INNOVATION

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A new lesson plan

Fruitive partnerships are beginning to emerge between practitioners and universities that can afford to invest in equipment that’s out of reach for most firms. While the 1990s were the era of the paperless studio at design schools, the past few years have seen the growth of the production studio, where students form interdisciplinary teams and learn advanced design and manufacturing techniques. PLY’s Daubmann teaches a graduate-level seminar on digital fabrication at the University of Michigan’s Taubman College of Architecture and Urban Planning. “The school has taken up this agenda to advance ideas about technology, construction, and fabrication, and allow them to affect the design process,” says Borum, who is also on the faculty. Students from both architecture and engineering work with several software packages, including engineering and modeling software SolidWorks and Digital Project, the CATIA-based program developed by Gehry Technologies. “The college has invested in 3D printers and CNC routers because everyone senses these technologies are becoming more prevalent in the industry,” Borum says.

Apparently Yale’s school of architecture hears the same muse. Dean Robert A.M. Stern focused on recent technology acquisitions in his annual letter to the school’s alumni this fall. Scattered throughout Paul Rudolph’s multileveled concrete building in New Haven are three laser cutters, a water jet cutter, 3D printers, CNC routers, a 3D laser scanner, and a foam cutter for large-scale models that’s the size of a New York City studio apartment. “Not bad considering that five years ago nobody knew what a laser cutter was,” says John Eberhart, director of digital media at Yale, who earned a master’s in architecture from the university in 1998. He estimates that Yale has spent some $500,000 on rapid prototyping and digital fabrication equipment, not counting the extra computers and infrastructure upgrades their acquisitions entailed, which easily quadruples that figure. The equipment has drawn interest from other departments that want to collaborate with the architecture school to develop joint courses and research.

But the surest sign of transformation is the establishment of an interdisciplinary design master’s program at an engineering school (Record, September 2004, page 187). At the Product Architecture Lab at the Stevens Institute of Technology in Hoboken, New Jersey, a diverse student body of architects, engineers, and programmers study digital design and production using real-world case studies. Architect John Nastasi, who created the lab and graduate program in 2004, says collaborative work methods will be just as important to architects as technical know-how. “Digital fabrication allows architects to have more input on manufacturability,
materials, costs—all the things we’ve handed over to construction managers for the past 20 years.”

In just over a year, the lab has attracted an enviable roster of industry partners. Greg Otto, an engineer at Buro Happold whose career has focused on technology-enabled collaboration between engineers and architects, is on the faculty. The New York firm SHoP, one of the first to invest in its own rapid prototyping equipment, has sent one of its senior designers to study there; the students are also using SHoP projects as case studies, including an overhaul of New York’s Fashion Institute of Technology. Front, a facade consultancy founded by architects and engineers who’ve worked for Norman Foster, Rem Koolhaas, and other top architects, contacted Nastasi recently to develop joint projects. “I call the Stevens program the digital Bauhaus,” says architect David Serero, a principal of Brooklyn and Paris-based Iterae Architecture, an interdisciplinary firm that’s using engineering software and digital fabrication on several projects in the U.S. and Europe.

The tipping point?

Granted, for several years architects have championed building information modeling (BIM, the latter-day term for digital models embedded with design and construction data) and better data-exchange standards to enable digital fabrication, mass customization, and faster, cheaper construction. CIS/2, for instance, resolves one data-sharing challenge, and groups such as the International Alliance for Interoperability and FIATECH continue to define and refine existing standards. But industry leaders also recognize that technological advances alone won’t define new business processes or transcend the uncertainties involved in digitally-based work methods. To that end, the AISC has developed model language for the use of 3D models as contract deliverables. And the next major update of AIA’s contract documents, due in 2007, will also address digital work methods, says Phillip Bernstein, FAIA, a vice president of Autodesk and chair of the committee revising the standards.

Improved standards and processes help, but people are the real catalysts. Whether the impetus comes from an architect or academia, client or contractor, pursuing digital fabrication for buildings takes both vision and gumption. It’s not a single-button push from modeled part to fabricated component, but the benefits of moving toward that goal have become clearer. “If I can say to a client ‘you can open your store a month early,’ that makes him happy,” says Moebs. “Considering how important repeat business is to architects, anything we can do to improve service to existing clients is a mandate for us.”

Students at Stevens’ Product-Architecture Lab are designing “Apsestraction,” a 400-square-foot addition to a church in Hoboken, New Jersey, with Dean Marchetto Architects. The steel structure will be cut with a CNC router, and its connection brackets will be fabricated using a digital printer.