Integration

"I believe that almost all students of architecture enter school wanting to acquire a broad technical competence in structures, materials and methods of construction, and environmental control systems of buildings."

"By the end of their first year we have educated this desire out of them."

— Edward Allen, FAIA, Topaz Medallion

DONNA KACMAR
University of Houston

INTEGRATION OF CURRICULUM

We recently revised our curriculum to integrate what has traditionally been thought of as technical "support" - classes such as structures, systems, programming, and construction - with the design studio. Integration of technical topics into studio is a goal of our college in attempting to address the "wrongs" of the separation between art/design and science/technology identified by Professor Edward Allen, FAIA and addressed when he received the Topaz Medallion.

Allen advocated for connecting technology and studio, and, in fact, teaching technical topics in the studio setting. He stated we must make technical courses not only relevant, but also interesting to students. He asks us to heal the "gulf" between design and building technology and we are seeking to do just that.

We are also responding to the changing profession. Architectural practices, in their quest to design higher performing buildings, are integrating technical requirements earlier in the design process. Ten years ago it might have been unusual to have a project kick-off meeting with more than the architect and client sitting around discussing the goals of the project. Today most project kick-off meetings include the client, architect, mechanical engineer, structural engineer, sustainability consultant, and even contractor or CM at Risk discussing the building program and project goals. Included in the initial project goals are issues about energy use and building performance that were, ten years ago, quite frankly, just not part of the discussion until well into the Construction Document phase on most projects.

ADJACENCY

Our first strategy is to have technical courses taught adjacent in time to studio meetings. This straight-forward schedule change allows for technical information to be covered directly before or immediately after studio. Previously all of our technical courses were taught in the mornings, allowing for plenty of time and

distraction for in between, almost making sure that topics discussed in structures class would not be thought about again that afternoon in studio.

Simply scheduling technical classes and technical faculty to be proximate (relatively) in space and time to the design studio space (and design faculty) allows all of the faculty to be addressing the same students in an adjacent time frame, allows technical faculty be readily available to offer guidance with design studio investigations, and makes it possible for students to remember what happens in the classroom and apply that information to their studio project.

DIVIDE

We divided the technical content into smaller pieces of information, organized by scope and depth rather than subject matter. We "chopped up" the content into smaller pieces and recombined topics in order to deliver technical content that acts more directly as support for design studio. A first semester student is now exposed to some very basic information on structure, material, and daylighting. As the student progresses through each semester the technical content progresses in complexity along with design studio expectations so the scope and density of technical information presented corresponds with the student's increasing abilities and expanded experiences. Each semester the technical sequence now aligns directly with the studio sequence. .

CROSS TRAIN

Our third strategy was to cross train faculty. Most faculty in our college teach either a technical course or design studio; very few design studio instructors have the interest in teaching an entire three-hour credit technical support course. However, when a studio faculty presents information on the importance of structure and discussing basic span information the students know that they will be responsible for showing structure and discussing structural issues in their studio project. Rather than hiring a whole new batch of technical faculty (and reinforcing the art versus science debate) we wanted to work with our current mix of faculty to reinvigorate our teaching.

The first three strategies allow for the integration of the content delivered in technical support classes and design studio to truly begin. Once the courses and faculty are adjacent in time and space, technical content is divided differently and more directly tied to studio levels, and all faculty are more conversant in the full range of issues we ask students to be capable of we can truly begin to integrate the technical course requirements with studio learning.

INTEGRATION – PART TWO

The cross training aspect of the revised curriculum has been more difficult to implement. Design studio faculty have not been as interested as we had hoped in delivering new technical lectures to students. Our current solution is to bring in adjunct level consultants, who specialize in various building technology areas, to teach portions of the building technology courses. This brings practicing structural engineers, mechanical engineers, and others in direct contact with the students but does not develop a new level of technical expertise within the studio faculty itself. However, the engineers bring both a level of expertise and current knowledge of integration in practice to the students.

The Tech 1 course, taken in the students' sophomore year, is taught by a team of engineers including two structural engineers and one mechanical engineer,

who introduce students to structural concepts and thermal comfort. This team approach allows different building technology topics to be delivered in the same course and it provides some flexibility for busy professionals who are very invested in the students but also sometimes have meetings to attend at their full-time job. The team approach builds in both flexibility and fluidity. Alternating topics allows students to think about both structure and systems in building technology class and in design studio without having to wait until the next semester to learn that a building needs a mechanical system in addition to columns. The students, and the NAAB Team from our recent accreditation visit in March 2014, are very excited by the insight the engineers bring regarding how integration is currently being practiced in projects.

The Tech 2 course, the next semester for each sophomore student, brings in a different structural engineer with a different perspective and the same mechanical engineer to provide continuity, and a full time faculty who leads the programming aspects of the course. The students continue to learn more about building structures and systems, including lighting, as they prepare a program to be used for the design studio project the next fall semester.

The course objectives are:

- To delve more deeply into the building systems covered in Tech 1 and to provide an understanding of the methods used in selecting and sizing structural systems and environmental systems. Upon completion of this course students will have a basic understanding of how structural and environmental systems are evaluated, sized, and selected both quantitatively and qualitatively.

The student who successfully completes this course will be able to (outcomes):

- Prepare a comprehensive program for an architectural project,
- Assess of client and user needs,
- Complete an inventory of space and equipment requirements,
- Analyze site conditions
- Review the relevant laws and standards and assessment of their implications for the project,
- Define site selection and design assessment criteria.

The Tech 3 and Tech 4 course, continue the students' junior year and include day-lighting workshops, energy modeling, and more specific and refined understandings of building systems. Each semester the same building technology topics are covered yet the content is of a greater depth and specificity as the student progresses, hopefully increasing in complexity along with the students' design skills. In Tech 3, the professional faculty includes a civil engineer as students begin looking at water systems, detention, and how those issues play out at the building and site scale. Tech 4 utilizes a case study methodology, and the faculty - one architect, one engineer – bring two different perspectives as they investigate building systems in contemporary works of architecture that range from the scale of a house to the scale of an airport.

In addition, a newly formulated professional practice course, supports this evolved curriculum. This course, interestingly enough, is taught be leaders from two different (and often competing!) local architectural offices which gives the

students a glimpse into two different organizational strategies. The NAAB Team noted the well-coordinated lectures and exercises in this class that has been completely overhauled and energetically taught by Theodora Batchvarova from Gensler and John Cryer, FAIA from Page.

COMPREHENSIVE DESIGN STUDIO

Our curriculum revisions include more than the desire to integrate technology with design. Our primary goal is to increase the quality of what we offer our students and (ultimately) our professional community. We need to provide students with enough structure early on so they have a common solid foundation for their learning and then compress the curriculum to allow for the earlier development of independent thinking and critical thinking skills. Integration of technology is also one way to help prepare students for an earlier successful completion of comprehensive design studio in order to allow them to have more options at upper level studios.

Along with the new changes that link our building technology course with studio we also changed the linear sequence of design studios. We compressed the overall curriculum and moved the location of the comprehensive design studio from fifth year to the first semester (fall) of the fourth year. This allows students to then take a series of three "professional studios" that offer a variety of different design investigations that focus on issues that range from urban scale investigations to material research. The comprehensive design studios, taught by six professionally active faculty, brings current architectural practice into the studio experience.

The curriculum also includes a capstone building technology course, taught by Rives Taylor, FAIA, who also coordinates the technology curriculum, titled Tech 5, linking the studio requirements with topical lectures. Coursework in the building technology course includes specific exercises that require current studio projects to be used as instructive examples for each topic. For instance, the students will complete an energy calculation based on their current building design. The students also begin to look at materials in this course. They do material research on interior, structural, and cladding materials including density and weight as well as life cycle analysis. This work is coordinated with the work of the Materials Research Collaborative. The student collected physical samples and data become part of the MRC's collection and database. These materials are intended to be materials that they are using in their current comprehensive design studio project. In addition, in teams, the students follow a current construction project for three months, understanding the general construction sequence and overall physicality of the built environment.

The overall schedule of the design studio is compressed with contextual and architectural precedents studies completed in the first week. In the next four weeks the overall building scheme is designed so it can be developed over another two weeks and presented at mid term. The second half of the semester gives the students time to address key systems and issues. During the first half of the semester a sequence of topical lectures addresses code, accessibility, structures, thermal comfort systems, plumbing systems, and electrical systems that students then incorporate in their project the second half of the semester

Individual studios also connect students with local engineers and consultants. This allows building technology information to be addressed three times. Once during a lecture and a second time in design studio along with the guidance of

the instructor. A third time a consultant is brought in to focus on each specific topic with each student. One studio day a structural engineer met with design students at their desks while a code consultant met with students I groups of two pinned to a wall. Students were able to cycle through both topics within the five-hour studio period. Another day was devoted to MEP systems and accessibility. A third day was devoted to landscape design and interior design. This three-pronged approach allowed the students to have more familiarity with the issues and to develop reasonable systems that connect to their design intent.

The NAAB Team also offered high praise for the comprehensive design work during their closing remarks following their review of the college. “In particular the Team felt the student projects exhibited for ARCH 4510 – Architecture Design Studio X (Comprehensive Design) was exemplary in both the design and presentation quality. The projects demonstrate design solutions that could, with very little effort, be converted into real-life building projects.”

This advanced architectural building studio ARCH 4510, coordinated by Geoffrey Brune, FAIA, focuses on the integration of the architectural idea and the building systems (that express the idea) at a conceptual level. The architectural parti, including the sequencing of spaces in both plan and section, are to be informed by the selection of structural, environmental, and material assemblage systems. Consultants for structure, MEP, life safety, and building regulations present information and field questions from the students. Consultants often return at mid semester to review work in progress. The studio faculty meet at the end of the course to evaluate the semester and evolve the program each year. We would like to increase the consultant integration to include site design / landscape, material systems, and information technology / communications. We continue to look for other ways to develop and improve our comprehensive design studio and look to strategies employed by our colleagues at nearby institutions.

Texas A&M University

In the department of architecture at Texas A & M University (TAMU) they teach comprehensive design studios fall semester of the fourth year of their four-year non-accredited Bachelor of Environmental Design degree program. They link a four-hour design studio with two building technology courses: a two-credit hour structures course and a two-credit hour systems. Students must enroll in all three courses at the same time. The faculty has experience in architectural design, civil engineering, mechanical engineer, lighting design, and building physics and typically teach in conjunction with up to six design studios. TAMU is looking at possibly requiring a similar approach in the second year of the undergraduate program and in their accredited Master of Architecture curriculum. The three classes are linked and the students receive grades from each faculty for each individual course. The faculty, within each studio, coordinate their activities and the students integrate structures and systems into their studio designs. This helps insure that students incorporate all of the issues required, both design and technical in nature.

Rice University

At Rice University’s School of Architecture Troy Schaum coordinates the program’s five studios in Houston and Paris along with teaching one of the Houston studios. Though the one-semester course is not explicitly linked with a building technology course they have developed a few strategies to link design with building technology. Their curriculum, Totalization, is meant to construct an

infrastructure that supports individual experimentation and a diversity of approaches to complex issues. They also have a "Joint Seminar", lead by Doug Oliver. Different topics are presented to students such as Schaum's own research on the history and evolution of project delivery and construction documentation. Students also present and have their projects critiqued by a series of industry experts, engineers and fabricators. This exchange continually sharpens their focus both on the root of their individual innovation and the issues that need to be addressed to make it feasible.

They visit the offices of such as Buro Happold Engineer, Mark Malekshahi and Facade specialist, Bob Heintges, in NYC and study examples of best practices from their work. While software like Ecotect, Karumba and RISA can help facilitate some integration Schaum believes that an integrated comprehensive design studio is only going to be as good as the overall curriculum that supports it. Students need to be engaged with the range of issues that touch architecture from day one and understand that innovation is derived from building ideas up from first principles.

Iowa State University

Farther north at Iowa State University, Jason Alread (who co-wrote with Thomas Leslie, Design-Tech, the best integration book I have found) coordinates and has taught one section of their comprehensive design studio since 2008. The comprehensive design studio is a one-semester course though the learning objectives are now coupled with another design studio after requested by NAAB after their most recent accreditation visit. The NAAB requested this because they didn't want only one studio to count for comprehensive design studio.

Though the design studio is not directly integrated with building technology courses it does occur the semester after the building technology sequence is complete. A previous course on technology integration was offered that was optional and it ran parallel to design studio. The NAAB did not like the offered course being an elective, even though about 75% of the students took it. NAAB failed Iowa State's comprehensive studio because it was not a required course. The faculty did not want to require it and the course lost steam so is no longer offered. Jason would like to reintroduce something, but there is little room in our course load so they changed the tech sequence instead (see below). At Iowa State they talk about technology as inseparable from the design process. Their building technology faculty teach in studio and are the coordinators of the comprehensive studio as well.

They also conduct a six-week technical documentation segment focused on how to consider organizing a drawing set from the point of view of a project architect as the last segment in their final technology class. Students are asked to consider how much information needs to be conveyed, how many drawings and details to show, how to reference one drawing to another, what scale should each drawing be drawn – basically how to communicate every unique condition and what drawings do are required to do this best? This is also tied into budgeting for the project fee and estimating project construction costs in order to make things as real as possible.

They are trying to make everything they present to students based on, as Ed Allen says, "need to know information". They set up the projects in order to make all the technical information seem relevant and necessary. They bring lab-based teaching in the studio and have "un-siloed" the building technology segments.

They do not teach structures, environmental systems, or construction methods in separate classes anymore. Each topic is presented together and the faculty move from class to class. A faculty member might teach conceptual structures in the morning one week to first year students. The next week they might be discussing concrete design details with fourth year students in the afternoon. This change of schedule is harder on the faculty, but ultimately better for the students, helping push technology integration into design studio as a primary concern.

FINAL POINT

The work of aligning curriculum with overall program goals requires constant refinement and active participation by faculty. Recent proposed changes to NAAB Conditions and NCARB's proposed curriculum suggest that faculty participation is critical at this moment in time if we are to continue to have any input in how future architects and designers are educated.

ENDNOTES

1. Edward Allen, "Some Comments Concrning Technical Teaching in Schools of Architecture", ACSA News, May 2005: 22-24.
2. NAAB Visiting Team: William Bevins, FAIA, John Folan, Susan Conger-Austin, Sheila Snider, FAIA, Grace Lounsbury, and Mary Hardin.
3. After our recent and very positive NAAB Accreditation visit we are again looking at our curriculum. A new faculty member is taking over the coordination of the technology sequence who hopes to "float" between various tech classes and be a bridge that links the technical themes of the tech classes to the design themes of the studios.