Software Application Interrelationships and Pedagogical Inclusions in Architectural Engineering Technology

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Introduction

"Computers are easy-to-use tools. It is just as easy to design and document lousy buildings with them as without them."

"Compared to engineers, architects must necessarily be more selective about the tools they purchase, and more creative in how they apply them."

Ken Sanders, AIA
The Digital Architect[1]

Software technology has taken enormous leaps in recent years in the ability to interrelate information between different applications. The successful development and global adoption of Microsoft Windows and Apple OS operating systems has lead to a world wide awareness of the ability to share information between applications on your desktop, between users in remote offices and, indeed, around the world.

The implications for this are staggering for any discipline but even more so for architecture. Architects must constantly analyze information cloaked in a variety of shrouds from the highly technical and somewhat obtuse building codes and life safety codes through numerical information related to building program, estimating and life cycle cost analysis and, of course, the graphic images of design drawings and working drawings. The amount of information, in all these forms, has increased tremendously and rapidly as new materials have been developed, building codes evolve and buildings, themselves, become more complex. Technology, however, is beginning to provide the tools to help the profession, and those on the route to professional licensure, keep track of this plethora of information.

The gathering of the information is but the first step in the process of bringing the dream of architecture to reality. Architects must decipher then coalesce the relevant information, respond to the issues raised and consolidate the written and graphic information into a coherent whole, Only then can the project be reviewed for compliance with the client's needs and the building official's requirements and, the ultimate goal, be built.

As the profession engages the use of software in ever increasing ways we must be certain that students are not left behind. Applications routinely used by architects in practice include:

- Word Processing

- Spreadsheets
- Scheduling
- Presentation
- Computer Aided Documentation (CAD)
- Database

Part I: Professional Practice Applications

"Real productivity is the avoidance of work"
Douglas Stoker

Before we look at the pedagogical implications and applications of the interrelationship of software it is important to have an understanding of the professional applications as a base to set student assignments in context.

The software being used by architects was outlined above. What are they doing with these software packages? What practical, day-to-day uses are finding their way to electronic documentation and manipulation? Which of the many applications should we consider when instructing students?

Architects have been using word processing for, conservatively, fifteen years. Initially used as "glorified typewriters" to manipulate specifications word processing has only recently, in the past two to four years, been tapped for other uses. These include:

- marketing "tear sheets" that combine written descriptions of projects with embedded images;
- project meeting reports that combine written records of activities on projects with imbedded snapshots of project schedules and imbedded images of job-site photos showing actual progress or problems;
- letters to interested parties with imbedded graphics from CAD or photographs;
- the more traditional specifications uses but with embedded graphics or products, procedures or schedules;
- in-house training manuals for CAD and other applications with text and screen images.

Spreadsheets are fast becoming as common place in firms as word processing. As the capabilities of spreadsheets grew, from the original manipulation of numbers to today's plethora of data, calculations, text, graphics and graphs, so, to, did the applications architects found appropriate for use with spreadsheets. These include:

- financial analysis of project (including IRR, NPV, etc.)
- financial analysis of the firm's activities (internal audits)

- building area calculations, taken directly from CAD, and crunched to report such information as gross square feet, net square feet, rentable square feet, construction costs, etc.
- architectural programming - developing space needs and conducting space needs analysis
- graphical analysis of costs, area, project completion and building use with building graphics imbedded in the spreadsheet;
- schedules, including door, finish, window and equipment with embedded graphics from CAD or product manufacturers.

Graphic presentation software is the current hot application for firms exploiting further use of their equipment. Programs can help architects:

- prepare a presentation to a prospective client by combining text, freehand drawing, captured CAD images and scanned photographs;
- develop in-house manuals for staff training and office procedures, especially training manuals for graphics and CAD software (!);
- progress reports for clients on long-term projects to combine text, graphics, charts, spreadsheets, CAD drawings and photographs of specific sites.

Examples of some of these applications follow (illustrations 1 through 7).
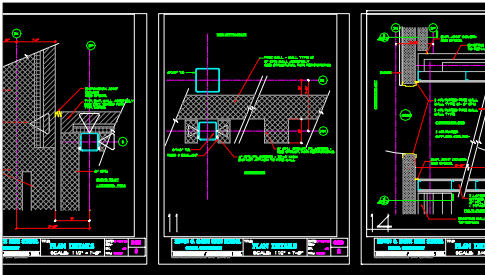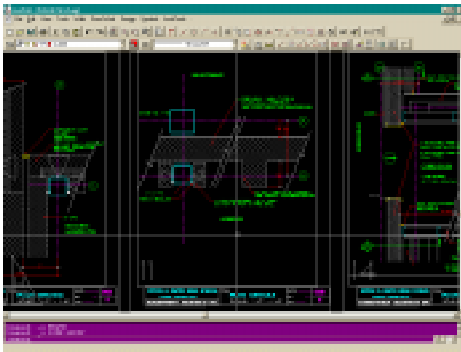
Figures 1 and 2: Example of linking AutoCAD with Microsoft Word. The top image is the screen capture of the AutoCAD session shown in the bottom image as a linked drawing. As AutoCAD is changed, the link is updated.

Figures 3 and 4 (below): The effect of modifying an AutoCAD image (top). The linked image is updated in the Microsoft Word. (Images Courtesy of Schoenhardt Architects, Inc.)
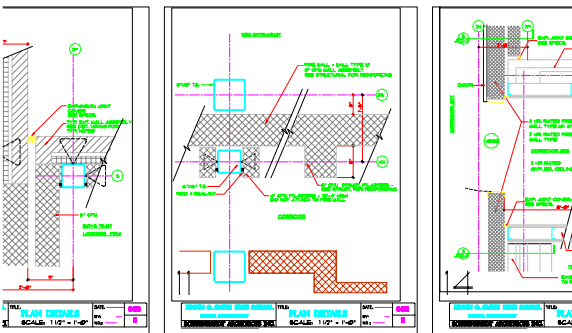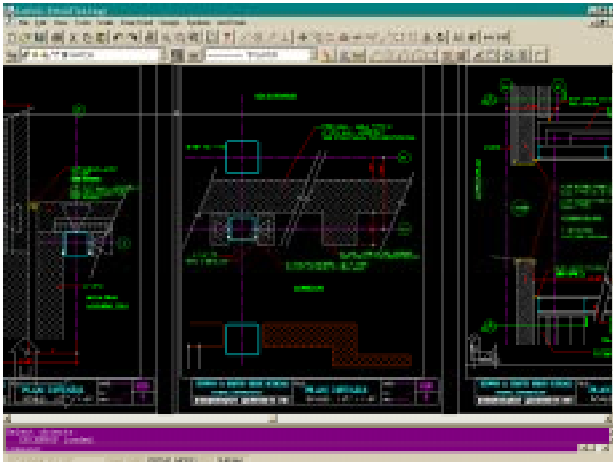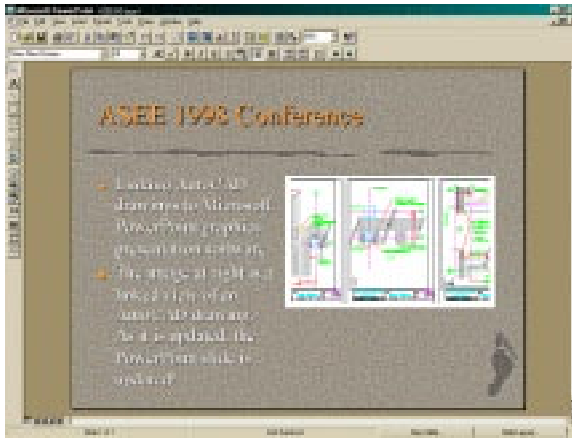
Figure 5: A screen capture from Microsoft PowerPoint showing a sample slide with a linked image from AutoCAD. This would be used as a promotional presentation tool, a publishing document or as a file downloaded to a slide generator.

(Image courtesy of Schoenhardt Architects, Inc.)

Notes on Agenda Items
Building Committee meeting
12 March 1998

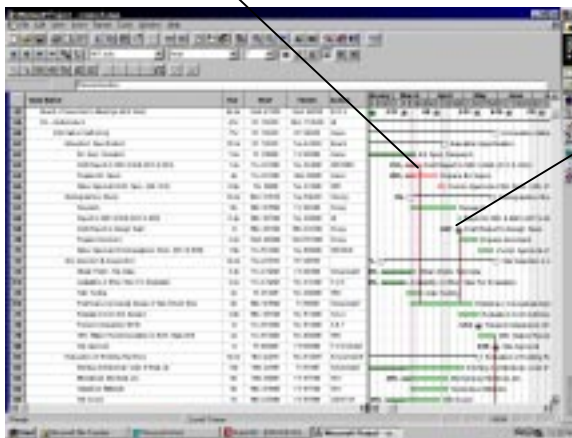| Item	Action	Description
5b		"Critical Path Issues"
		1. Educational Spec. (SBC 4/9, BoE 4/14)
		2. Demographic Study - Draft to Design Team 4/27
		Final SBC (5/14) BoE (5/26)

Figure 6: An example of incorporating images into project agenda meetings. A portion of a Microsoft Word document with a captured screen image from Microsoft Project.
(Image courtesy of Schoenhardt Architects, Inc.)

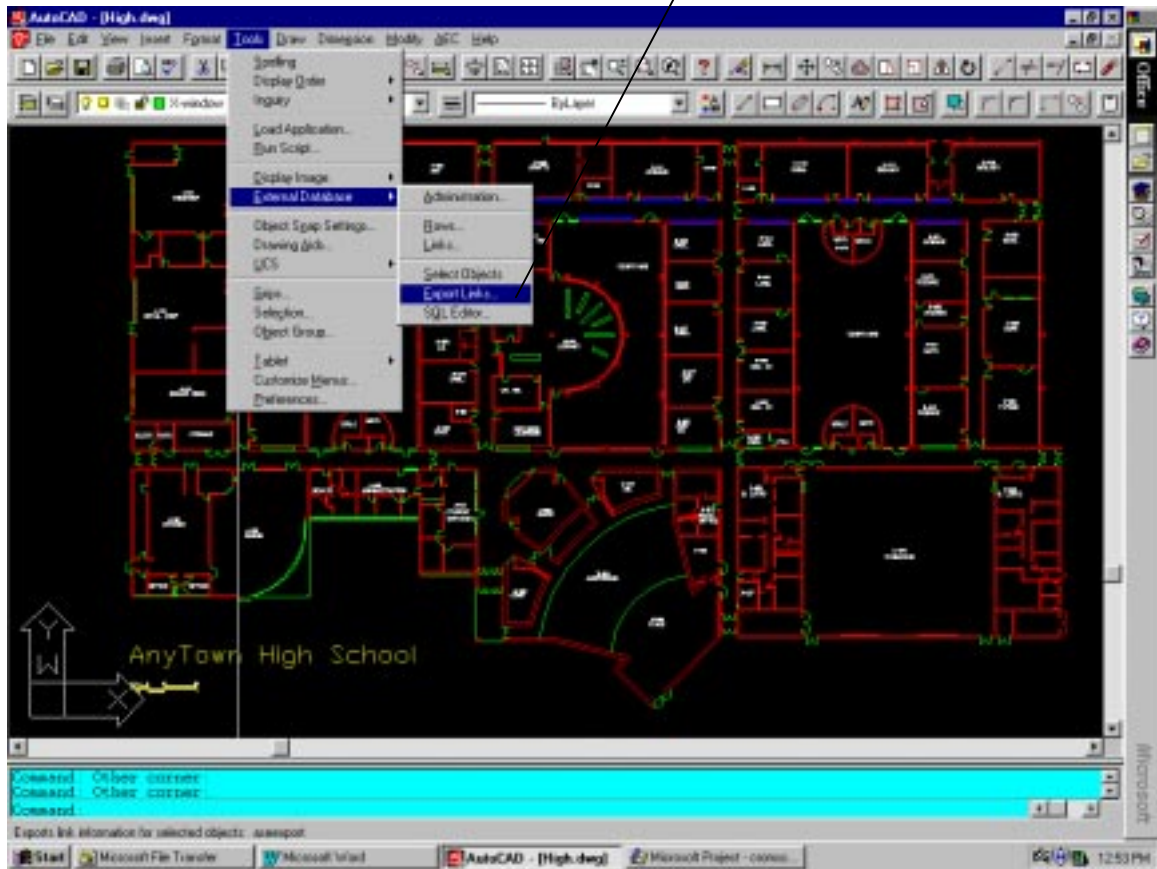To link documents, use the pull down and cascading menus.

Figure 7: An example of incorporating an AutoCAD image into a training document created with Microsoft Word.
(Image courtesy of Schoenhardt Architects, Inc.)

Part II - Pedagogical Applications

> *"As children tremble and fear everything in the blind darkness, so*
> *we in the light sometimes fear what is no more to be feared than*
> *the things children in the dark hold in terror…"*
>
> Lucretius,
> On the Nature of Things (ca. 60 B.C.)

> *"A credulous mind…finds most delight in believing strange things,*
> *and the stranger they are the easier they pass with him; but never*
> *regards those that are plain and feasible, for every man can*
> *believe such."*
>
> Samuel Butler
> Characters (1667 - 1669)

I find it most incredulous that many institutions do not teach *real applications* of software.
Applications, discovered and rediscovered through labs and studio exercises, in which students

are confronted with problems faced by practitioners. In the labs involving computer applications I present scenarios seen in practice and require students to solve for the unknown. The requests may seem strange at first but through exercises they become plain and feasible. Well, at least feasible!

Lab exercises take root in, first, developing the base documents within individual applications. The students are given, via lecture material from me and guests, an actual project currently or recently in an architectural firm. Students are then required to produce:

- CAD documents (using AutoCAD[2] r13 on Windows95[3] platforms)
- spreadsheet base showing room schedule or required parking including graphs and charts (using Microsoft Excel[4])
- word processing document describing the project to an audience of their choice (client, building official, planning review board, professionals, etc.).

After the base documents are done, further lab exercises develop scenarios to link or embed the various software documents. Lectures focus on the process and the purpose giving students the how and why of the exercises. It then becomes the student's responsibility to develop the appropriate links and/or embedded documents. Students work in teams since this is the way the world works today! There is no one right answer since, in many cases, this is also the way the world works! Student teams then present their solutions to the class and visiting guests in each of three ways:

- written documentation
- oral presentation
- graphic presentation using the computer and overhead projection

The goals of the exercises stress the real world application and problems facing professionals:

- an actual project
- a professional target audience
- a professional review jury (clients, review boards, building officials, peers, etc.)
- multiple methodologies for representing and presenting solutions including written, oral and graphic.

Students gain marketable skills since they deal with real problems and produce real solutions.

Part III - The Future

> *"Technology advances are reducing the cost of computer hardware by an order of magnitude every few years. The unreported bad news is that expectations are increasing at an even greater rate. This means that, year by year, for a fixed sum of*

money, you will be able to purchase a significantly more powerful
computer that will do somewhat less than you expected."

<div align="right">Nicholas Weingarten, FAIA</div>

"Technology is anything invented after you were born."

<div align="right">Alan Kay</div>

The future is open. Possibilities include:

- interactive database linking across networks including the World Wide Web;
- interactive applications across networks, including the World Wide Web;
- distance collaboration with other universities;
- industry applications developed from student interests and development
  - application software to develop Quick-Lynx and AEC-Lynx
  - information models which can be used by the profession
  - project type-specific models using software to integrate tasks
  - ??????

"We must not believe the many, who say that only free people
ought to be educated, but rather the believe the philosophers who
say that only the educated are free."

<div align="right">Epictetus
Roman philosopher and former slave</div>

Bibliography

1. Sanders, Kenneth, *The Digital Architect*, 1995, Wiley.
2. Autodesk, Inc., 1997
3. Microsoft Corporation, Windows95, 1995
4. Microsoft Corporation, Excel for Windows95, Version 7.0a, 1985-1996
5. Microsoft Corporation, Powerpoint for Windows95, Version 7.0b, 1987-1996
6. Microsoft Corporation, Word for Windows95, Version 7.0a, 1983-1996
7. Microsoft Corporation, Schedule for Windows95, Version 4.1, 1983-1996

Biography

JAMES E. FULLER, AIA is an Assistant Professor of Architecture in the Architectural Engineering Technology program at the Ward College of Technology at the University of Hartford in West Hartford, Connecticut. He is a licensed architect, a member of the American Institute of Architects and the Connecticut Chapter of the AIA serving as its President in 1994. He has spoken around the country on computer applications in architecture.