Building an Intranet Model for CAAD: Staying Connected for Group/Self-Paced Learning

MURALI PARANANDI
Miami University

Over the past decade most architecture schools in North America have recognized the value of digital media for design and have been active in integrating them into their curricula in some fashion. The success or failure of such ventures is heavily influenced by such factors as the predominant faculty attitude towards digital technologies, the availability of finances and personnel, and most importantly which instructional strategies are adopted. This paper presents work in progress at our institution which, fortunately, has enthusiastic faculty support for exploring the potential of digital technologies through innovative instructional strategies, in response to limited financial resources and personnel. The infrastructure and instructional models we describe propose to enrich the educational experience in digital design media for our students. With these initiatives we anticipate enhancing the fluidity of design representation while providing opportunities for group/self-paced learning.

Keywords

Computer-Aided Architectural Design (CAAD), Hardware, Software, Internet, Intranet, Information delivery, Self-paced learning, Group learning.

1. BACKGROUND

The Department of Architecture at Miami University has been active in embracing digital technologies for visualization in its curricula for fifteen years. The department offers three elective courses that deal with computer representation. Typically, these courses have been taken by interested upper level undergraduate students. The drawback of this arrangement is that it deprives the students of utilizing the potential of computer representation as a medium of inquiry in other courses earlier in their curriculum and therefore being able to build an appropriate philosophical and technical approach to the integration of digital media with conceptual design methodologies. Recognizing this, the department has broadened its vision to explore the digital media as decision making media. We believe that the best way to achieve this goal is to introduce digital media earlier in the curriculum along with traditional media, so that the students can explore their potential in various subsequent courses (Fig. 1.). The author is entrusted with the challenge of educating and training about 80 undergraduate students (ARC 112), and about 10 graduate students (ARC 611) in the use of computer media for architectural representation and visual problem solving over a span of 7 weeks, every year. This also marks the introduction of digital media in a required course for the first time in the department's history. The initiative described in this paper is designed to enrich the educational experience in digital design media and these introductory courses will be used as a test bed.

2. UNDERLYING ISSUES

2.1. Economic/logistical issues

Keeping up with the constantly developing trends in hardware and software industry is an expensive proposition. Most schools defray the costs of computer equipment by instituting a student computing fee. At the present time, we do not have such a system at our school. The funds available for equipment purchase and upkeep are modest and sporadic. In our newly restored building facility (to be completed and occupied by mid-1997), all the student workstations in all design studios will be wired for video/data connections so that students can tap into the campus network as well as the departmental intranet. Incoming students will be encouraged to acquire low-cost personal computers use in their design studio work as well as to connect with other students, instructors, and the university community through the departmental intranet. In the mean time, we are trying to build a laboratory infrastructure that creates opportunities for group/self-paced learning, distance learning (so that computing can be decentralized), and has little platform bias.

Additionally, like most schools we constantly deal with pressures from various sources (including students, concerned parents, and area practitioners) to use industry standard software and hardware (such as AutoCAD on IBM-PC compatible) in our instruction. While we recognize that there are some merits in providing some vocational skills to our students to increase their marketability, we believe that

the educational objectives should take precedence. While Macintosh platform is used in our instruction due to majority faculty preference, our instructional materials and methods tend to be generic, with a focus on the concepts making students aware of the platform/software specific issues. We encourage interested students to take courses in using AutoCAD on IBM-PC compatible computers in local Community/Technical colleges. Students also have access to a library of instructional tutorials of various popular software programs on various platforms in CD/Videos format for self-paced learning.

2.2. Pedagogical issues

Digital design media consist of *computer graphics programs* typically developed by engineers based on *mathematical logic* and *engineering models* which are characterized by *rigidity* in their operational behavior. While this may work well for representing pre-conceived ideas for illustration purposes, it becomes a hindrance for representing an evolving built form/space [Gross ,1994]. The process of envisioning architecture/interiors demands *fluidity* which the existing digital media do not accommodate well [Kalay, 1987]. The pedagogical challenge here is *to make the usage of digital media second nature* so that the student/s can focus on *what* they are representing rather than *how* they are representing.

In dealing with Digital Design Media, the instructional problems are as follows:

1. To make the students identify and develop fluency with the *critical features* of various programs. Stoker [Stoker, 1992] correctly points out that when employing digital media for design tasks, 90% of the work is accomplished with 10% of the capabilities (critical features) of the particular program.
2. To develop *critical thought* and *strategies* for effective use of the critical skills identified above by using a multiple representation scheme [Paranandi, 1996] for *design problem solving*. As pointed out by Eastman, "Multiple representations break down the issues and allow them to be dealt with piecemeal; otherwise they would be overwhelming in their complexity" [Eastman, 1986].

3. ADDRESSING THE SHORTCOMINGS OF THE PRESENT SITUATION

In this section we identify the following as the major shortcomings of the present situation and we also discuss how we propose to address them.

1. Information Delivery,
2. Design representation and communication.

3.1. Information Delivery

Traditional practices of information delivery for teaching digital media skills include faculty reading from and elaborating on their notes accompanied by a demonstration of software features projected on to a bigger screen, while the students copy the information into their notebooks and try to mimic what is projected on the screen on their desktop computers. These practices generally do not represent an efficient use of faculty time or talent for the dissemination of information to large or multiple groups of learners or for the acquisition of information by learners with diverse backgrounds and skills [Wagner, 1996]. Students have a limited ability to listen to any lecturer over a sustained length of time. Fifteen to twenty minutes seems to be the limit before boredom sets in, no matter how skilled the lecturer is [Bonwell 1991]. At the end of such a lecture/demo session, what students retain often ends up being few insignificant details rather than a comprehensive conceptual understanding necessary to apply these skills independently. Typically, there are no opportunities for learning or practicing these skills beyond this class room scenario.

We propose to overcome these problems by incorporating an intranet model for information delivery in multimedia format to create following oppotunities.

3.1.a Group Learning

Our intention is to allow students to "learn by doing" [Verner,1967; Johnson, 1993; Dvorak, 1995] and increase learning effectiveness by using the students as teachers [Bouton 1983].

Network-based distribution of instructional material

We will be recording the demonstration of various software critical features and associated strategies as QuickTime movies and distribute them on the intranet for students so that they can go over it at their own pace (Fig. 2, Fig. 3). This will allow the faculty to use the class time for discussing conceptual aspects of digital media rather than the mechanics of pressing buttons and pulling menus. Since the demonstrations used in lectures are available as QuickTime movies for reference, students can play them while practicing with a particular software.

Using students as teachers

We will also be recording the student help sessions where we answer students questions one on one and add them to a central indexed archive. If another student comes up with a similar question, we will refer him/her to this archive. We will also encourage students (as an optional extra-credit project worth 5% of their course grade) to document the "tricks and tips" they discover on their own as QuickTime movies. As observed by Rutherford [Rutherford, 1996], such effort causes students to reflect upon their activities, which in turn reinforces their understanding of the principles. These indexed archives thus also become a reference available to other students and instructors outside of the classes where they are created.

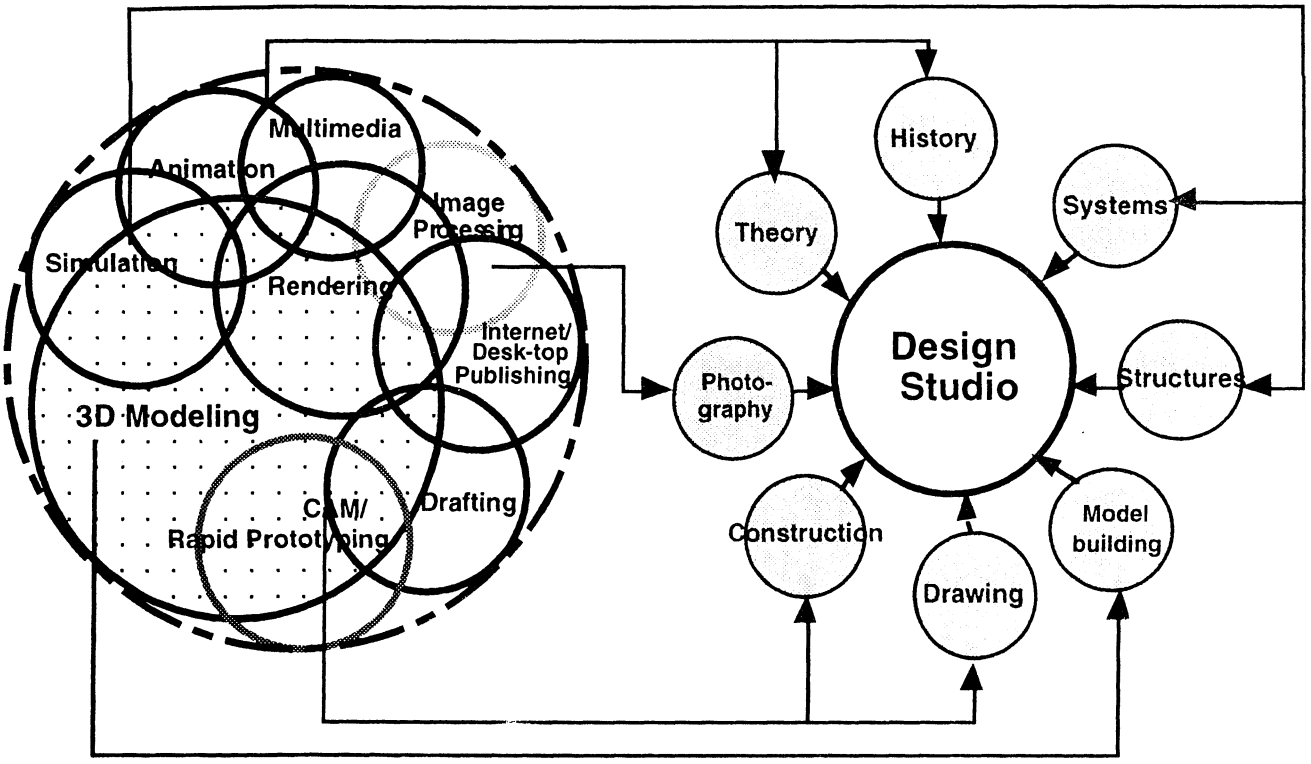

Fig. 1. Potential of digital representation in architectural education as we envision.

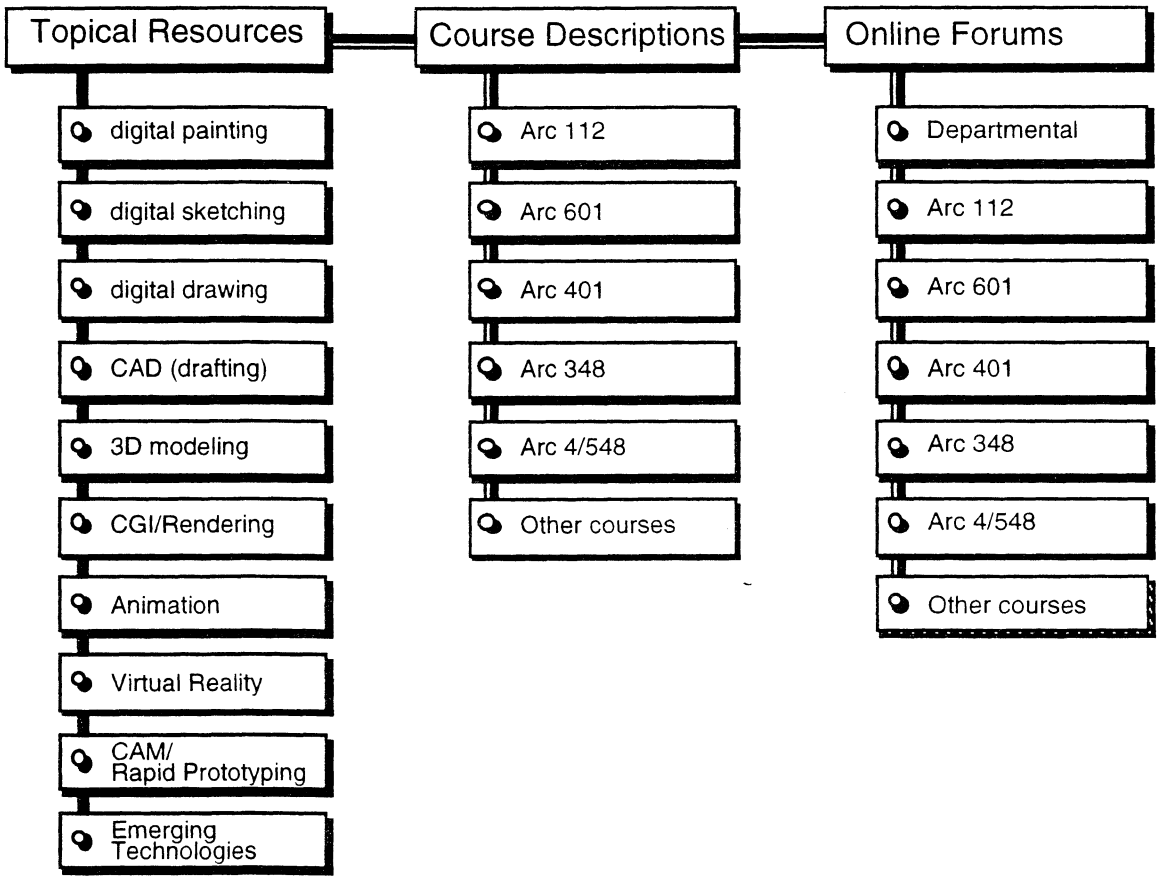

Fig. 2. Organization content on intranet. Individual faculty members will tailor the material to suit the course needs which may include content developed by other faculty members, students both within our department and elsewhere on the Internet.

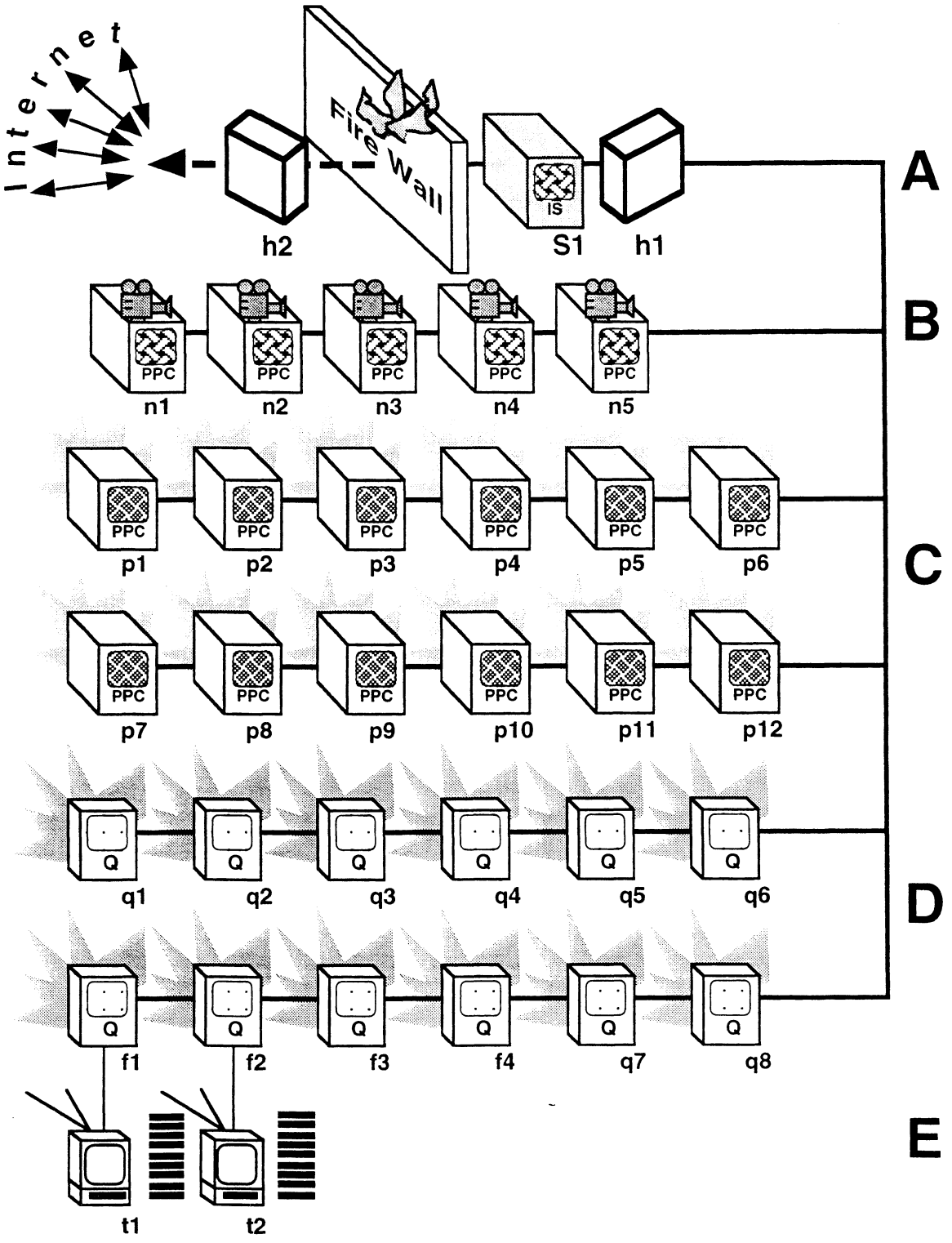

Fig. 3. Proposed intranet network of computers. Category C computers comprising of PowerMacintosh 7100 (66 MHz/56 MB) models are going to be dedicated for the exclusive use of students (12) in the upper level studio (also taught by the author). Category D computers comprising of Quadra 700 (25 MHz/36 MB) models and Macintosh FX (40 MHz/48 MB) will be used as instructional machines in the new required introductory courses taught by the author as well as existing upper level elective courses. Category E machines are for self-paced video/CD based tutorial practice by any interested student/faculty. Category B computers represent the highest-end machines in the laboratory (Power Macintosh 8500/180 MHz/96MB RAM/AV capable) to be used by those students with special needs such as video conferecing, CD-recording, advanced rendering, animation etc. Not shown in the figure, a Quadra 900 used as PrintServer and a Power Macintosh 8100 used as file server. All computers have Zip Drives for have external data storage. Other peripherals in the laboratory inlcude a scanner, color printer, laser pritner, large post script plotter, slide printer, CD-recorder, and jazz drive for storage.

Keeping them connected

We will provide the students access to our intranet server for web conferencing, ftp (file transfer protocol), e-mail; so that they are connected with other students/faculty in the class and the department. Our intranet server would host course syllabi, lesson plans, class updates, homework assignments, as well as mechanisms to submit projects.

3.1.b Self-Paced Learning: A stock pile of Experiences to learn from

A stockpile of resources strategies, worksheets, how-to recipes, FAQs (Frequently Asked Questions), and techniques (recorded in QuickTime movie format) that are organized by topic (using internet multimedia protocols and Java) and are accessible for students over the network for self-paced learning.

Instructional video tapes

Professionally produced instructional tapes available for the use of various popular commercial software programs. We also intend to produce instructional videos locally with help from Miami University's audio/visual services. We plan to set up 2 multimedia workstations so that students can view these videos and practice new skills at their own convenience and pace. It is also our hope that these video tapes help familiarize the interested students with platform/software-specific idiosyncrasies.

3.2. Design Representation and Communication

It is very important that the student designer communicates the ideas under development clearly with himself/herself, as well as with the instructor/critic. Unfortunately, a lot of this depends on the capabilities of the hardware and software, and how students use them.

During design development phase, the students do not keep a record of the design process that can be communicated with instructor/critics. Current design presentation practice involves students putting together a few rendered images as a slide show which is then projected using LCD display panel onto a bigger screen mounted on a wall. Most of the time, these pictures are not adequate to narrate the design. Both critics and the students experience frustration in communicating with one another because of the rigid nature of this type of presentation. A typical design review involves such questions as "What are we looking at?" "Where is this in relation to what we just saw?" "What if we step back?" "Do we still see that from here?" "Can you remove that wall and show the interior?" etc.

We expect to address these issues incorporating (1) digital and analog sketchbooks to keep a log of the design evolution process, (2) virtual walk-throughs of buildings and spaces incorporating Apple's QD3D and QuickTime VR technologies for design presentation, (3) digital libraries of objects and artifacts such as cars, trees, people etc. to support visualization of the built environment, (4) by educating the students about hardware/software limitations, issues of abstraction/levels of detail and data organization strategies, and (5) internet/intranet based "data sharing" and "video/web conferencing" for design collaboration.

4. CONCLUSIONS

Initially, we will explore the strategies outlined in earlier section in the introductory required courses during spring 1997, fall 1997, and spring 1998. If these initiatives succeed, we expect that our students will (1) produce higher quality work that successfully incorporates multiple representation strategies, (2) keep an analog and electronic log of the design process, and (3) communicate their ideas more clearly with critics and colleagues. We also believe that the intranet based instructional model for teaching digital media issues to architecture students is well suited to accommodate future developments in the information delivery [Tschumi, 1995; Wagner, 1996]. Eventually, we plan to expand the scope of our intranet to other courses within our department as well as to the outside world so that the resources compiled can be used by other schools as well.

ACKNOWLEDGMENTS

This project is partially supported by a grant from Office for Advancement of Scholarship and Teaching, Miami University, under "Learning Technologies Enrichment Program". Author thanks Dr. Robert Benson, Prof. John Weigand, and Prof. Fuller Moore for their support and encouragement in this project.

REFERENCES

Bonwell, Charles C. [1991]. "Active Learning: Creating Excitement in the Classroom." *ERIC Clearinghouse of Higher Education*, Association of the Study of Higher Education, ASH-ERIC higher education report; 1991, no. 1., Eison, James A., ed., Washington DC: School of Education and Human Development, George Washington University.

Bouton, Clark, and Russel Garth. [1983]. "Learning in Groups." *New Directions for Teaching and Learning*, San Francisco: Jossely-Bass.

Dvorak, Robert W. [1995]. "CAD in Education: The University of Arizona." *ACADIA Quarterly*, FALL 1995. PP 5-9. The Association for Computer Aided Design in Architecture.

Eastman, Charles M. [1986]. "Fundamental Problems in the Development of Computer-Based Architectural Design Models." Proceedings of the Computers & Design Research Symposium, M.I.T., August 4, 1986.

Gross, Mark D. [1994]. "Roles for Computing in Schools of Architecture and Planning." *Journal of Architectural Education*, pp. 56-64. ASCA Inc.

Johnson, Brian. [1993]. "The Graphics Application Paradigm: A Framework for User Understanding of CG/CAD Applications" in F. Morgan, R. Pohlman, eds. *Proceedings of ACADIA '93* conference,

Kalay, Yehuda [1987]. *Computability of Design*. John Wiley & Sons, Inc., New York.

Paranandi, Murali. [1996]. "CAAD as a Thinking Medium: A Strategy for Computer Aided Architectural Design Education." Proceedings of eCAADe '96 conference, Lund Institute of Technology, Lund, Sweden.

Rutherford, James. [1996]. C. Yessios, ed. *Partnerships in Learning 4: Joint Study Program 1995-96 Annual Report.* Pp 94. auto·des·sys, Inc. Columbus, Ohio.

Stoker, Doug and Jones, Denis B. [1992]. "RISCAD: A Simplified Approach to CAD System Design," in Karen Kensek and Doug Noble, eds. *Proceedings of ACADIA '92*, Pp 113.

Tschumi, Bernard. [1995]. "One, Two, Three: Jump," in Martin Pearce & Maggie Toy, eds. *Educating Architects*, Pp. 24-25. Academy Group Ltd. London.

Wagner, Norman. [1996]. "Telecommunications and the Changing Nature of Instructional Delivery." *Syllabus*, Volume 9, No.9, June 1996, PP 10-12. Syllabus Press Inc.