

# Learning from the Architecture Studio: Implications for Project-Based Pedagogy

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*Published in International Journal of Engineering Education, Vol. 17, Nos. 4 and 5.*

## The Architectural Design Studio

Studio education, central to architectural training in the US for most of the twentieth century, is a provocative and fruitful model for engineering and software design education. The Architecture studio, an American adaptation of the atelier-based training at the Ecole des Beaux-Arts in 19<sup>th</sup> Century Paris[1], offers us a teaching model from a design discipline in which the functional and the structural, the social and the technical, must be successfully blended [2,3]. A look at the central features of the architecture design studio indicate some interesting possibilities for design education in other technical fields.

## Features of the Design Studio

At MIT in Fall 1995, a “Software Design Studio” course explored the use of the studio approach in teaching software design to graduate and undergraduate students. Organized and taught by Bill Mitchell, Dean of Architecture and Planning at MIT, and Mitch Kapur, founder of Lotus Development Corporation and designer of Lotus 1-2-3, the course borrowed many aspects of architecture studio teaching. Key features of the course reveal some of the essential characteristics of architectural education that may be portable to education in other technically-based design fields:

- **Student work is organized primarily into semester-length projects, responding to a complex and open ended assignment.** In the architecture studio, students start with an assignment, or “program,” which usually describes the type of building they are to design, the size and shape of the site, a list of some client requirements, and perhaps a rough budget or other constraint. In the Software Design Studio, students began the semester with the very general charge to “reinvent the community weekly newspaper for the digital electronic era.” They were expected to have a partially-working prototype to demonstrate by the end of the semester, using either existing technology, or justifying why the technology they chose would be readily available within five years. Students were permitted very broad latitude in their approaches, and they chose to focus on a variety of aspects of the problem: some concerned themselves with creating a vehicle for delivery of conventional wire service reports and the like, while others branched off in novel directions, creating everything from a handheld device for news reading to a newsgroup browser that represented postings as colorful spheres arranged in a DNA-like strand. Faculty set the expectation that students would do overall conceptual design and be able to answer questions about who would use their creations, in what settings, using which hardware platforms, and so forth, but that students might choose only one aspect of their design for detailed exploration.

- **Students' design solutions undergo multiple and rapid iterations.** A distinctive feature of architectural education—and architectural practice—is the rapid proliferation of potential design solutions. It is not unusual for a student, sitting alone or with a teacher or colleague, to quickly sketch a series of possible approaches to a design problem. In the architecture studio, faculty often enforce rapid iteration by requiring students to present in the first weeks of the semester a proposed solution to the given problem. This requirement is akin to “rapid prototyping,” and it rewards experience and a facility for quickly sizing up the situation, as well as allowing early and frequent critique by others of a student’s design. The requirement for early commitment to a solution has its origins in the practices at the Ecole des Beaux-Arts, where students advanced in their education by doing well in design competitions. Each competition began with students receiving an assignment and remaining in the Ecole building for a set period of several hours, during which they were to sketch out their solution to the assigned design problem. At the end of the period they handed in their sketches, then spend the ensuing weeks working out the details of the solution which they had sketched. Their final design, on which their work was judged, was not permitted to vary significantly in overall approach from the sketch they had submitted on the first day. American studio education is not so rigid, and students may change their designs significantly over the course of the semester, allowing them to learn from their own continued work and the feedback of others. In the Software Design Studio, students submitted a one-page description of their approach at the fourth class meeting, and reviewed their plans with a faculty member the following week. By mid-semester, the practice of having students present their work-in-progress to the group every few weeks was well established. Most students set a general direction early on, but some student projects changed dramatically in the last weeks of the semester.

The ability to work quickly, and to draw effectively on past experience, are key features of professional expertise. In their discussion of the difference between the expert and the merely competent chess player, Hubert and Stuart Dreyfus describe Stuart’s experience on his college chess team: “At some point, a few of his teammates who were not mathematicians began to play fast five- or ten-minute games of chess, and also began eagerly to replay the games of the grand masters. But Stuart and his mathematical colleagues resisted because fast chess didn’t give them the time to *figure out* what to do. They also felt they could learn nothing from the grand master games, since the record of those games seldom if ever provided specific rules and principles. Some of his teammates who played fast chess and studied grand master games...went on to become chess masters. Yet Stuart and his mathematical friends never got beyond the competent level.” [4] The parallel to student activities in the design studio is striking: students are exposed to relevant precedent (community newspapers or historic buildings are the games of the grand masters) and to rapid iteration of design solutions (fast chess). In the design studio, students of software design can learn to combine instrumental reason (“figuring out what to do”) with a more tacit “knowing-in-action”[5]. It is this combination which is essential to the development of true expertise, and the design studio can be a powerful venue for educating expert software practitioners.

- **Critique is frequent, and occurs in both formal and informal ways, from faculty, peers, and visiting experts.** One of the hallmarks of studio education is the creation of a “culture of critique,” in which students, who spend long hours working side by side at their projects, give each other frequent feedback, and also get both formal and informal feedback from the faculty in charge of the studio. Architecture students also participate in “pin ups,” in which they literally pin their drawings to the wall and discuss their work with critics, and “desk crits,” a discussion with a faculty supervisor at the student’s desk. In the software course, interactions were more limited because the students did not share a common physical space, but instead worked in their departmental laboratories or their own personal workspaces. The group met for three hours a week in a classroom with electronic projection capabilities, and after the first weeks of the semester, most

of the time was devoted to group reviews of each student's work-in-progress. In the software studio, as in traditional architecture studio teaching, a "jury" composed of faculty and outside experts reviewed and judged the students' projects. In some studio courses, outside experts or clients may participate in intermediate reviews or discussions as well.

- **Heterogeneous issues—ranging from structural integrity to the social impact of the design—are considered, often in the same conversation.** A characteristic feature of design discourse is its dense interweaving of heterogeneous issues, and its odd method of progression—raising topics, considering them, and then often moving on to other issues without clear resolution of earlier concerns. Observers have commented on the linked and contingent nature of design decisions, reflected in design conversations [5], and one author has compared design conversations to jazz improvisation [6]. In the Software Design Studio, a conversation might range from such issues as what it really means to be a *community* newspaper, to details of interface design, to what the right software tools are for implementing the design. One special strength, then, of studio-based teaching is its ability to support multidisciplinary and integrative education. The studio can act as a forum for debate and discussion of a wide variety of issues. The instructor is responsible for making sure that the most important issues are covered during the course of the semester.
- **Students study precedents (past designs) and are encouraged to think about the big picture.** Architecture students study precedents both in separate courses devoted to architectural genres ("The Modern Movement," "Renaissance and Baroque Architecture") and within the context of a specific studio course. If, for example, the studio assignment involves designing a community center, students may look at pictures of ancient marketplaces, rural Grange halls, modern community buildings by named architects, and so forth. Faculty make presentations about relevant issues of precedent and method on an "as needed" basis during the course of the semester. In the Software Design Studio, students participated in discussions about *Fishwrap* (an electronic daily for MIT undergrads), the *Vineyard Gazette* (from Martha's Vineyard), and the *Boston Phoenix* weekly. Precedents exemplify particular solutions to design problems; students are challenged not to imitate but to use the precedents as inspiration and to stimulate a rethinking of the problem at hand. One of the challenges for students, and for faculty, is to avoid a sole focus when thinking about a design problem: students must be able to think at a high level of abstraction about the overall problem ("What is a community? What fosters community?") but also be able to shift focus to detailed design. The move from big picture to detail should be iterative, and students may need help to move back and forth. In the Software Design Studio, some students had a tendency to become obsessed with the details of implementation, and it could be challenging to bring them back to higher level conceptual thinking.
- **Faculty help students to impose appropriate constraints on their design process in order to navigate a complex and open ended problem and find a satisfactory design solution.** An important faculty obligation that accompanies assigning students a complex, open ended problem is helping them to converge on a solution. Students may easily be overwhelmed by the enormity of the task set for them, and the number of possible directions in which their designs might head. Judicious and timely intervention can help a student focus or, when too focused, open up their thinking to explore new possibilities. The studio project is constrained at the outset in a variety of ways: by the limits specified in the initial assignment, by the amount of time allocated to the studio course, by the materials and methods available to students, and so forth. Additional direction is likely to be needed, however, in order for a student to successfully complete their project. In the case of the Software Design Studio, for example, a student was proposing an electronic newspaper for an island community. He seemed particularly interested in the problem of how to design and sell advertising, so the faculty suggested that, in the context of sketching out the overall solution, he

also go into detail about an advertising plan.

- **The appropriate use of a variety of design media over the course of the project significantly supports and improves students' insight and designs.** Donald Schön has described the design process as, in part, “a reflective conversation with the materials of a design situation.” [7] Often a designer’s decisions are influenced by the unexpected “backtalk” that comes from developing the design. A sketch of a building may reveal an unanticipated problem or a surprise opportunity—or an unanticipated problem that *becomes* a surprise opportunity. A three dimensional model of the building, or a visit to the site, may offer a fresh way of seeing the problem and of approaching a solution. Design media—whether they are electronic, paper, modeling clay, or any other material—have *affordances* and *constraints* [8]. Like other everyday objects, they allow or encourage (afford) certain kinds of use and prohibit or discourage (constrain) others. Pens are for writing, and for poking things with, but do not make good cups. Cups are good containers for beverages, pencils, and fresh flowers, but you cannot use them to write with. Some design media are more pliable than others, and some are easier for a novice to use readily, but all design media encourage certain kinds of design exploration and discourage others. A paper and pencil afford rapid sketching, and rapid modification by erasing or writing over. Building blocks let us see three dimensional forms more readily. A PowerPoint presentation—text organized into phrases—can also be a medium for presenting design ideas, and this medium favors things that can be expressed explicitly, using words. A prototype built in Java will support exploration of interaction, while a wall poster helps a group of people to focus on and discuss issues that lend themselves to visual presentation. Because different design media have different affordances and constraints, designers can productively exploit these differences by using different media at different points in the design process. Adopting a new medium can allow a designer who is stuck to see the problem in a new way, or to explore previously unexplored aspects of a design situation. In the Software Design Studio we made only limited use of multiple media, but by the end of the semester we became convinced that enforcing the use of a variety of media—for example by requiring a verbal presentation using overhead slides at the beginning of the semester, followed by a storyboard on a wall poster or using Director software, followed at last by an electronic prototype—would encourage students to focus on different aspects of their project at different points in its evolution. This would, we felt, allow more experimentation and design exploration than had taken place for some students who moved directly into creating an electronic prototype.

### Using the Studio as a Road Map to Design Pedagogy

Studio teaching represents one point on the spectrum of activities that constitute hands-on student work. It is fruitful to explore to what extent individual features of studio education are also found in other project assignments, large and small. Students can be given open ended assignments that require quick solutions (say, a proposed solution 24 hours later, or even an in-class exercise); they can be given assignments that require solutions drawing on multiple disciplines, with multiple brief iterations; they can have faculty and peer critique and help constraining a complex problem; and they can experiment with multiple design media and how different media draw attention to different aspects of a design problem.

Using the key features of a studio course as our jumping off point, we as educators may want to ask ourselves where our current assignments to students fall—and where we would like them to fall—along a number of dimensions:

- Complexity of the problem

- Open endedness of the problem
- Duration of the assignment
- Rapidity of iterations required
- Collaboration encouraged or discouraged
- Explicit incorporation of reflection
- Heterogeneity of issues addressed
- Variety of student skills required
- Use of diverse media for design and presentation
- Use of precedents/exemplars
- Collaborative development of a problem definition or use of a preexisting design specification

One final aspect of studio teaching deserves reiteration: it lends itself well to multidisciplinary teaching and learning. Because of the heterogeneity of issues considered in studio courses, and the way in which students are encouraged to look at the totality of what they are doing, multiple perspectives on the problem at hand are more easily introduced and assimilated into the flow of the course. Faculty may teach in multidisciplinary teams, students may work in multidisciplinary teams, and judges, critics, and clients may introduce multiple perspectives.

#### Acknowledgments

This work was supported in part by a Career Advancement Award from the National Science Foundation's Ethics and Values Studies program. Thanks also to Anne Beamish, Turid Horgen, Mitchell Kapor, William Mitchell, the late John Schumacher, and Carol Strohecker.

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