Bridging the Gap: Reviving Pedagogical Discourse in Architectural Technology Education

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"…we graduate generation after generation of students who are not broadly competent, and whose design work suffers from a lack of understanding of the technical means by which we build….Why does this happen? The simple answer is because of "The Gap."…that huge bottomless gulf that separates the design studios from the technical courses in most schools of architecture."[1]

Edward Allen

Background

For many years now, an undercurrent of dialog has been ongoing regarding the separation (and it could be argued, polarization) in most schools of architecture between the "core" design studios and the "supplementary" lecture classes in technology. A discussion of the relative ineffectiveness in students' abilities to apply understanding from their technical coursework in their design work, and a proposed curricular model to overcome the limitations of this division was proposed in a JAE article nearly twenty years ago (Gelernter 1988). Almost ten years later in 1996, a group of architectural structures educators convened for a two and one half day meeting at the University of Wisconsin at Milwaukee. In response to the desire to infuse structural technology classes with new pedagogic approaches, the theme of this meeting was on sharing creative ways to teach structures. Largely spearheaded by the efforts of Edward Allen, FAIA (recipient of the 2005 AIA/ACSA Topaz Medallion for Excellence in Architectural Education), with strong support from then ACSA president Linda Sanders, herself a structures educator, the gathering was by all accounts a great success and generated much enthusiasm among its some 60 participants. A number of advances in teaching technology in architectural education were shared, some finding their way into published works; however, overall no great "sea change" in the pedagogy of teaching technology occurred. At the conclusion of the meeting an impromptu discussion was held to consider future such meetings and the possible formation of a permanent organization. But this never materialized and in time the event itself faded into collective memory; in most schools the traditional curricular model remains the accepted norm.

Though the gap between technology classes and studio largely still exists, the desire among a growing number of educators to find ways of at least bridging, if not altogether closing it, has not abated. This paper describes recent efforts of the co-authors to rekindle a dialog long smoldering, and hopefully bring it back into flame. Though the issue itself has not changed, the acceleration of new developments in innovative material and digital technologies and concerns in the profession with integrated practice threaten to widen—not close—the gap if we do not begin to take action soon.

The Building Technology Educators' Symposium

Our efforts began several years ago when we individually and independently learned of the Milwaukee conference. Being technology edu-

cators ourselves (structures, materials, and construction) and passionately dedicated to a calling of teaching, it seemed an exciting event and we wondered why this had not happened since. The need for a repeat gathering clearly seemed overdue in our own minds, and casual conversations with other technology educators gave weight to the feeling of a similar pent-up desire among our peers. By happy coincidence of shared interest and timing, upon learning of what had begun as each other's independent efforts at different universities we joined forces to organize what became the Building Technology Educators' Symposium (BTES). The BTES brought together nearly 70 faculty who teach in the areas of structures, materials, and construction in architecture. The focus of the meeting centered on issues of pedagogy in architectural technology and a theme of sharing among each other the best of our teaching practices. The subtitle of the event was "A gathering of architectural educators, passionate about teaching and technology."

"The Building Technology Educators' Symposium was the densest concentration of relevant, thoughtful presentations about pedagogy that I have ever experienced."

Patrick Rand
North Carolina State University

The BTES was held in August 2006 at the University of Maryland School of Architecture, Planning and Preservation. By all accounts and well beyond our wildest expectations, it was a resounding success. Immediately following the event we began to learn of ways in which many of the attendees had been inspired to initiate curricular changes or adapt teaching projects they would have not otherwise considered prior to the event. And we were committed to carrying this into the future. At the end of the symposium we intentionally scheduled a meeting to discuss the possible formation of a permanent organization…we did not want to let it fall to chance or be forgotten again this time.

A great success in its own right, the organizational meeting quickly led to a focused effort to define exactly what the purpose and mission of the new organization, now named the Building Technology Educators' Society, would be. An organizing committee was formed, and as of the time of writing this paper, two meetings have been held with a third soon to occur. A website at www.arch.umd.edu/btes has been established that provides links to the symposium proceedings and audio recordings of the session presentations, and a listserv has also been created for general use in the exchange of ideas and for maintaining connections between faculty. It is indeed exciting to be a part of the formation of a new association of like-minded educators, one dedicated to pedagogic concerns as a core value.

This paper thus chronicles the rational of why, with many other well-established architectural organizations including ACSA, the Society for Building Science Educators' (SBSE), ACADIA, AIA and others too numerous to list, is yet *another* organization necessary, and how such an organization will ultimately benefit not just the relatively small number of architectural technology educators, but programs of architecture overall as well as, ultimately, the profession of architecture. One could easily conclude, for example, that the technology focus sessions at the annual ACSA meeting should serve this function. Even in years past, however, when there was a separately conducted annual ACSA Technology Conference, the focus was not primarily on pedagogic issues. It will be shown that the new organization is much needed, filling a critical gap in the discourse of architectural education.

First, a Definition

In this discussion, frequent reference will be made to the phrase "Architectural Technology" or "Architectural Technology Education." We wish to be clear that this references the specifics of the technology of actual built construction, the bricks and mortar, concrete, steel and stone of construction, and not to the design *means* to that end. Traditionally these are the courses most frequently referred to as "Materials and Methods of Construction" or "Building Technology" and "Structures." Clearly we live in an era when computer technology is beginning to revolutionize the processes of design and construction, and there is necessarily an overlap between this and the physical manifestation of the creative act. Our intention in the BTES however is, first, to explore building technology as we have defined it and, second, how other areas of technology and design relate to the physical act of making and building architecture.

The Need for Connections and Mentoring

The dialog of technology pedagogy tends to rise and fall. The November 1997 issue of the JAE, for instance, was almost wholly devoted to the subject, and featured a half-dozen thought-provoking articles. But this has remained far more the exception than the rule. A cursory review of the JAE editions published in the nine years since reveals that there has not been a repeat of such a concentrated collection of outstanding writings.

It follows, then that technology teachers in architecture schools tend to be a scattered group with scarce resources to inform them of effective teaching practices beyond the traditional norms. Even for programs that actually have in-house faculty (as opposed to hiring structural engineers, professionals, or contractors in adjunct positions, or "farming out" the courses to related civil engineering programs), there are frequently only one or two members actually dedicated to technology teaching. The effects of this isolation are numerous. The aforementioned "gap" frequently leads to isolation of technology faculty from the design faculty, and a resulting perception of technology education being somehow "different" and distinct, and often of lesser importance, than design education. Technology faculty thus suffer from a lack of peer connection both within their own institutions and with colleagues at other schools. When connections do occur, they are primarily related to research initiatives, not with regard to pedagogic concerns. There has been no national venue for these connections to occur in a structured manner, and as shown the extant literature is thin.

In his acceptance speech for the Topaz Medallion in 2005, Edward Allen enumerated how the current generally accepted curricular structure and—importantly—content within that structure more often than not leads to students who tragically both lose their interest in the material and cannot effectively apply it to their designs.[2] In his keynote address at the BTES, he built on this theme by stressing that the finding the correct form for buildings is ultimately the essence of building technology, not the calculations of beam sizes or duct runs or room cavity ratios.

Though current curricular models have existed for decades, it is a little discussed truism that we actually have considerable latitude for how technology is taught in an architectural curriculum even within those models. For example, for accredited schools, the most stringent guideline for teaching of structures comes in the form of Criterion eighteen of the National Architectural Accreditation Board, entitled *Structural Systems.* In one succinct paragraph, this criterion reads "*Understanding of* principles of structural behavior in withstanding gravity and lateral forces and the evolution, range, and appropriate application of contemporary structural systems." This actually leaves wide latitude for implementation, with pedagogic approaches including coursework integrated into studio, innovative hands-on approaches, and applications using modern computer technology among others.

Fig. 1. The "Great Space" was a general gathering area during breaks between sessions and for meals.

Recent discrete surveys by Christine Theodoropoulos and David Thaddeus concerning architecture education have revealed that one of the primary reasons for absent technical information in curricula is due to the lack of teaching resources available to new faculty for instruction.[3] Young faculty in their early years of instruction are thirsty for material to teach technology courses and because of the considerable latitude offered in constructing a curriculum in technology, many are at a loss for how to effectively construct coursework.

The authors of this paper attribute that much of their limited success in teaching has been a result of reading articles on pedagogy, gleaning information from mentors at conferences through discussions at breaks, and simply word of mouth. A network of individuals teaching in the same area connects a web of teaching ideas that are effective, up to date,

and timely for our constant changing nature of the architecture profession. The BTES fulfilled this function and brought together attendees from international locations including Hong Kong, India and Israel. It offered a networking dynamic that cannot be found to the extent to which it is found in other venues. Among the features we implemented at the BTES was a "gift exchange," whereby materials such course syllabi, classroom exercises, CD-ROM image banks were made available from each of the participants to share with one another on the walls of the "great space" in the architecture building. *(Fig. 1)*

"Without the Symposium, I never would have met Dana Gulling from the Savannah College of Art and Design, Vincent Hui from the University of Waterloo, or Ulrich Dangle from the University of Texas at Austin, not because we had nothing in common, but we have no common research interests. These people, (as well as sixty others) rocked my world! The exchange of ideas was intense starting with the opening keynote address by ed Allen and it hasn't stopped yet."

Patrick Tripeny
University of Utah

Fig. 2. Kirk Martini of the University of Virginia demonstrates "Arcade" in an hands-on workshop

Teaching Technology is Teaching Design

The historic conventional view of courses in technology places them in the context of a lecture hall, separated from design studio experience. But a surprising number of symposium presenters spoke of how they incorporated design ideas into what traditionally would be thought of as courses focusing purely on technology content, even if not conducted in a studio format. This notion had been introduced by Ed Allen nearly a decade ago[4], and is slowly beginning to be seen in various programs.

Recognition of our educational mission in the context of an architectural program is also recognition of the basic difference in the needs of students taking course work in materials, structures and construction classes versus their peers in comparable engineering programs. Put one way, students of architecture need more to learn *how engineers think* than to *think like engineers*. Similarly, students of architecture need more to learn how material engineers, manufacturers, fabricators and builders think than to think like a specialist. This kind of empathetic thinking has dramatic implications for form and quality of making buildings beyond performing rote tasks with the mind of an engineer or contractor. It empowers students of architecture to capitalize upon the potential of structures and construction thinking in the process of design. In fact much conceptual framework for a project might center around the idea of the act of building rather than on a theoretical notion of a divergent topic. Too many times architecture is developed by looking outside our discipline as if the field of architecture itself is not interesting enough to sustain our interest, develop conceptual ideas and finally architectonic form. As we begin to see the pedagogy of architectural technology in structures and construction *as design in its own right*, not merely a set of numeric calculations, architectural design in schools becomes much richer, layered, physical—in short, real, and students will be better prepared to becomes leaders in the art of building in practice.

The range of topics that were included in the BTES were broad, and encompassed structures and construction technology theory, technology pedagogical models, technology integrated curricular models, technology teaching tools, design-build education, building enclosures, technology education, and the current hot-button topic everywhere in our industry, Building Information Modeling (BIM). Several participants illustrated new computer-based teaching tools they had been developing in recent years. *(Fig. 2)*

Fig. 3. “Troubled Bridge Over Water.” Vincent Hui’s inventive adaptation of Patrick Trippeny’s cardboard bridge testing.

Among all of these topics a theme continued to emerge, that of *design based learning for technology*. For example, Ulrich Dangel’s presentation on design based process for teaching building enclosure illustrated how students are encouraged to consider utilizing a diagramming method to establish design responses to varied climatic conditions, and diagram envelope assembly schematics that meet the desired climatic condition. Instead of waiting around to have the studio—a generally accepted place of synthesis in the architectural curriculum—adapt technical issues, this gathering enlightened technology educators to incorporate design based learning directly in to the courses themselves through hands-on learning, case study methods, and laboratory group experiments in making.

Many presentations talked about hands-on making exercises to learn building technology information. This connects it to design as an iterative making process.

Hands-on work in technology courses offers the opportunity to engage with materials, construction and structure in a real way that builds instincts and intuition about the nature of buildings. Students develop this subconsciously and are able to recall these principles during the process of design. Learning from matter or material, although not as strong as at childhood, presents the fundamental learning of humans throughout their existence, not to mention with especial regards to creative thinkers and makers such as designers. Providing material making heuristic experiences for young architects during their beginning, ofttimes formidable, years in design based technology courses helps to forge the basis for the knowledge in making, building, and creating intelligent architecture in the design studio an on into practice. The symposium has already helped to stimulate participants with new project ideas, changes that may not have otherwise occurred. *(e.g., Fig. 3)*

“I found the BTES conference quite inspirational, and left with a greater interest in developing more "hands-on" class projects. One recent example was just completed in my "Building Technology, Materials & Methods" class: a one-hour workshop in which the class of about 60 students built a 2-story wood-frame house (suitably reduced in scale).”

Jonathan Ochshorn
Cornell University

Changing Practice

As change continues forward with innovative materials and information modeling practices for design and construction the role of the architect is in constant flux, one that is difficult enough for practitioners to understand, much less for faculty of architecture. As we will never be able to keep up with the constant change in innovation of materials and construction, educators in the academy must determine to provide primarily to students a set of core technical competencies, an understanding of basic and unchanging principles, the development of critical thinking skills that will sustain them throughout an entire lifetime, and aid in building intuition that works to give meaning and purpose to technology in architecture.

Building Information Modeling has continued the discussion of the computer’s role in design-

ing and building. New materials and applications of construction provide for more efficient structures, more durable, performance based building systems, and more environmentally sensitive and responsive architecture. Simulation and performance modeling in structures and construction technology will continue to pervade the profession and therefore the role of the educator in technology becomes important in establishing a critical pedagogy. Keynote address by Joseph Burns of Thorton Thomasetti Structural Engineers (Chicago, Illinois office) focused on the advances in digital practice of design and construction and the ever present need for educators to be critically aware of the changes that are ensuing in practice and evaluate their effects on architectural education. As a result of the presentation, discussions ensued regarding our role as educators in technology teaching and preparation for the constantly changing climate of contemporary architectural practice.

Study of Pedagogy is Still Scholarship

It is a perennial concern that *design education* within traditional university settings is not considered equal in status to pure research. We further stipulate that this study of the pedagogy of architectural technology is in fact the scholarship of teaching and should be valued as such. In the seminal *Scholarship Reconsidered: Priorities of the Professorate*, Earnest Boyer argued for the need to consider the scholarship of teaching as equal in status to pure research.

We conclude that for America's colleges and universities to remain vital a new vision of scholarship is required. …We proceed with the conviction that if the nation's higher learning institutions are to meet today's urgent academic and social mandates, their missions must be carefully redefined and the meaning of scholarship creatively reconsidered. (Boyer 1990, 13)

…today, teaching is often viewed as a routine function, tacked on, something almost anyone can do. When defined as scholarship, however, teaching both educates and entices futures scholars. Indeed, as Aristotile said, "Teaching is the highest form of understanding." (Boyer 1990, 23)

Fig. 4. Proceedings of the 2006 Building Technology Educators' Symposium.

The BTES may provide a vehicle to facilitate this promotion. Rather than one single issue of the JAE in nine years devoted to the issue of architectural technology pedagogy, the proceedings from annual or biannual meetings of the BTES *(Fig. 4)* may become a compendium and reference manual for those who seek to learn new pedagogic practices and promote their development. As disparate individuals in programs scattered across the country, our voices are more often than not lost to the wind. Collectively though, and with one voice, we may become agents for change in the larger scope.

"The BTES conference reinforced my belief that we need to address students with respect and intelligence. We are not so much gifting students with wisdom, as much as we are drawing it out of them. From the perspective of their raw vision, they are able to intuit great creativity and accomplishments. The diversity of life experience that students bring with them allow for us as educators to tap into new paths of thought, to invent new ways of doing, to experiment, to challenge, and most importantly to have fun along the way."

Fredrick H. Zal
Atelier Z, Portland, Oregon

Genesis of an Organization

Since the time of the symposium, the organizing committee has been at work on defining what exactly the new organization should take. It is likely we will be pursuing incorporation as a 501(c)(3) non-profit organization. Still in its nascent stages of development, the organizing committee of the Building Technology Educators' Society has been diligently working on drafting our vision and mission statement, pursuing the requisite legal steps for incorporation as a 501(c)(3) non-profit organization, developing our constitution and bylaws, and establishing policies on publication rights and procedures. A graphic for the society has been adopted *(Fig. 5)*

Although still in draft form as of this writing, the mission statement is close enough to ratification by the Organizing Committee to present herein. This draft mission statement reads:

The Building Technology Educators' Society (BTES) is an organization of architectural educators, passionate about teaching the technology of building design and construction. The BTES seeks to promote and publish the best pedagogic practices that facilitate student learning and enhance the status of our disciplines in the profession at large. This we do by:

- sharing the best teaching practices in architectural technology
- promoting critical discourse on issues related to pedagogic theory in architectural technology, with peer-reviewed publications of its work for public dissemination
- promoting the scholarship of teaching and pedagogic theory
- enhancing the mentoring process among faculty, students and practitioners, for the enrichment of all involved and for the preservation and propagation of accumulated experience and wisdom.
- stressing the issues concerning technology in architectural curricula and helping to influence change when necessary in the related accreditation process.
- fostering the continued betterment of the profession at large
- serving as a point of contact, in particular for the discussion of issues related to building technology, with the design professions and building industry at large,
- bringing issues of concern to our affiliated entities at large in the Academy, profession, industry and associated regulatory agencies and
- facilitating connections among like-minded individuals for collaborative research.

So it is with much enthusiasm and excitement that we enter in the next phase of our endeavors with the development of the new, *permanent,* organization. We live in a time of an ever-increasing pace of change affecting both the profession and academy. New design approaches and computer technologies such as BIM, though far from realization of their potential, are nonetheless coming with an inevitability. Shall we direct this change or will we be directed by the pressures of commerce? Though long in coming, the time has never been more pertinent. The BTES has the potential to reinvigorate the discourse on pedagogy in architectural technology. We welcome and encourage *all* those keenly interested in promoting the pedagogy of architectural technology to join with us in the Building Technology Educators' Society and help to bridge the gap so long existing.

Fig. 5. Logo of the Building Technology Educators' Society.

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Endnotes

[1] Edward Allen, “The Essence of Building Technology,” Keynote Address from the *Proceedings of the 2006 Building Technology Educators’ Symposium.* (August 2006)

[2] Edward Allen, “Some comments concerning Technical Teaching in Schools of Architecture,” ACSA News. (May 2005)

[3] AISC Survey of NAAB programs, David Thaddeus 2005 & NSF Seismic Survey of Architecture Programs, Christine Theodoropooulos & Ryan Smith 2005. Both surveys indicate that nearly half of technology instructors in NAAB programs are in their first five years of teaching and are therefore most in need of teaching materials.

[4] Edward Allen. "Second Studio: A Model for Technical Teaching," *Journal of Architectural Education*, Vol. 51 No. 2 (November 1997): 92.

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