MIND THE GAP!
RAISING THE BAR: Re-integrating Design and Technology through Design Competitions

TERRI MEYER BOAKE
University of Waterloo

ABSTRACT

Much of the traditional course work done in Technology courses (building construction, environmental design and structures) is not the type of project based work that will eventually be included in a student's portfolio. One of the attractions of Design Studio is the production of creative work that will enhance a student's portfolio and eventually assist in finding a job. Although traditional technical project and assignment work may well be necessary in order for students to understand concepts, if the learning is to be meaningful and lasting, this knowledge must be able to be incorporated into their design work.

Architectural competitions with a technical focus provide a wonderful and relatively easy way to entice students into spending additional time learning how to incorporate technical knowledge into high level design. The added scope of the competition will normally also require the engagement of their digital learning, creating final projects that are much more highly developed than might traditionally be expected.

This paper will outline the way that design competitions have been incorporated into a range of core and elective technical courses, looking at the logistical problems and potentials that result.

KEYWORDS

Competitions, technological design, digital design, project based work

THE HISTORY OF THE GAP

For most of history, from the construction of Ancient Greek Temples to the Neoclassical buildings of the 1800s, architectural design was a unified process. During the Enlightenment, the well rounded "Renaissance Man" ceased to be able to simultaneously address the "art" side of Architecture with the more technical studies of stereotomy, mensuration and physics that were being developed. In the 1700s, building materials became more varied and construction methods more complex. The incorporation of iron, steel and concrete into construction increased design requirements well beyond the capabilities of the "Architect as Master Builder". The use of simple materials in tradition based construction gave way to composite assemblies and "wicked" problems. Historic techniques needed alteration as well as technological validation as potential building failures for larger structures needed to respond to "higher stakes". This accelerated increase in knowledge requirement led to the creation of two separate disciplines – that of the Architect and that of the Engineer. Educational strategies were subsequently divorced, creating a perceptible gap, and with rare exception, proceeded to educate the Architect in the Arts, and to rely on the Engineer to validate and calculate the structural implications of their designs.[1] Subsequently, the majority of courses in the area of structural design, mechanical and electrical systems, to this day, are mostly intended to give Architects enough information to speak intelligently to their consulting engineers, but not to undertake – certify and take liability for – the material itself. Architectural courses dealing with construction, envelope, environmental and

building science concerns, for which the Architect is likely to be responsible and therefore liable, typically sit on the technology side of the gap. This means that they are segregated from the sexier Design portion of the curriculum.

Without statistical references, I think it is safe to say that the majority of students who choose a career in Architecture are motivated by more so by their creative skills (interest in Art, English and History), and less by their desire to solve technical issues (referencing courses in Mathematics, Physics and Science). So the decoupling of the disciplines supports the general nature of students to study alongside their strengths, reinforcing or worse, widening the gap. The nature of technology teaching, also viewed empirically, would suggest that this also holds true for many teachers of technology. Emphasis in lectures and required course work more closely aligns with engineering and "numeric" concerns than a "Design" first and "solve the technical problems later" mentality.

It is easy to spend time laying blame for the gap, but this has not been productive in solving the problem. The history of lamentation by faculty teaching marginalized technical and environmental courses is long. The first ACSA Technology Conference in 1983, which coincided with the launch of Edward Allen's first edition of *Building Construction: Materials and Methods*, saw several hundred faculty members who taught structures, construction and ECS, gather to commiserate. Other groups, such as the Society for Building Science Educators[2], which formed in 1984, began to gather to address the need to share and alter teaching methods as a means to garner increased student interest in courses with environmental themes. The Building Technology Educators' Society formed in 2006 (more than 20 years later) for precisely the same reasons.[3] The fact remains that the majority of students who enter professional architectural degree programs do so because of an interest in Design, not Technology[4], making it difficult to garner interest in either increasing or integrating purely technical content into Design centric curricula.

If the divergence of architectural and engineering paths two centuries ago succeeded in decoupling technological material from the Design problem, creating contrasting pedagogical teaching practices, then one means to re-couple the material would be to examine continued successes in the teaching of Design, and incorporate this method into technology teaching. That is not to say that most technological subjects need be taught entirely in the Design Studio format – i.e. largely with the absence of extensive lecture content – just that design, being an iterative and integrative process, uses a repetitive methodology that succeeds in reinforcing its lessons, through project based learning that draws in the innate creativity of students. *Design is project based.* The types of projects that are normally given in Design Studio involve the design of complete buildings of varying size. The end product of the course work is normally a set of drawings and models, all of which can be incorporated into the student's portfolio and assist job applications. The same cannot be said of most of the course work done in technology courses.

Approaches to teaching technical courses may need to evolve from the traditional lecture format, to one which more closely approximates methods used in Design Studio in order to draw in the interest of both students as well as other faculty from within the academy. The type of course work given also needs to change to more closely approximate the nature of that given in Design Studio that has succeeded for many years in captivating students. *Technical project work can be portfolio worthy.*

THE POTENTIAL IN ARCHITECTURAL COMPETITIONS

For students to seriously undertake a significant technical design project that runs parallel to and may therefore act in competition to Design Studio, there needs to be a major incentive to put extra effort into the work. Using an actual design competition has proven to be a major success in getting students to spend the extra time required to create a highly developed *technically proficient* solution to a problem whose focus is clearly Design. Most student design competitions have the added lure of prize money and fame. In the case of such a major piece of work, this has been done in lieu of a final exam in the technical courses that I teach.

Logistics and Pragmatic Issues

Selecting the right competition is important as it is necessary to find one that reinforces the subject matter being evaluated. Student focused competitions are preferred as the organizers tend to create rules and guidelines that are targeted at students, are of limited scope, and that fit better with the academic year. Professional competitions may have requirements that preclude student entries if the outcome is to include the physical construction of the winning entry. It is necessary to check that student entries are permitted. Registration fees may be a disincentive for students. Where competitions are used as projects in my technical courses the students are given the option to enter (or not). The physical submission requirements must be met. This allows the financial situation of the student to factor into the equation. Where mounted boards must be printed and shipped, or where there is an entry fee, it may be unreasonable to demand that students enter as part of the technical course requirement.

Not all competitions will include a comprehensive set of requirements that reflect the values or aims of the course. It is possible to layer additional requirements on top of the given pro forma – and require students to make a separate additional submission for the course to evaluate specific aspects that fall outside of the competition brief.

Most project submissions in academic programs lack the same sense of rigor or reality associated with practice. Deadlines can be read as artificial, where late submissions may be penalized but will likely still be accepted. Failure to follow format guidelines will often be overlooked if the project is "good". Students can print as many panels, drawings or images as required for formal reviews, normally without strictly enforced format guidelines. Design competition rules, regulations and submission deadlines add reality to the exercise. If a submission is late, it will not be considered. If the number of boards, orientation,

size and format is not followed, the submission may be thrown out. The course instructor can simply adopt the competition requirements as part of the course requirements. This eliminates "negotiations" from the students to deviate from the "rules".

We have used a series of industry sponsored student design competitions as the terminal projects for our Building Construction, Digital Design and Environmental Design courses. The projects have been strategically sequenced to require a convergence of skills. The first mandatory competition final term project is situated at the end of their second Building Construction course. The students are also taking Digital Design the same term, studying Rhino, VRay, Photoshop and InDesign. The project is a co-requirement for the two courses. This ensures that there will be a high level of digital skill in the production of the construction project. It tends to make the digital project more challenging, but this in turn necessitates that students pay close attention to the lessons in the digital course. It is a "win win" situation in terms of raising the bar for the final submissions for both projects. In fact, the competition motivated project submissions for the two technical courses often exhibit a higher degree of resolution than for the parallel design studio work.

A smaller design project, not competition based, is required for the parallel environmental design course which I also teach. Digital submissions in a "two board format" are required. There is a spillover of quality into this project that arises from the introduction of the working methodology in the competition based parallel project that combines digital and construction knowledge and skills. A second competition based final project is included in their second environmental design course, the following academic term. In this instance the digital skills have already been established and the project is only evaluated for one course.

1A	1B	Off Term	2A
Building Construction 1	Building Construction 2		
	Environmental Design 1		Environmental Design 2
	Digital Design Basics		
Design Studio 1	Design Studio 2		Design Studio 3

Table 1: Competition based technical projects are indicated in yellow. Non competition design based technical projects are indicated in blue.

Competition Project as Final Exam

One of the difficulties in using competition based projects in a technical core course with limited contact and supervisory hours is the inability to replicate the studio model for the ongoing review of work. A single faculty member cannot possibly conduct timely desk reviews of the work. Often the Teaching Assistants are incapable of providing suitable help or consultation as they having limited experience in detailing and construction. Giving erroneous or misleading help is worse than providing no help. To pedagogically address this issue, the final projects are given in lieu of final exams. This is stated to explicitly convey to the students that basic questions of clarification will be answered, but that they are working independent of regular guidance from the course instructor or teaching assistants. They have full access to texts, manuals, the internet and even each other, to work through details, but in the end they are being graded on their ability to understand and interpret the course material and integrate it into a comprehensive, technically proficient project that also exhibits high design and presentation merit. A small number of the weaker students find this problematic, but this is not unexpected. The better students seem to enjoy the freedom this provides for them to explore a range of solutions and ideas. Feedback on the lack of guidance is positive as it sits in marked contrast to Design Studio where they must defend their ideas every step of the way, sometimes to the point of frustration. This "unguided final exam" format promotes the development of strong skills and independent thinking.

Where competitions are used in lieu of a final exam, they have typically been weighted at 40% to 50% of the final grade and the students are allowed to work in pairs to reflect the relative increase in the amount of work required as a result of this format. Students are permitted to work alone but no reduction of technical content is allowed. For some students it is understood that they prefer to work alone and can sometimes work more expediently if not negotiating the design and detailing. Although arguments can be made that students need to prepare for professional team situations, this is not always valid for educational exercises where evaluation must be certain that all students engaged in the project participated equally.

COMPETITIONS WITH A TECHNICAL EMPHASIS

Many student competitions are sponsored by industry in the hopes of raising student awareness of products and systems. Some also include "open categories" making them even more adaptable to the specific requirements of the course. If the instructor is not interested in spending the time inventing a program, the predetermined brief can provide a very good solution. The challenge lies in finding a competition that is small enough to suit the available time, yet detailed enough to provide a significant combined technical/design opportunity.

Structures/Construction Competitions

A number of competitions are available that focus on asking students to explore innovative solutions in steel, concrete and wood systems. Many of these are sponsored on an annual basis by ACSA. The availability of the competition is subject to the funding ability of the sponsor. The recent recession in the U.S. has seen the demise of several sponsored events.

The Steel Structures Education Foundation Competition[5] is a Canadian competition that is in its 10th year. It is based on the design of a smaller steel structure (pedestrian bridge, tower, cantilever, tension members) and has been easily handled by first year students upon completing two courses in building construction, one in digital design and two design studios. The limited scale and complexity of the competition allows students to focus on the development and detailing of a structural system that IS the design element of the project. In this way they are learning that the ability to understand and create innovative as well as functional details feeds directly into the quality of the design of the building. It has been used as a joint requirement with the computing course that has provided instruction in Rhino, (FormZ, formerly), VRay, Photoshop and InDesign. As a result the finished product has been more comprehensively designed than in previous years where projects were completed without either the incorporation

of digital skills or with the intention of submission to a national competition. The attraction of prize money is not lost on the students. Our students win on a regular basis. Faculty sponsor prizes are also appreciated!

The projects are submitted to two distinct courses with separate grading criteria. This is to avoid problems associated with double counting. The construction course examines the projects for excellence in innovation and detailing, looking only at the boards. The digital course additionally requires that students submit all of their raw files on a disk so that the instructor can assess form, format and methodology of the digital files.

The ACSA/AISC Competition not been used for this course as the scope and building type is typically beyond the capabilities of the first year

students and the time commitment also beyond the week that is dedicated to allowing the students uninterrupted time to complete the SSEF Competition. To allow the students the time to concentrate their efforts on this project the project is due on the last day of exams. The students are given 5 to 6 days clear of all other academic commitments prior to the submission. Although they may have started the project earlier in the term, this week allows them to concentrate on the work and seems to allow them to produce proficient and complete projects. Submission to SSEF follows a week later, allowing them time to tweak and deliver their work. The 2011 Competition saw our first year projects sweep the awards, beating out students in higher years from across Canada. This leads me to believe that this method is working.

Figure 1: SSEF 2011 Award of Merit for a Biomimicry Theme – final project for both building construction and digital design. Jeremy Jeong and Sheelah Tolton.

Figure 2: SSEF 2008 Award of Excellence for a Cantilever Theme – final project for both building construction and digital design. Matin Moghaddam and Mathew Winter.

Ecological Competitions

Where the SSEF Competition has been running consistently for 10 years, providing a dependable opportunity for a final project, ecological competitions to support work in the Environmental Design course have been less reliable. In 2003 the Architectural Review sponsored a competition titled "A Writer's Retreat"[6]. This was adapted for the course to require that the retreat respond to ecological criteria in addition to the general requirements of the competition. At this point very few students actually entered the competition, given the costs of shipping boards to the UK and issues with timing. This competition was discontinued and for two years was simply used as a model for the final project. Minimum LEED[TM] Platinum requirements were added to the base project,

resulting in a more rigorous and better detailed set of projects.

In 2002 the TIA "Ecohouse Competition"[7] was launched, sponsored in later years by the Concrete Association in the UK. This increased the scale of the dwelling required from a one or two person dwelling to one that could accommodate a family of six. This proved not to be a large issue for the students and the scale and amount of drawings required remained about the same as for the Retreat. Several students from the second year core course entered the competition. Senior students enrolled in the Competition Elective also submitted (see below) placing on two occasions.

The Ecohouse Competition ran for several years but was discontinued as a result of the severe

recession in the UK. Again the Ecohouse brief continued to be used in the course as a basis for the project work, with the LEED[TM] Platinum requirements as an added requirement. The later iterations of the Ecohouse were useful in bringing mandatory Carbon Neutral requirements to the brief, resulting in more highly detailed student projects. The project submission requirements still included the formality of "boards" and digital drawing to keep the bar raised, but the quality of the work declined somewhat as students resorted to using SketchUp to speed up the digital work, recognizing that these were not "real" competition submissions.
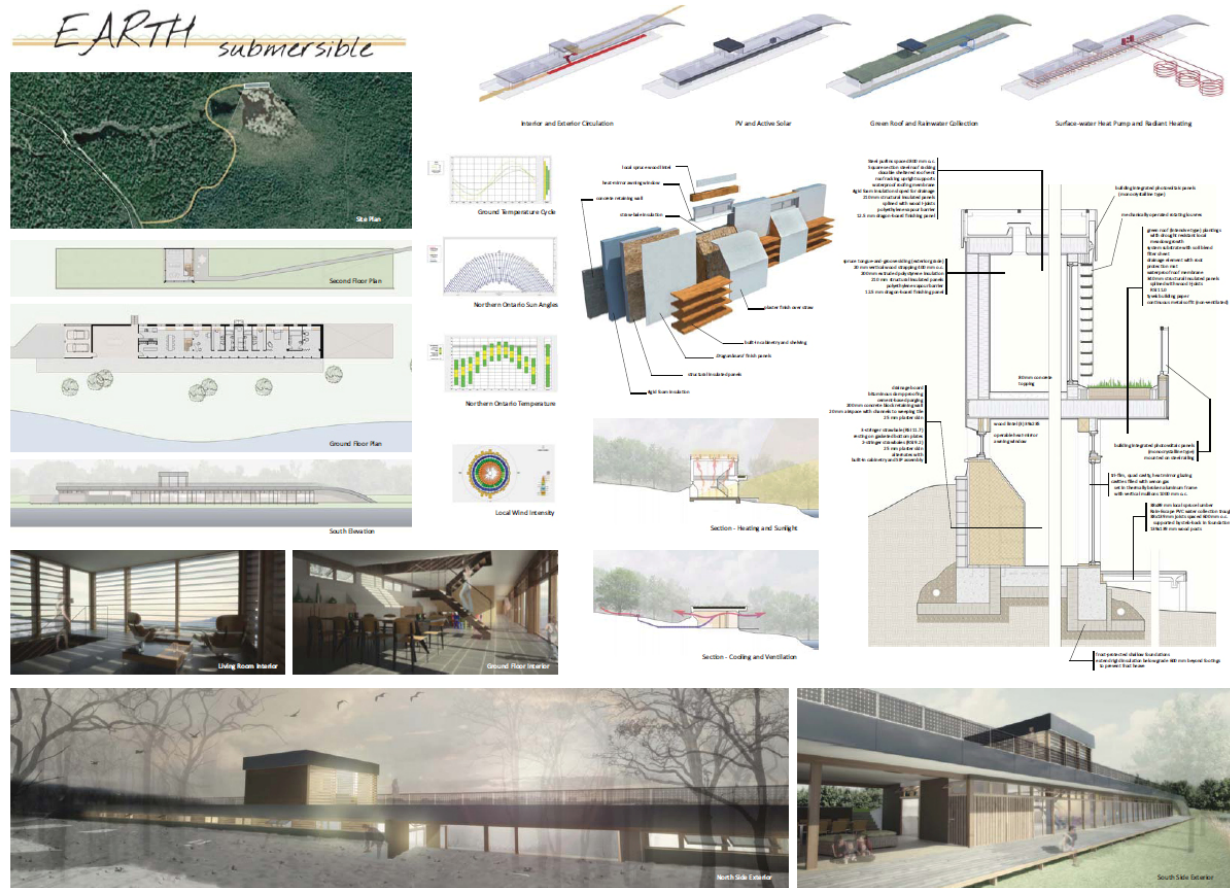

Figure 3: Home Sweet Home Competition Finalist – Samuel Ganton and Haley Zhou

In fall 2010 Toronto Green Specifiers announced the "Home Sweet Home Competition"[8]. The organization offered parallel competitions for practitioners and students. The student focused brief looked for an ecologically designed dwelling to house Brad Pitt and Angelina Jolie and their 6 children in a Northern Ontario rural location. Where previous ecological house competitions had left the location quite open, allowing students to select the site and climate zone, the Home Sweet Home brief had selected a very specific location. While this may have provided the competition organizers more control and potentially an easier time judging the work, the site was not terribly easy for the students to work with as the goal of a self sufficient dwelling was difficult given less than optimal solar circumstances and cold growing conditions for edible planting. Where the SSEF Competition will

see 75% of the student projects submitted for evaluation, the Home Sweet Home Competition only realized around 15%. The competition had a $50 entry fee and a submission deadline that fell 3 months after the end of the academic term in which the project was produced. A significant written component was required that explained the environmental choices in the building.

Even with only 6 pairs of students entering the competition, the work was of high enough quality to result in 4 projects making the top 10 – final judging took place on April 12, 2011. Feedback from the students whose project was selected as a finalist indicated that all groups had chosen to modify or make major revisions to their course project in order to improve the project for competition submission. This group of students was engaged in their first coop work term at the time of reworking submissions and reported asking for assistance and advice from architects in their respective offices to improve the projects.

The final results of the Home Sweet Home Competition were extremely disappointing. The judges and judging criteria were not particularly clear and architectural merit seemed quite low in importance. The winning schemes were done by teams from technical and engineering schools and in the opinion of architects present at the judging, were not good choices to use to convince the public of the potential for sustainable housing. This left a sour taste with the student finalist teams and has been chalked up to a "live and learn" lesson. This is to highlight the importance of selecting the right competition and ensuring that Design is held as an important criteria in judging.

THE COMPETITION ELECTIVE

Ten years ago our school suffered a significant budget cut and as a result, we had to sever numerous adjunct positions. The adjunct faculty had been offering a number of popular electives which were suddenly not available. The Competition Elective was designed on the same principle as the competition element as final project for the core courses, and was created as an independent study elective that would require minimal time commitment in addition to my already full core teaching load. Up to that point our school had very few students entering events such as the ACSA Student Competitions. They

were not adopted by the studio faculty and students had no free time to undertake the work during an academic term. The elective has been very popular as a for credit course, although the numbers enrolled vary from term to term and year to year as a function of the nature of the competition opportunities offered.

The Competition Elective has a two part submission requirement. The student is responsible to complete the actual competition according to the submission requirements for the competition. This varies as a function of the competition and therefore requires additional monitoring and accommodation of the student as they meet these external deadlines that may not correspond well with the academic calendar. If the student fails to enter the competition, no credit is awarded. The student must also complete a research essay in response to this quotation.

> "The works of the past always influence us, whether or not we care to admit it, or to structure an understanding of how that influence occurs. The past is not just that which we know, it is that which we use, in a variety of ways, in the making of new work…. The typology argument today asserts that despite the diversity of our culture there are still roots of this kind which allow us to speak of the idea of a library, a museum, a city hall or a house. The continuity of these ideas of type, such as they are, and the esteemed examples which have established their identity and assured their continued cultural resonance, constitute an established line of inquiry in which new work may be effectively grounded."
> The Harvard Architectural Review. Volume 5. Precedent and Invention. Between History and Tradition: Notes Toward a Theory of Precedent. John E. Hancock.

The study of precedents demands that the students make a formal accounting of the typologies, ideas, forms, technologies, buildings and architects that they have used as the basis of their design. This simultaneously forces them to acknowledge the influences on the design, construct a reasonable research paper, and provides a means for evaluating the project given that no formal presentation is made. Recent

feedback from the students during our 2011 Curriculum Review indicates that many choose not to take the elective because they do not wish to write the essay.

The elective is offered at both undergraduate (third year minimum) and graduate levels, with slightly different requirements. For the undergraduate submission the project is valued at 75% of the grade and the 1,500 word research paper at 25%. For the graduate students the research paper requirement is increased to 5,000 words and the project and paper are weighted equally. Group work or paired work is permitted as a function of the scale of the project. Individual research papers are always required.
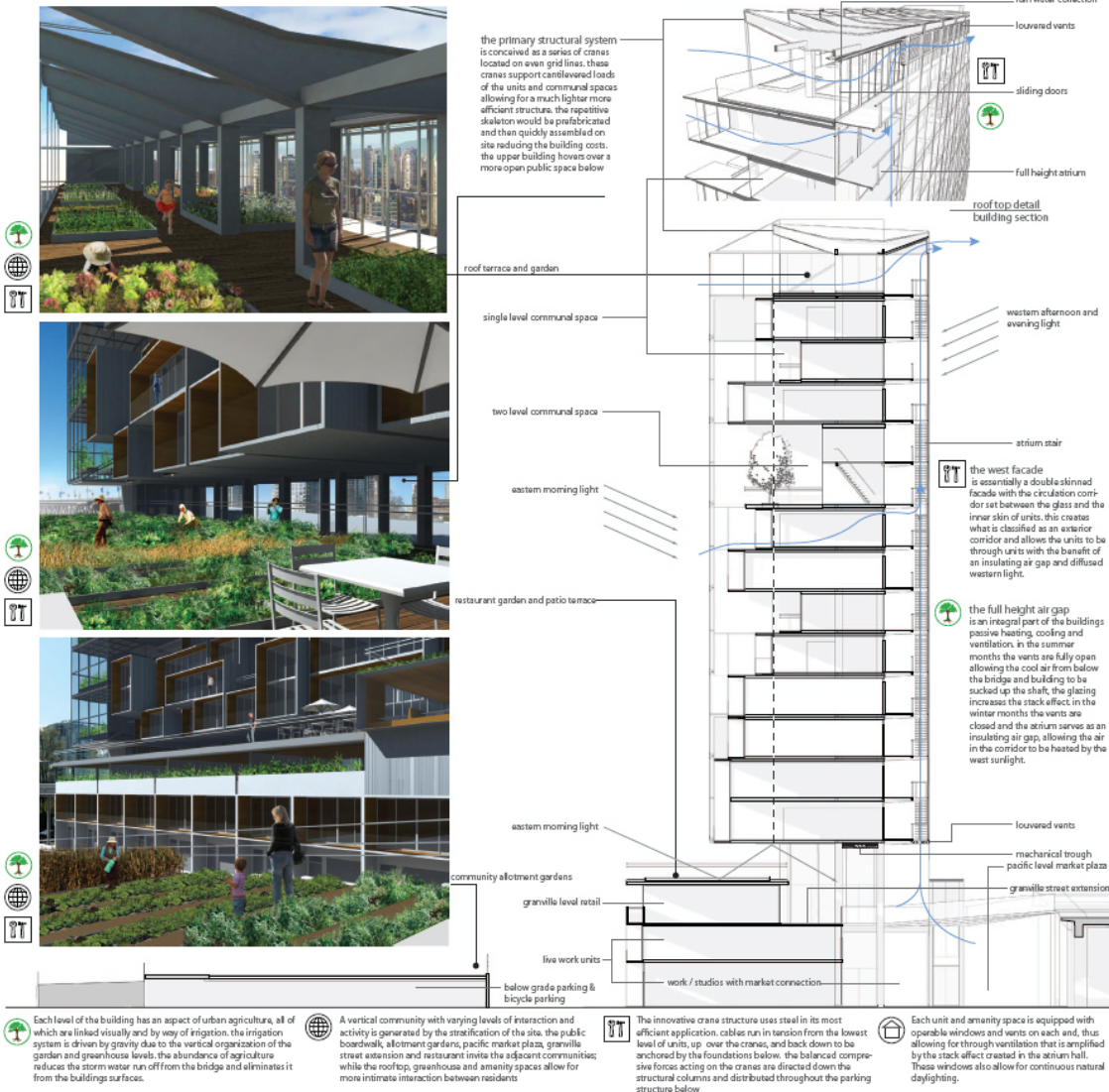

Figure 4: Second Place Prize for the ACSA/AISC Assembling Housing Competition – David Schellingerhoudt and Linday Nette

This half credit elective offers students the opportunity to engage in larger scale competitions than can be accommodated in the junior level technology courses. As the course relies on maturity and independent work, undergraduate students must satisfy performance requirements in design and digital courses in order to be approved to take the course. Minimum grades in both Design Studio and Digital Design must be met. Initially such requirements did not exist and it was found that less competent students would fail to complete the competition (resulting in academic problems) or submit embarrassingly substandard work. As competitions are useful to showcase the work of your academic institution, it was preferred to have the best work showcased. From a personal perspective, this course is given by me on top of an already full teaching and administrative load, so this is also an effective way to limit enrolment and associated issues.
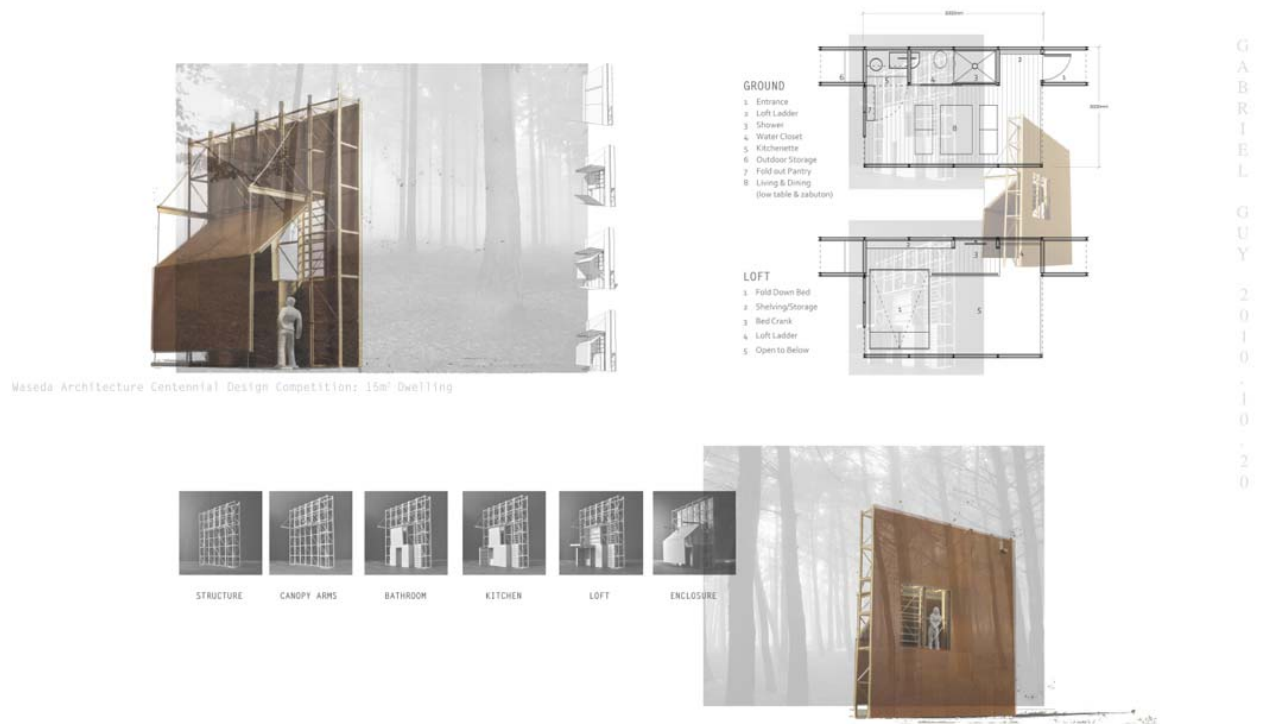
Figure 5: Second Place for the 2010 Waseda Architecture Centennial Design Competition – Super Mini House - Gabriel Guy, graduate level elective

Course lectures can also be tailored to support unusual competition opportunities as they arise. This past fall a competition was announced for the re-cladding of an existing 1970's downtown tower in an adjacent city. The competition was limited to student entries from three local Schools of Architecture. As the building was situated on a constrained urban site, it seemed likely that the re-cladding could take the form of an innovative double skin façade. As this topic was to be addressed in the environmental course underway at the time, but not in time to support work for the competition deadline, the lecture module was moved up and expanded to provide additional information and ideas for the students.

Figure 5: 80 Bloor Street West Competition, Second Place Prize. Preliminary First Stage Board. Aidan Mitchelmore and Dennis Tang.

Several students undertook the competition. A pair of students that entered the competition, in addition to their normal academic load, and not for credit, placed second. The competition was organized in two stages and during the shortlist period the students worked with cost consultants and engineers to look at the viability of the proposal as the client was intending to construct the solution. Had this not been a "competition" it is highly unlikely that the students would have taken on the additional work. Their feedback regarding the educational benefit of the second stage research and time spent with consultants was highly positive.

CONCLUSION

The bottom line is that it does not take much investigation to find a competition that can easily be adapted for use as a terminal technical/design project and which also leverages the interest and experience of the students. For environmentally based courses, the awareness of global warming has greatly increased the number of competitions comprehensively addressing this theme.

In addition to the lure of prize money, most of the competition winners are published, both on the Internet and in print. The students are very keen to be able to add these projects and citations to their portfolios – representing some of the only technology based work that does get included in their official "design" portfolio.

One of the problems that is difficult to overcome when incorporating competitions into technical courses, devoid of the usual feedback and presentation structure associated with Design Studio, is the lack of exposure or public sharing of work that happens during reviews. Work that is done on computer is not even easy to view while passing by a classmate's desk. Often students

choose to work at home, making the projects even more private. To allow students the opportunity to see the work of the class, I have been posting their projects on Facebook and also on the School web site. This permits fairly easy viewing of the work by the class. It also allows subsequent classes to view the entire suite of projects created by previous classes, and tends to raise the bar once again. Blog posts would also work, and allow for comments and feedback.

Using National and International competitions as the vehicle for the terminal technical project in a course sends a clear message to students that Technology IS Design. If approached comprehensively, these projects can serve as good preparation for the Comprehensive Building Design Studio. Competitions can allow courses like Digital Design, Building Construction, Structural Design and Environmental Design to converge, thereby assisting in closing the gap between Design and Technology.

Future Considerations

Although the independent work model has worked well to manage the teaching and grading load associated with high enrolment core courses, it has always seemed a shame and perhaps a missed opportunity to have been unable to provide a high level of constructive and instructive feedback during the design process. Competitions offer the possibility of winning, and providing the students with critical feedback after the fact is only somewhat useful. For this reason a course is in development that will be offered to senior level undergraduate students as an elective that will focus on Architecturally Exposed Steel Design. The course will include an abbreviated support series of lectures and a seminar model to discuss the design and detailing of the projects as they are being developed. It will use the SSEF competition as a "warm up" project, focussing on the larger AISC Competition for the final term project.

NOTES

[1] This is covered in great detail in "Architecture and the Crisis of Modern Science" by Alberto Perez-Gomez (MIT Press, 1985) as well as the "The Beaux Arts and 19th Century French Architecture" by Robin Middleton (MIT Press 1982). The shift to pragmatism is also evident in the "Precis de Lecons" by Jean-Nicholas-Louis Durand (1813).

[2] SBSE Web site. http://www.sbse.org

[3] BTES Web site. http://www.btesonline.org

[4] Corcoran, Erin. Masters Thesis. Architecture: Developing a Self Aware Profession for a More Balanced Future. April 2008.

[5] SSEF Competition Web site: http://www.ssef.ca/competitions/ssef/

[6] A Writer's Retreat Competition: http://www.comarchitect.org/award_student_2003.htm

[7] Ecohouse Competition Web site: http://www.concretecentre.com/main.asp?page=1740

[8] Home Sweet Home Competition Web site: http://www.hsh-competition.ca/?page_id=98