Digital Technology and its Effect on Pedagogy in Architectural Engineering Technology

James E. Fuller, AIA
Ward College of Technology
University of Hartford
West Hartford, Connecticut

Abstract

Digital technology is rapidly changing the way teachers teach throughout academia. This is especially true in Architectural Engineering Technology. The effect of technology on teaching falls into three areas:

- **Curriculum Supplement** - How traditional subjects and methods are effected by technology
  - ways to better illustrate traditional subjects using technology
  - ways of expanding relationships of subject areas by using technology;
- **Curriculum Enhancement** - How technology provides new ways of teaching and learning
  - transforming traditional topics and methods into electronic media and using the new medium to take the subject matter beyond that which could have been shown previously;
- **Curriculum Specific to Technology** - New curriculum developed due to technology
  - teaching courses or parts of courses that are necessary because of technology such as hardware and software issues

With these effects in mind, what are the ramifications? What extended effects do these introduce? What are the influences that need to be evaluated and considered to effectively prepare ourselves to teach with these in mind? Where are our students in this?
The Technology Influence

Let’s look at each of the technology-influences more closely to see what topics in the curriculum, in particular, they influence.

**Curriculum Supplement**: Technology has already had a significant impact in this area. Technology supplements current and traditional curriculum in such technical subjects as statics, structural design, contract documents (working drawings) and mechanical systems. Its enhancements revolve around the application of programs to re-present information in new ways. For example:

- **Statics and structural design**: use of spreadsheets to perform calculations of static structures; using spreadsheets for selecting beam sizes and reinforcement in concrete beams;
- **Contract documents** use of spreadsheets for door, window, finish, equipment schedules; word processing for specifications; the use of CAD to produce construction documents; use of scheduling software to produce project staffing schedules and construction schedules;
- **Mechanical systems** use of spreadsheets for sizing piping and ducts; spreadsheets for performing heat loss calculations

In all of these examples, the technology is used to supplement the teaching and learning of information that, prior to technology, was done using manual techniques. The technology is improving the delivery process but is not extending the knowledge base nor changing the pedagogy. It is helping, but not enhancing.

**Curriculum Enhancement**: Here, technology provides new ways of illustrating current curriculum and takes the curriculum further in the process. The technical subjects are very much the same – statics, structural design, contract documents (working drawings) and mechanical systems. In this case, however, the re-presentation of information is also reformatted and enhanced. Examples include:

- **Statics and structural design**: The use of simulation programs to graphically show the effect of structural loading on members; testing of materials and model structures in a virtual model base; multi-media documents to illustrate, in text, numbers and graphics, structural principals and practices;
- **Contract documents**: The use of CAD to produce construction documents that link to a project data base for estimating materials and construction; linking drawings to
spreadsheets for schedules; multi-media documentation of construction drawings to show product photo with installation application and project site-specific photo;

*Mechanical systems:* graphic simulations of heat loss/heat gain;

*Curriculum Specific to Technology:* This is the new area of focus even in instances where technology has been incorporated for a significant time period. Due to the ever evolving, ever changing nature of technology, there are new technology-specific curriculum topics on a regular basis. The curriculum must address this. This curriculum covers such topics as:

*Basic computer use:* keyboards, mouse, CD-ROM, fragmentation, error recognition and management, etc.

*Intermediate:* Web/internet, e-mail, QuickTime video, DVD, CD-W, etc.

*Advanced:* distance learning, interactive learning, web publishing, etc.

Illustration 1, found on the next page, is a synopsis of the above arguments.
Illustration 1: Three Alternative Paradigm Scenarios of Curriculum, Pedagogy and Technology

1. **Enhanced Curriculum Paradigm:**
   - Technology
   - CURRICULUM
   - Traditional Learning
   - • Drafting: Technology used to SUPPLEMENT teaching/learning
   - • Writing: Supplemental to Traditional Pedagogy
   - • Math/Physics

2. **New Paradigm:**
   - TECHNOLOGY
   - ENHANCING Curriculum
   - • Data base management: New curriculum due to the presence of technology
   - • Multi-media presentations: New Pedagogy required to integrate curriculum and technology
   - • Interactive documents: Technology

3. **Parallel Paradigm:**
   - TECHNOLOGY
   - ADDITIONAL Curriculum
   - • Hardware: Pedagogy of Technology
   - • Software: Skills required due to technology • Interface
   - • Input/Output devices: Specific “technology-tasks”
   - • Internet
   - • ?
Influences on Technology Curriculum and Pedagogy

There are six primary influences on the effective use of technology and the appropriate effective pedagogical decisions. These are, in no particular order:

I. **The K-12 base knowledge and skills**: What do the incoming students have in the way of useable knowledge and appropriate skills from their first twelve years? Are there deficiencies? There are bound to be discrepancies and disparities between students. How do we address this inequality without hindering the curriculum?

II. **Technology Resources**: Do we have the appropriate hardware, software and training to effectively use the technology?

III. **Project Structure**: Can we update curriculum to take full advantages of new learning opportunities or is the change so dramatic we need to start from scratch?

IV. **Curriculum Linking**: The curriculum must become more seamlessly linked throughout the education process in order to take full advantage of the potential of technology. How can this be done? What are the steps? What are the priorities? This process could start by developing a curriculum map of current courses, faculty assignments, goals and resources.

V. **Students Assessment**: With more work being done electronically, how do we adjust the assessment tools and the assessment process? The learning process becomes more complicated and the assessment process must be capable of accurately and effectively showing the level of comprehension.

VI. **Goals and Vision**: We must develop compatible goals and visions to help faculty understand the process and desired outcomes as well as providing a clear and attainable set of goals for students.

**Conclusion**

One fact remains constant regarding the use of technology in education: it will always be changing. By recognizing that the effect of technology on curriculum can be categorized into the above three influences, we can begin to address the issues more directly. Our primary goal, indeed our mission, is to prepare our students for the profession and for living in a technological world. Developing a set of professional skills, specific to their discipline, will
provide a base for their success in their chosen discipline. However, we must also engage them in a commitment to understand the external factors, tangential to their profession, which impact their ability to succeed. Technology is prime among many external factors.

Biography

JAMES E. FULLER, AIA
James E. Fuller, AIA is Assistant Professor of Architecture at the Ward College of Technology of the University of Hartford in West Hartford, Connecticut. He is a licensed architect and has been since 1984. He is an active member of the American Institute of Architects and is on the national Architects and Education Committee. He is certified by the National Architectural Accrediting Board. He holds a Bachelor of Architecture with University Honors from Carnegie-Mellon University and a Master of Education from the University of Hartford. He is also an architect and project manager with Schoenhardt Architects in Simsbury, CT. with a primary focus on educational facilities, especially K-12.
He was President of the Connecticut Chapter of the American Institute of Architects in 1994, Vice-President in 1993, Commissioner of Design for 1991 and 1992 and was on their Board of Directors from 1991-1995.
He currently serves on the Executive Committee and Program Committee of the Construction Institute. He also is a member of the New Hartford (CT) Board of Education Technology Committee and the Curriculum Sub-Committee.
He has lectured around the country on the use of computers in architecture including speaking engagements in Boston, St. Louis and Carmel Valley, CA.