Round Table Session on "Theoretical and Experimental Issues in the Preliminary Stages of Learning/Teaching CAAD"

MARK Earl, MARTENS Bob and OXMAN Rivka

University of Virginia, Charlottesville, Virginia, USA *ejmark@virginia.edu*
Vienna University of Technology, Vienna, Austria *b.martens@tuwien.ac.at*
Technion Institute of Technology, Haifa, Israel *arrro01@techunix.technion.ac.il*
With statements from:
Scott C. Chase, University of Strathclyde *s.c.chase@strath.ac.uk*
Thomas Kvan, University of Hong Kong *tkvan@arch.hku.hk*
Hannu Penttilä, Helsinki University of Technology *penttila@mittaviiva.fi*
Marc Aurel Schnabel, University of Hong Kong *marcaurel@hku.hk*

According to eCAADe's mission, the exchange and collaboration within the area of computer aided architectural design education and research, while respecting the pedagogical and administrative approaches in the different schools and countries, can be regarded as a core activity. The current education session follows up on a round table discussion held at eCAADe 2000 in Weimar, Germany, which was continued in the form of a plenary session at eCAADe 2001, focusing on sharing ideas on a more progressive curriculum under the topic "The Ideal Computer Curriculum". The primary objective for the 2002 education session is to engage participants in an active discussion, not the longer format presentation of prepared positions. The round-table itself is limited to short opening statements so as to ensure time is allowed for viewpoints to be exchanged and for the conference attendees to weigh in on the issues discussed. The panel will critique current patterns teaching of computer aided design in schools of architecture, a review of past practices with the potential for guiding future direction.

***Keywords**: Architectural School, Curriculum, Computer Based Design Methods, Pedagogical Strategy*

Outline

The eCAADe 2001 education session on "The Ideal Computer Curriculum" (Mark et.al., 2001) defined "Specific Subject Areas", differentiated in three levels (A-C), representing the idea of an educational pyramid with a large base. The basic level (A) was titled "Digital Design Media". This subject area covers a broad set of computer based design applications at an introductory level, including interactive communications (web page development), geometrical modeling, digital image processing, and mixed media productions that involve the use of digital video, scanning and output media.

Learning universal principles and basic concepts serves as the main focus within the context of Information Technology (IT) related to architectural design education. Furthermore methodological issues will typically be encountered in any early educational program, including how one designs physical and virtual space (designs for the the current "hypes", such as Cyberspace, Virtual Reality, etc.). While on the one hand, individual media technologies need be examined as in-depth topics in order to make substantive advances. On the other, multimedia provides a plurality of approaches for working with computer technologies and likely establishes a broader critical framework for curricular development. The eclectic and synergistic approach of working with multimedia in a typical architectural design studio leads to envisioning new technologies potentially beyond the boundaries of more traditional inductive research methods.

This round table session looks back upon preliminary experiences with CAAD as a whole within the curriculum, not as a purely historical exercise, but rather as a way to understand our present trajectory forward. Using this approach, the round-table will more specifically address:

The lessons learned from past experiences in CAAD within the curricula

The implications for newer approaches for teaching CAAD relative to the eclectic culture of the design studio in Schools of Architecture

A comparison of alternative trajectories of CAAD education

The authors of the round table proposal (Mark, Martins and Oxman) invited statements from interested participants that were in turn accepted for inclusion by the ECAADE organizing committee. Each of these statements is summarized below. The statements are largely unedited and, to preserve the distinct character of each contribution, there was no attempt to try to unify these into a specific style. These statements are also meant primarily as points for discussion rather than full treatments.

The statements by Chase and Pentillä focus on the preparatory stage of design education. They then relate the preparatory stage to the larger framework of a complete educational program. The statements by Kvan and Schnabel concentrate on the more eclectic processes and inventions occurring relative to design activity in studio. They give some weight to the creative furnace and need based appropriation of technology in the studio design process. All the panelists take on a critique of the older established approach based on computer specific deign methods courses or technology courses that at one time served as the main vehicle for bringing technology to design schools. Today, these separate courses can be viewed in contrast to and possibly complimentary to specific design project centered studio activity. The culture of design studio is becoming increasingly digital, but this doesn't mean that all adaptations or approaches are pedagogically the same or complete. Are we moving towards a continuum of a design activity where the studio is the ultimate venue for true innovation in all media, or how does this emerging studio context change the focus and goals of more specific computer aided design research and technology courses? Is CAAD as a distinct topic of inquiry fading in significance as it become mainstream? What are the challenges in design education that may necessitate some degree of specialization in order to push the state of the art? The following contributors give some insight with their outlines for discussion.

Statement 1: Pedagogical issues for first year architectural design computing [Chase]

First year students come to the university with a wide range of backgrounds, skills and expectations. An introductory curriculum should cater to

and shape this variety, allowing students to achieve a basic level of computing skill and knowledge while still allowing potential advanced exploration, by

- ensuring a basic level of computing skill;
- replacing bad computing practices with good ones;
- demonstrating the potential of computing tools for design;
- encouraging a considered approach to the use of computing tools;
- providing an appreciation and understanding of the benefits and difficulties in using the computer in conjunction with or instead of non digital methods.

Prior knowledge

The first hurdle in teaching incoming students is to ensure that they have a basic level of computing skills and good habits. Students enter these days with significant computing experience, but despite claims to the contrary, are often still lacking certain basic IT skills. Optional bridging classes are a good way to ensure basic competency; university IT classes can be customised to ensure relevance to an architecture curriculum. One benefit of a bridging class is that it can introduce good computing habits, e.g. proper backup procedures.

Integration

Integration is the buzzword for developing new CAAD curricula. Given traditional architectural pedagogy, implementation can be difficult. A key goal is to enable the students to see the relevance of computing to their design process, and to ensure that it is utilised properly. This requires

active participation of computing teaching staff throughout the curriculum, especially in design studios;

an understanding by design tutors of the potential of computing in design and a willingness to *actively* lead students down this path;

recognition of the considerable changes that may need to occur in a studio curriculum, e.g. the introduction of short design exercises that simultaneously develop both computing and design skills and knowledge;

greater support in preliminary stages of teaching, when students are unclear about new technology and its application to a discipline with which they are unfamiliar.

Results

By the end of the preliminary stages of learning, computer use should be engrained in the student's everyday working patterns. This includes

- design exploration;
- presentation (e.g. image processing, word processing, web, paper);
- communication (e.g. email, discussion boards, assignment submission).

In summary, the first year curriculum should show the students the possibilities of design computing, teach good computing practices, and offer a broad base from which to build upon.

Statement 2: Skill Based or Knowledge Centered: Which Approach to Teaching CAAD? [Kvan]

There are two frameworks for teaching observed in schools of architecture. The most distinctive mode of architectural education is the well-established tradition of project-based teaching in the studio. This method of teaching reflects the nature of practice where the business of architecture revolves around the delivery of design in a project setting. This task-focused process is well suited to building tacit knowledge, the knowledge of doing and action. In contrast, CAAD teaching typically focuses on skill building and is taught independently of action. CAAD classes are set up to teach geometrical modeling, digital image processing, and the use of digital video, scanning

and output media. This is paralleled in other skill teaching schools offer classes in life drawing, drafting, model making.

Is CAAD teaching skill building or should we consider it as the action based activity? I would argue that the skill-focused means of teaching is detrimental to the development of appropriate skills and attitudes in CAAD application. Since skills are acquirable by most people through repetitive practice, the value of these skills is relatively low. This mode of teaching reinforces the perception that CAAD is technique and tool that is separate from architecture. Practice reflects this by setting up CAAD departments of digital draftsmen. Discourse in architecture reflects this in the distinction between designers and computer users. In all, the attitude hinders development of digital exploration of architecture.

To overcome this, we need to frame all teaching of CAAD as knowledge building, not skill building. In the tradition so of our teaching, this means teaching in project centered activities. Clearly there are advantages in the skill-centered approach. Access to expensive and scarce resources can be managed; the repetitive nature of command instruction can be minimized. The penalties of teaching in this mode, however, are not considered and should be articulated.

Statement 3: Adapting Architectural Computing into Preliminary Stages of Architectural Education - A few common dilemmas and a few proposed solutions to them [Penttilä]

Check students' skill level

- Don't waste time in teaching word processing, email or hardware architecture to all 1st year students - basic IT-literacy and skills will be more and more common knowledge;
- Offer optional IT-basics info for those who need it;
- Target your teaching resources to essential architectural design education with the new media.

Avoid over-emphasized and misleading IT-expertise

- Early IT-expertise with no architectural understanding tends to lead the architectural students easily to non-design activities, such as general IT & new media experts, CAAD-maintenance work,... or teaching;
- First year students, especially from elementary schools, are very open to whatever ideas given by their tutors, hence, start immediately with architectural tradition.

Start teaching CAAD immediately with architectural design problems

- Never ever start courses with CAD-system specific technical facts;
- Don't underestimate students' ability to search for technical solutions also independently;
- Students teach minor keyboard-skills to each others.

Teach the teachers

- Architectural students seem to know CAD-tools and gadgets better than their design tutors - a constantly growing dilemma;
- Low CAD-expertise of tutors leads to controversial classroom situations: tutors manage the content, but not the tool to work with;
- Organize separate workshops for new media essentials, CAD-basics, web-publishing, etc. to design teachers;
- Digital tips and tricks can easily be taught in few-hour intensive sessions;
- Your "less digitally conscious" colleagues tend to have a high motivation in learning the digital tools.

Create CAAD-facilities that support teamwork

- CAD is often taught in large, hierarchically organized classroom suitable for mass education;

- Organize also smaller-scale design studio facilities and architectural workgroup "cells" equipped with CAAD-facilities.

Distribute and adapt CAAD-education to "traditional architectural education"

- CAAD-education should be taught during the whole span of architectural education;
- Integrate CAAD-education into architectural curricula;
- IT and CAAD-education should be taught by all architectural professors;
- In fact, "digital" is currently already very traditional.

Statement 4: *Motivation and Stimuli* [Schnabel]

Student entering The University of Hong Kong (HKU) already own powerful computers with CAAD software. The whole campus of and its peripheries are networked either wireless or with high-speed network connections. Lecture-notes, assignments and tutorials are typically on-line. Digital communication, working within multimedia and mobile environments is for most Hong Kong students' common practice. Learning or teaching of any form of digital media must therefore reflect the expertises that students already have before they receive an architectural education. Students don't require any longer training in operation of software nor lectures and tutorials. Even complex 3D thinking is widely acquired through e.g. interactive 3D-games. The availability and ease-to-use of software gives students the chance to explore more in less time without supervision than ever before.

Consequently CAAD-education has to stimulate the interest in architectural design and, more important, establish a mechanism to control and enhance the quality of the architectural design produced with the help of digital media. At HKU, we realized that the direct and instantaneous translation of idea to form plays a key role in the education and development of architectural design. 3D-Modellers, 3D-Scanner, Virtual Environments and Rapid Prototyping are used to aid both students and teachers to explore and study architectural creativity in a way that enables a deeper involvement into design-issues. These design technique with direct cause-impact-circles give enormous motivation to students. Since production time and cost are fairly eliminated, students do not become too attached to a design, which is the outcome of long training of particular IT-applications, modelling and production.

Working with multimedia-systems is based on the creativity of design-ideas and the skill to combine different (traditional or digital) applications to create and transform design. Education must provide the right incentives to students to engage in independent experimenting and as a result in self-learning. Differences in IT-skills of students and teachers are levelled out through the students' engagement using multi-media tools in different disciplines and design-contents. Vertical studios, which make use of IT, challenge and engage students to acquire new techniques and skills.

We don't teach CAAD, but tie digital media together with other areas of the curriculum and discipline: visual communication techniques, precedent studies, 'kit-of-parts'-design, collaboration with engineers, etc. In other words, digital architectural education is dependent on the stimulation and creativity of students and teachers rather than on hard- or software or the teaching of those.

New technologies always shaped the curriculum of architectural studies. This became more imminent that ever since The University of Hong Kong (HKU) introduced its Information Technology (IT) - scheme: every student entering the university receives a powerful notebook for marginal costs. The whole campus and its peripheries are networked either wireless or with high-speed network connections. Lecture-notes, assignments

and books are typically on-line. Digital communication is for most Hong Kong students basic understanding. Working within multimedia and mobile environments is as common as the use of their own handheld PDA and always online GPRS (General Packet Radio Services) mobile-phones. Learning or teaching of any form of digital media must therefore reflect the expertises that students already have before they receive an architectural education. Students don't need any longer training in operation of software. Even complex three-dimensional (3D) thinking is widely acquired through interactive 3D-games. The availability and ease-to-use of software gives students the chance to explore more in less time or effort than ever before.

CAAD-courses have to stimulate the interest in architectural design and, more important, establish a mechanism to control and enhance the quality of the architectural design produced with the help of digital media. At HKU, we realized that the direct and instantaneous translation of idea to form plays a key role in the education and development of architectural design. 3D-Modellers, 3D-Scanner, immersive Virtual Environment and Rapid Prototyping are used to assist both students and teachers to explore and study architectural creativity in a new way that enables a deeper involvement into design-issues. Since production time and cost are fairly eliminated, students do not become too attached to a design, which is the outcome of long training of IT-applications, modelling and production. A solution can not only be altered as quickly as new ideas emerge but also experienced virtually or real. New and different forms of architectures can be developed independently of the software, its capabilities and its know-how of manipulation. Working with multimedia techniques is based on the creativity of design-ideas and the skill to combine different (traditional or digital) applications to create and transform design, which matches the actual idea and not vice versa. Disputes over designs are conducted in virtual as well as in real 2D and 3D media. Feedback to solutions are in real- time, - scale or -material. In other words, architectural education is dependent on the stimulation and creativity of students and teachers rather than on wiz-kids, who master digital media virtuously. Now we have an enormous opportunity to produce quality in design and education with the assistance of IT. This was not realized years ago. We successfully tied the basic education in digital media together with other areas of the curriculum and discipline. Visual communication techniques, precedent studies, historical analysis and collaboration with engineers now incorporate basic and advanced digital-design-media. With this help of IT and this different expression of (Computer Aided) Architectural Design architects can communicate their ideas easier and more direct. CAAD becomes a tool of communication, which enables teachers and students to explore design and not technologies.

Broad topics suggested by statements

The statements can be classified as follows:raise some of the following points for discussion:

A. Teaching and Changing Pedagogy Issues

Subject: Teaching Approaches
Issue: What differences do we encounter in faculty and student angagement when CAAD is used as a tool to explore a design project as contrasted with being taught as a distinct topic with its own specific logic and design research potentials?

B. Curricula and Organization

Subject: Pedagogy for Structuring the First year
Issue: What is the stepped educational sequence

needed to inculcate advanced computer technology expertise in a context characterized by a range of student aptitudes and experience levels, different teacher attitudes and abilities, and in a context dominated by design studio problem solving.

C. Team and Individual Teaching Design Environments

Subject: Dilemmas Concerning Architectural Education of in the Digital Era
Issues: What approach should be taken to broadly introduce and educate teachers directly or to support team work the evolution of their teaching methods indirectly to best take advantage of emerging CAAD technology?

References

Mark, Earl.: 2000, A Prospectus on Computers Throughout the Curriculum*, Promise and Reality (eCAADe Conference Proceedings)*, Bauhaus-Universität Weimar (Germany), pp. 77-83.

Mark, Earl, Martens, Bob and Oxman, Rivka: 2001, The Ideal Computer Curriculum, *Architectural Information Management (eCAADe-Conference Proceedings)*, Helsinki (Finland), pp. 168-175.

Novitski, Barbara-Jo (Ed.): 1987, Integrating Computers into the Architectural Curriculum, ACADIA Conference Proceedings.