograph.

At mid-term, the students concentrate on the final presentation work of the thesis problem. At this time, emphasis is placed on a collaborative research project in the integration course. The intention of the research project is to allow the students to test what they have learned about *strategy in design decision making* by assessing the work of others. Students select a real project they can visit or one they are familiar with from their foreign travels. They consider the project, the client situation (budget, process, program) and they review the consequences of particular decisions related to code, zoning, room placement and section, siting, massing, structure, systems and the resultant responsiveness of the building enclosure. These research projects are proving to be a valuable resource for younger students as they grapple with questions dealing with significant building massing for a particular typology, i.e., a library, or labor and cost implication for a decision involving a particular structural and enclosure system.

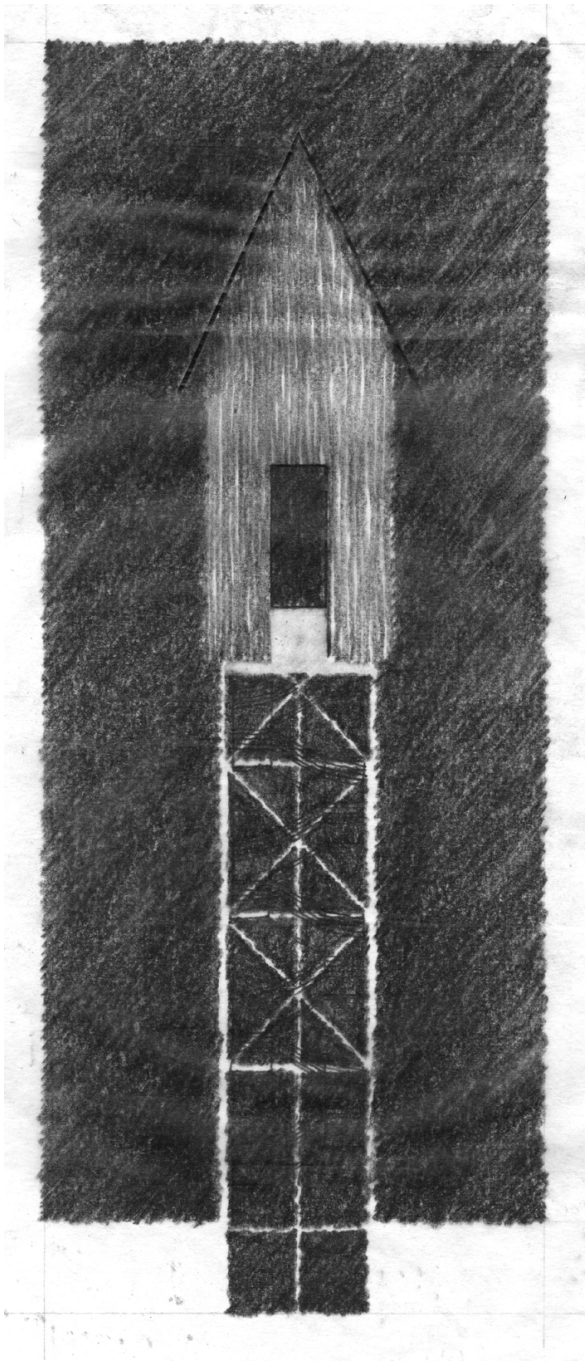


(Figure 7. Student integration module)

Conclusions

Within the theoretical framework of learning by doing, discovery and strategy are mutually inclusive tools for design thinking. Students can consider implications and repercussions for certain design decisions without taking anything away from the discovery process of creative thinking. Thoughtful understanding of the designation of a particular occupancy use can guide a student quickly to construction types and material assemblies without slowing the conceptual process. In fact, the opposite is more often the case. Students know where to start and why to start, as evidenced by the use of archive work.

The knowledge added to design education by this research and project is the awareness of a need for coupling or 'scaffolding' device for certain kinds of courses made especially possible via asynchronous teaching. Certainly faculty can be expected to share information as mentors or students can be expected to continue translating and transferring information on a need-to-know basis. But the development of non-linear teaching mechanisms (in this case, the clear articulation of the six modules of content) deliberately scaffolded or linked to other critical coursework (the thesis design problem) instills the importance of *strategy* to critical thinking about consequential and linked decisions in thoughtful and responsive work.



(Figure 8.Student integration module))

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