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Title Page of Chapter 2

Electronic Teaching and Learning: Trends in Adapting to Hypertext, Hypermedia, and Networks in Higher Education

by

Robert E. Jensen

&

Petrea K. Sandlin

Trinity University
715 Stadium Drive
San Antonio, TX 78212-7200

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University of North Texas, Denton, TX 76203-3677, USA Phone 817-565-
3090 Fax 817-565-4930

Chapter 2

Why? The Paradigm Shift in Computer-Aided Teaching/Instruction and Course Management Software

Judging from the course evaluations, these teachers want to get started with multimedia right away. They've seen how computers work, and had their first look at what multimedia can do. Now they're ready for the sequel.

Bamforth (1993)

Clearly, the potential savings inherent in transforming the existing labor-intensive system are enormous. Yet, there are attitudinal barriers that must be overcome before this transformation can take place. ... The first of these pertains to teachers themselves.

Measelle and Egol (1994, p. 8)

Information technologies, over time, have the power to transform completely instructional methodologies . . . Much more than reading and writing is required of the educated person in the modern information era.

Noblett (1995, p. 28)

Alas, however, much of what passes for multimedia isn't worth stuffing into your computer, and it can be hard to tell from the boxes (in stores).

Mossberg (1994b, p. B1)

Introduction

Chapter 2 is a somewhat personal account of why we ventured into computer-assisted learning (CAL), what we discovered, and where we made and overcame some mistakes. **Most importantly, our purposes herein are to provide accounting educators with questions to ask and places to contact for more information regarding alternatives of today and tomorrow.** What should educators look for in the way of CAL hardware and software? What questions should educators raise when evaluating CAL aids provided by publishers and other vendors? What pedagogical pitfalls should be avoided in CAL? What benefits might be gained both in teaching and research? We stress that CAL is a research frontier since so much is happening in the way of technology and so little is known on how to best utilize this explosion of new CAL alternatives. We also recommend a paper edited by a former president of EDUCOM in Heterick (1993). We also recommend Francisco and Landry (1995) for a brief overview of multimedia accounting classroom presentations. Readers are referred to Chapter 0 for definitions for definitions of terms and acronyms used in this chapter. It will be helpful to print a copy of Chapter 0 to refer to while reading or searching this and other chapters of this book.

Purposes of This Chapter

In this chapter we provide a revised and updated version of the topics discussed in Jensen and Sandlin (1992a). The chapter focuses on the following areas:

- (1) **Advantages and disadvantages of CAL.** Particular attention is placed upon course management software (CMS) which can be used in authoring animated CAL lessons, making presentations of those lessons in class, and providing lessons for use outside the classroom on a campus network or on floppy discs which can be loaned to students.

- (2) **CMS publisher supplements for CAL.** This chapter provides a detailed discussion of questions that publishing companies should be asked about the CAL supplements that are available to textbook adopters.

Current CMS options for educators seeking to author or otherwise modify computer-aided teaching and learning materials are available with only a modest starting investment. "Electronic transparencies," some of which are authored by CMS vendors on contract from publishing companies, are presently available free to faculty who adopt a variety of accounting, business, and other textbooks. With added investments in CMS authoring options, these electronic transparencies can be added to, updated, and otherwise modified by the adopters. Most publishers now have electronic transparencies for basic accounting texts that can be modified without any investment in authoring systems. Those systems are not full CMS systems, however, and they have very limited (or sometimes nonexistent) features for graphics, animations, audio recording, and full motion video. One of the most interesting servers for technology in education is the MIT university "MIT EVAT Report-Models for the Future" at <http://www-evat.mit.edu/report/>. Possible uses of the Internet by practicing accountants and some interesting site addresses are given by Cohen (1995). Internet sites for accounting educators are discussed in Chapter 4.

Some argue that CMS or other CAL electronic transparencies are little more than glorified overhead transparencies and slides. This view overlooks the power of the computer for text searching, random access, hypertext features, hypermedia features, and interactive learning from electronic courses used outside as well as inside the classroom. Scientists are far in the lead in accepting the power of computer visualizations for learning and research. CAL entails far more options than simple electronic transparencies. Given present campus networking and emerging national networking and multimedia opportunities, we argue that CMS authors and users will go much further in the future. CMS authors linked by desktop computers around the world will become major forces shaping the education of the world. Due to current and advancing technology in this area, we think innovative CAL eventually will focus on networks linking urban and rural locations worldwide. Educators will generate customized multimedia pedagogy to be networked to on-campus and/or off-campus learners who interactively participate in the learning processes. Traditional concepts of "classrooms," "courses," and "class hours" may be drastically altered. Learners will have vast choices of where, what, how, and when to engage in interactive learning activities. It is increasingly common for educators to communicate with students via e-mail, but few take it as far as University of the South Professor Gerald Smith according to an article in the San Antonio Express News on May 8, 1994. In Smith's class there are no longer test papers, hand outs, text books, or term papers. Everything, including class discussion, is conducted on network. A similar paperless approach is taken in accounting education by Professor Rubik Atamian at the University of Texas - Pan American. Alternatives such as email, BBS services, and Groupware for networked PC instruction are compared at Texas A&M

University by Klemm and Snell (1994). They conclude that desktop conferencing is the best alternative and compare alternative vendor products for such purposes. For accounting educator Internet networks see ANet and PIC-AECM. Farrington and Eeley (1994) describe how networks are being integrated at the University of Pennsylvania, including campus electronic publishing and distributions on "netbooks" and "disc-books."

Some professors argue that classroom electronic transparencies are merely a poor man's rendition of videotapes and televised education. We argue that their graphics capabilities, retrieval speed, database storage, and rapid inexpensive capabilities for customized revision make them a much more viable and personal medium than television. Video footage without graphics is like a home movie and is seldom useful in classrooms. Until very recently, video footage with graphics cost upwards of \$1,000 per second (using very expensive studio production facilities) and was not easily customized and updated by individual professors.

Most emphatically we are not arguing that computer-assisted teaching take the place of videotapes or compact discs in teaching! Classrooms of the future will be equipped with multimedia learning facilities; in fact, they may not even be classrooms in the traditional sense. But unlike the videotapes and compact discs that are now available, instructors will be able to make their computer-assisted teaching be an extension of their personal style and preference, by using customized aids to teaching and learning. We have some videotapes that were purchased or sent to us by publishing firms, but these videos were conceived, written, directed, filmed, and edited by someone else. Our computer projected visual aids were conceived, written, directed, authored, and edited by US!

Events are transpiring that suggest accounting courses of the future will be less debit and credit oriented, less FASB rule oriented, less GASB rule oriented, less SAS rule oriented, and less technical in general (e.g., see Wyer (1993)). This is the main theme of the Accounting Education Change Commission's Position Statement No. One (1990), and the plea of public accounting firms who sponsored the inception of the AECC. Our courses are to become more conceptual and career inspiring, although accounting education should not, in our opinion, depart entirely from some grounding in technicalities. According to Milbank (1992), Professor Richard Florida of Carnegie Mellon University advocates treating students like customers and allowing them to choose what they learn. Interactive CAL cannot replace the need for human instruction, but it can be a tremendous supplement to "customers" choosing what they want to learn.

Computer-assisted teaching (CAT) allows us to efficiently help students visualize technical matters without having to devote as much class time to details as in the past. CAT that is cleverly designed helps students learn technicalities at their own pace of learning. We use CAT to get students started on a technical problem in the classroom. Later on, they can privately finish it on network in a CAL setting. Students can replay technical explanations repeatedly until they master details on their own outside the classroom. More class time is, thereby, available for cases, visiting speakers, student presentations, videos, etc.

Publisher Supplements

We are grateful to the vendors of commercial CAL materials who provided us with the listings shown in Appendix 1. Although we are critical of some of this material in Jensen and Sandlin (1992a, and 1992b), it should be noted that most of the CAL items listed in Appendix 1 are either new or forthcoming, so our old criticisms may no longer apply. In some instances, however, we are still critical of the newer CAL materials, especially the supplements to accounting textbooks.

In contrast to CAL language, medicine, music, and science education (e.g., the ADAM anatomy electronics materials that are so popular in medical schools and bilingual science products from Integrated Learning Systems), disappointments for us after having examined most publisher-supplied CMS "electronic transparencies" for college **accounting textbooks** include the following:

- (1) Superficial coverage of chapter contents (mostly chapter outlines and material already in hard copy instructor study guides).
- (2) Little or nothing added that isn't already in the textbook, especially in terms of added literature citations and materials that allow an instructor to do more than repeat what students have already read in their texts. For example, one basic accounting text has a CD-ROM version, but the disc is not a hypertext or hypermedia extension. The CD-ROM simply contains parts of the textbook in word processing form. For example, it is not like the CD-ROM version of the highly popular calculus text by Anton (1994) which has hypertext navigation controls, audio, and animated graphs such that the hypermedia book contains more than its hard copy counterpart.
- (3) The shortage or complete absence of animation in equations, tables graphs, exhibits, etc.
- (4) The shortage of imaginative graphics and color animations in videos. Videotapes and videodiscs provided as free accounting textbook supplements are little more than video camera footage of lecturers, interviewees, or factory processes with little or no videographics and hypermedia nonlinear navigation controls. Exceptions to this are the high quality videodisc training modules developed in England by Price Waterhouse (see the Appendix).
- (5) Limited or no color variations. This is partly due to the publisher's desire to have the material display well on monochrome LCDs as well as color LCDs. This is not such a limiting factor in newer publisher supplements that tend to have VGA.
- (6) The shortage or complete lack of detailed problem solutions in multimedia supplements. The problem solutions may still be limited to hard-copy instructor's manuals with some spreadsheet templates.
- (7) Little or no use of the many CMS options such as conditional branching and menu-choice branching for interactive learners.
- (8) No extensions into interactive multimedia comparable to what publishers are now providing with many elementary and secondary textbooks in other disciplines. In particular, we are referring here to CD-ROM hypermedia discs. For example, large publishing firms have Authorware or comparable CD-ROM hypermedia supplements for introductory psychology and calculus but no such CD-ROM supplements containing audio, video, and animations for any accounting textbooks to date.
- (9) No interactive lessons and graphics on videodiscs that are currently being made available to accounting educators. The few videodiscs that are emerging are not an integral part of

computer hypermedia. The only exceptions we have found are the innovative Price Waterhouse training videodiscs listed in the Appendix, but at a price of \$4,000 each these are not going to be adopted by many colleges and universities.

In fairness, it should be pointed out that publishers are just beginning to experiment in providing CAL supplements to their college accounting textbooks. Massive investments in terrific CAL aids to be freely given away to educators are probably not cost effective as free supplements to accounting textbooks as they are as supplements to science and mathematics textbooks having larger basic studies and secondary school markets. To date, accounting CMS supplements for accounting educators have often been rushed out by general programmers who are not specialists in the subject matter (whether it be accounting, economics, electronics, or automotive mechanics) that they are asked to author as textbook learning aids. Also the development corporations usually have not been given sufficient contract fees to do their best work. The CMS supplements have sometimes been hurried to the market full of errors and shortcomings. Some publishers such as Prentice-Hall and Houghton Mifflin had CMS HyperGraphics supplements in earlier editions of introductory accounting texts and then dropped them in later editions.

In the Appendix, it can be noted that many publishers offer spreadsheet supplements for accounting textbooks. Some of the other the Appendix findings are summarized below:

- (1) Some publishing firms offer electronic transparencies in either Astound, PowerPoint, or related presentation software.
- (2) Videotapes are sometimes available. Only recently have a few publishers ventured into videodisc supplements for accounting principles texts. These discs tend to be mostly video camera footage with little or no videographics and hypertext.
- (3) Computerized cases and practice sets are more common and some of these are quite good, although none, to our knowledge, are yet in hypertext or hypermedia formats.
- (4) Increasingly, publishers are offering supplements containing computerized databases of annual reports and/or financial data from real-world companies.
- (5) McGraw-Hill offers custom publishing such that instructors can choose what portions of text material to combine into a text and the personally desired sequencing of chapters. Instructors can add some of their own materials to these customized texts.
- (6) Publishers may one day offer accounting texts in CD-ROM or another electronic medium other than hard copy, but their strong biases for hard copy will delay for many more years

their offerings of electronic or network alternatives to hard copy. For example, one publishing firm has a CD-ROM version of a popular introductory accounting text, but the disc is not a hypertext or hypermedia extension. The CD-ROM simply contains parts of the textbook in word processing form. Although not in accounting per se, a noted exception and good example of hypermedia learning material is Harvard University Christopher Bartlett's CD-ROM (with Sumatra Ghoshal) entitled Managing International Business (See Appendix 1). This disc combines accounting, finance, marketing, and international strategy in the hypermedia presentation of three Harvard cases (Phillips & Matsushita, Proctor & Gamble, and Asea Brown Boveri (ABB)). There are some good accounting firm hypermedia training materials available from accounting firms, but these are often too expensive and too narrow in scope to be of wide use to college educators. Excellent examples are the Price Waterhouse videodisc offerings at \$4,000 per disc (see Appendix 1). Since both the Bartlett-Ghoshal and the Price Waterhouse Appendix 1 offerings are intended for use by individual students interactively (as opposed to class presentations), the costs to equip entire student laboratories are prohibitive.

- (7) The **A**tkinson, **B**anker, **K**aplan, and **Y**oung (1994) textbook entitled Management Accounting is noteworthy as being the first accounting text accompanied by an Internet bulletin board. Prentice-Hall was the first publishing company, to our knowledge, to offer an interactive two-way network dialog between adopters of selected textbooks and the authors of those books, including a bulletin board of latest readings related to the text, abstracts of related literature, and classroom aids. The ABKY network was the first of the Prentice-Hall offerings to adopters and is available on listserver@watarts.uwaterloo.ca.

Database servers are now on line for educational cases in business and accounting. For example, ECCH cases are available on the Internet (European Case Clearing House, Cranfield Institute of Technology, Beds, MK43 0AL, United Kingdom, 0234-750903.) The ECCH now offers an on-line network server for international cases. Although none of the cases are, as yet, in hypertext or hypermedia format, it is a useful feature to have cases available for file transfer on the Internet. The Harvard Business School now has some cases on CD-ROM. Although most of these are not in hypermedia or hypertext formats, they can be electronically searched. The CD-ROM course module "Managing International Business" from the Harvard Business School has some multimedia features (see the Appendix for the address and email instructions).

Perhaps some of the dilemmas of the publishing companies are best stated by the following anonymous response to our Appendix inquiries:

Some thoughts without attribution: Advances in the use of electronic delivery systems are accelerating all the time. Already we could be well into the era of integrated media systems except that it takes money, and where does the money come from? Traditional text publishers (I spent 30 years with ~~XXXXXXXXXXXXXXXXXXXX~~ publishing company and was closely associated with both their ~~XXXXXXXXXXXXXXXX~~ Programs) have so badly polluted the market with free non-book materials the academic community has been

spoiled into expecting free non-book materials in the future. But if a publisher were to attempt to change this, not only would the change be directly in conflict with expectation, how would a faculty member, or a student pay for it. (In the last two years the most common topic of discussions at the American Accounting Association national meeting was the effect of budget limitations on departmental and personal operations!)

Questions to Ask Your Textbook Publisher

While many textbook publishers supply CMS supplements, there is still much room for improvement. The following questions need to be directed to these publishers.

- (1) Are CMS or other computer aids (CD-ROMs, videodiscs, etc.) and supplements available for classroom presentations? Can these or other supplements be used in computer labs and on campus networks without hardware or licensing difficulties? Can runtime versions that do not require the purchase of software licenses be loaned or given to students by their instructors? These supplements are not the same as the practice sets, spreadsheets, test banks, and other computer supplements traditionally made available with all basic accounting textbooks. Do classroom teaching supplements have font sizes suited to large classroom projection screens? Do they have chapter menus so that they can be easily accessed during classroom lectures? Are they interactive in hypertext and/or hypermedia? Do the CD-ROM supplements have full-motion video clips, audio files, animations, and graphics images? Do the videodisc supplements have professional videographics? Are they of comparable quality to supplements being developed in the sciences and humanities. An example of what can be done in hypermedia is provided by the Voyager Company CD-ROM entitled "Who Built America?" This is a scholarly hypermedia account of U.S. history between 1876 and 1914. To our knowledge, supplements available in accounting and business are no where near the quality of "Who Built America?" For example, the Richard D. Irwin publishing company (See Appendix 1) has a CD-ROM version of the Larson text, but the disc is not a hypertext or hypermedia extension. The CD-ROM simply contains parts of the textbook in word processing form.
- (2) Do they have detailed and animated end-of-chapter solutions with quality graphics or are they generally lecture outlines and/or fill-in-the-blank student study guides? None of the CMS supplements to date, for example, have problem solutions suited for classroom projection. Some have computer spreadsheet template solutions, but the fonts are too small for effective presentations in front of large classes. Were CMS supplements authored by accountants? Some supplements have been generated by software development firms who do not employ accounting specialists. Authors who are not accountants are less apt to include and material that is not written in the textbook. Were the textbook authors actively involved in supervising and editing the supplements?
- (3) Can educators easily edit, update, and add problem solutions to their lecture and problem discs, or is the material recorded on sealed discs like CD-ROMs? What systems are required for modifying publisher-supplied discs? DOS? Microsoft Windows? Mac processors? HyperCard? Toolbook? **Commercial CD-ROMs (and other read-only discs such videodiscs, CD-I discs, and CD-MM discs) will not supplant the**

need for CMS materials, because read-only discs cannot be authored, edited, updated, customized, and otherwise modified by most individual educators.

Accounting, auditing, and tax pedagogical materials need frequent changes to avoid obsolescence. Most educators, in our viewpoint, will not be happy with electronic learning materials that they cannot update, add to, and customize for their own pedagogical styles and preferences. CD-ROMs and CD-Is have a place in multimedia education, but they will only be one component that is combined with material authored by individual educators.

- (4) Can instructors and students easily jump from both authoring and runtime modes into DOS and then return to exactly where they were in the lesson? These are nice features in most CMS options that are not in some of the non-CMS supplements.
- (5) Will infra red (IR) hand-held remote control devices work for classroom presentations? These are commonly used in electronic "slide" shows and HyperGraphics CMS. Publisher supplements that utilize mouse controls do not, to date, have full-featured track ball delivery from wireless remote controls.
- (6) Does the publisher offer both PC and Mac versions of supplements? If DOS versions are run on Mac computers, do they run in slow motion animations and what color and other qualities are lost? What animation, color, or other features are lost in translations from Mac to Windows versions?
- (7) Do the supplements have optional versions providing more color variations for users having VGA versus older CGA color adapters? Are the supplements restricted to monochrome versions?
- (8) How often will newer updated versions be available? Do new textbook additions have revised CMS supplements provided with previous editions?
- (9) What are the authoring and runtime licensing restrictions on use by educators and students? Are there authoring license discounts to adopters of the text?
- (10) Can these supplements be networked for student use on and off campus? Can publisher-supplied discs be loaned or copied for student use in residences? What are the added network technical installation and network licensing restrictions? Some CMS systems are difficult to install on network. Presently most vendors do not charge extra for educational network licensing, but network licenses in business firms and government are sometimes very expensive (even for training courses).
- (11) Can the supplements be easily used with hand-held student response pads or other means of student interaction in the learning process? Although built-in CMS codes for remote control were once a unique feature of HyperGraphics, limited remote control devices are now available for menu-driven supplements of other supplements.

- (12) Do the supplements allow the instructor to keep a complete roster for each course, record response frequencies, give tests, and flash response frequency distributions on the screen? Can the progress of each student on network or in a computer lab be tracked for each lesson section?
- (13) Can the instructor flash a student's name at random on the screen to prompt that student to respond? This feature in HyperGraphics is great for holding student attention to the lecture or case discussion in class.
- (14) Do the supplements have literature citations and other materials not found in the textbook **(such that the instructor's in-class presentations can be more than regurgitation's of material students can learn from the text)**? Publishers often supply this material in instructor handbook supplements. These might also be provided in CMS discs so that instructors may refer to items that have not already been mentioned in their textbooks. Most CMS supplements now provide demonstration problems and review questions not contained in the textbook chapters.
- (15) Are the supplements field tested? For example, the Arizona State University hypertext lab course now offered by McGraw-Hill has been extensively tested in accounting computer labs at over 25 colleges and universities. Rick Birney authored an extensive ToolBook (but not Multimedia ToolBook) project for basic accounting computer labs at Arizona State University. The lead professor for these lab courses is Ralph Smith. This is an extensive project that includes tracking of student progress and computer examinations. The lab course is available from McGraw-Hill (See Appendix 4) and described in CETA Newsletter, November 1993, p. 4. It is also reviewed in Syllabus, September 1984, p. 36.
- (16) If the learning materials are designed for individual student interactive learning in student labs or on campus networks, what are the group purchase and/or network license fees? Excellent works such as Bartlett's CD-ROM and the Price Waterhouse videodiscs, for example, may be viewed as too costly for multiple users on campus.

Customizing CMS Supplements

If the textbook of your choice happens to have CMS or other electronic transparency supplements, these might give you a foundation on which to build your own customized color and animated lecture aids. You may want to get a CMS authoring license so that you are allowed to edit, update, add problems, and solutions to the publisher-supplied discs. Our strong recommendation, however, is that you, like us, delve into authoring your own CMS materials "from scratch." This lets you optimally choose your own preferred style and content. It forces you to evaluate alternative means of presenting topics and cases. It allows you to change textbooks without having to lose supplemental CMS material provided for a prior textbook. Authoring your own CMS aids does take considerable start-up time. Once these materials are in place, though, most CMS packages make revising and updating relatively easy. Our experience is that we now save a great deal of time and effort in

course preparation by having our CMS files continuously up to date so that materials needed for a given lesson can be selected on a given day.

You can become quite efficient and minimize the time it takes to author and revise CMS materials. You may save time by using the following methods:

- (1) Importing text from your word processor or scanner. For example, if you have a research paper on your word processor and would like to make an animated color presentation of parts of your material, **you do not have to retype your work**. Simply import the parts you want to present and then change text colors, font sizes, highlighting, and animation on the imported text.
- (2) Using a **mouse or stylus** for graphics drawing and cursor movement.
- (3) Using an **optical scanner** to copy text from any hard copy material that can be legibly copied on your scanner (scanners vary as to ability to copy small symbols, colored pages, and fine lines). For example, data tables, pictures, cartoons, text material, etc. can be fed into your CMS lessons without having to initially draw or type. You can then modify the scanned material to add color, text, and animation.
- (4) Using a **capture utility** to make a clip file of all or any part of any screen on your computer (for example, a Lotus table or Harvard Graphics chart). Most CMS options either have capture utilities or they will read common graphics files such as TIFF and PCX that are generated from any of various graphics or capturing software options. You can then alter the pasted clip with new text, coloring, animation, and added graphics. Graphs, exhibits, tables, and equations are often much more interesting to students if colored parts evolve in timed animation rather than having all of the detail flashed on the screen at one time.
- (5) Using a **merge utility** that allows you to copy pages from one lesson into other lessons. There are times when literature reviews, exhibits, or other pages fit into more than one lesson or course.
- (6) Using a **video capture** utility to import still frames or sequences of full motion video into your lessons. Capturing video frames avoids a lot of drawing or more complicated picture importing from sources such as Kodak Photo CDs where film has to be specially processed and put on CD discs in processing labs. Imported video images can be modified provided copyright laws are not violated.
- (7) Using a **compression utility** to compress your completed lectures into space saving files. An entire course with thousands of screens can be stored on one floppy disc in compressed form. It is very time consuming to have to repeatedly load new discs during either authoring or course delivery sessions. For example, HyperGraphics has utilities for compressing (building) and decompressing (unbuilding) authored lessons. Other vendors may not have similar utilities for entire lessons, but many can now handle graphics compression (e.g., JPEG compressions) and video compressions (e.g., Quicktime compression).

Advantages of Computer-Aided Teaching

Change is never easy, and learning to author your own computer projected materials will take time and effort. And after you have learned, it takes time, effort, and creativity to program your presentation. There must be gains to you in terms of your efficiency and effectiveness or you will be disappointed in the results. Some of the many advantages are listed below:

1. **You can enhance your research presentations** Have you ever attended conferences where researchers point to overheads that you cannot read or follow? Almost as bad is having to sit in the audience and leaf through pages of the paper while the presenter is talking. Instead, that researcher could have imported parts of the text and graphics into an animated show where graphs, tables, and equations evolve in large size and multiple colors. The presenter can control it all with a remote control. Vast amounts of material can be stored and then used to answer questions from the audience. All equipment necessary for the presentation can be carried in a brief case.
2. **You will be better equipped for today's generation of young people weaned on television, videos, and electronic games.** Many of today's students are incompetent and/or impatient readers. Purists may try to force these young people into becoming avid book readers who long to devour contents of libraries, but realists in modern education assert that purists will thereby fail to reach a large percentage of today's electronic generation. Instructors today have a harder time luring students to class and capturing attentiveness in class. From kindergarten through doctoral seminars, instructors are finding it more necessary to vary classroom time between alternative modes of instruction --- videos, cases, role playing, question and answer, lectures, field trips, visiting speakers, mentoring programs, and (possibly) computer-projected teaching and computer network teaching. Jim Wilson (1990) of the Texas Education Corporation states the following after adopting HyperGraphics in electronics training:

When potential students sit in on a class session, they realize how easy it has been made for them to approach learning, and that completely changes the psychology of the classroom. For many, this is perhaps their first positive learning experience. The result is that they stay in class. As outlined above, improved learning results since students' attentiveness is held at a high level throughout the class (emphasis added). (p. 6)

In Garland et al. (1992) states the following:

Many of us believe the electronic enhancements make the material easier for students to interpret. These enhancements are not simply a different way of doing things but represent a better way of presenting material. We are providing students with views of our material which printed material and the ordinary lecture cannot provide. There is no way in which a three-dimensional economic production surface can be displayed and rotated in a transparency, a lecture, or a book. but it is easy to do with a computer and display. And once seen, it is simple

to explain to students the difficult concepts of returns to scale and returns to a variable input.

3. **You will be forced into giving more thought and attention to course preparation and teaching creativity.** You may have taught a course for so long you can almost do it entirely on automatic pilot. Forcing yourself into authoring the entire course will awaken you to new ideas for creativity, innovative ways to animate problem solutions, and searches for relevant material not in the textbook. Some might feel this is more of a one-shot set-up cost, but our experience has shown that we spend as much time revising and updating for repeat usage as for first-time preparations. This is not entirely an "advantage" of CMS due to the time and trouble it takes each day, but it pays off later in the time and trouble it saves us in preparing lessons and off-campus presentations. We also find this "database" helpful in research projects. Our conclusion is that adding updated material is vitally important even if doing so can be a burden if it is done on an almost daily basis.

4. **You can make available (in a computer lab or campus-wide on a computer network) both the material you present in class plus added material and problems that you want students to study outside the classroom.** Most campuses have a network of some type even if it is a network accessible only from computers in the computer center. If networks are not available, CMS runtime discs may be loaned to students or placed in computer labs on campus. As indicated previously, our students can replay our lectures and problem solutions at their own learning pace any day at any time of day. Our students spend less time trying to take notes and more time trying to follow the flow of in-class explanations. If our university was networked to other campuses, we could present our research findings with animation and graphics in an interactive mode that exceeds mere teleconferencing capabilities. Even without access to global networks, our research presentations are now sometimes sent elsewhere, including Europe and Singapore, on CMS floppy discs. Some researchers are able to make suggested revisions and additions on these discs and return them to us. We thus share research back and forth in a CMS language filled with animated equations and graphics.

5. **You and/or your students can randomly access your lecture notes and other displays for all or part of an entire course.** Both hard copy hand outs and acetate overhead transparencies are bulky to store and difficult to access without fumbling about. With electronics, you get menus and instant access to entire courses. This especially helps in repeating material and course reviews.

6. **You can avoid chalk dust. What you put on the "board" earlier is not permanently erased and can easily be repeated in animated evolution just as it was the first time it was presented.** One of the things our students like best is our electronic ability to go over something a second or third time if there was something they missed along the way.

7. **You can pack onto a small disc multiple courses, research papers, literature abstracts, and other materials that would fill a large room in hard copy equivalents.** This is especially useful for professors who travel around the globe. Only HyperGraphics and Quest CMS packages have compression utilities, but newer compression options are available such as Intel's DVI and Apple Computer's new QuickTime (both Mac and Microsoft Windows versions are now available).

8. **You and your students will be better prepared to adjust to the times when the "information highways" come to town.** Rivera and Singh (1994) contend that Mosaic accesses to graphics, video, and audio on the Internet are already educators' best friends. Rutherford and Grana (1994) explore how to create a "family" of learners in remote locations using interactive video teleconferencing. These present technologies are wonderful, but they are only precursors to the true information highway. Already AT&T Corporation has its fiber optic Synchronous Optical Network (Sonet) operating as a transmission backbone (with flow capacity of 155 megabytes per second) across the United States. Technologies are coming to a head and plans are being laid to bring the digital information highways to Main Street USA and elsewhere in the world. In homes and offices, a single piece of electronic equipment (let's call it the **PCTV** computer/television superhighways terminal) will combine what are now television sets, telephones, stereos, videotape players, videodisc players, compact disc players, and computers. The PCTV will be networked to hundreds of millions of "servers" ranging from the computer files of individuals to the systems of computer files that contain *virtually* all the movies ever made, all the contents of daily newspapers, all the "television" shows ever recorded, all the cataloged products and services available from vendors, all public documents of governments, all the contents of libraries, all instructional and training courses on most anything known in the world, and so on to limits beyond our present imaginations. There becomes little reason to hide any piece of information from the networks provided sufficient controls are in place to limit access by transaction price, security clearance, privacy considerations, and legal constraints, including worldwide copyright protections and penalties. Each PCTV terminal on Main Street will be connected to millions of servers containing financial information and education/training aids on how to interpret and use this information. Instead of annual and quarterly printed financial statements, business firms will be make information (publicly or to selected employees) available, say, daily. Brokerage houses and security analysts will also be able to provide information and analyses in real time. Stock exchanges, bond exchanges, and commodity exchanges may even disappear if networked buyers and sellers are allowed to trade directly with one another. Students of the next century will have to know how to navigate networks of the world. Industry and corporate data will soon be available on vast file servers of the information highways. As pointed out initially in this book, the roles of professors will be changing as follows:
 - a. Course instructors will play a larger role in inspiring students to want to learn more about a subject and a smaller role in explaining that subject to students.
 - b. Course instructors will spend more time authoring hypermedia materials that will be available at all hours on campus networks and recording compact disks to be available to students.
 - c. Course instructors will play a much greater role in selecting learning goals and helping students to choose from a mind-boggling multimedia library of worldwide learning material that will build at an exponential rate in the next century.

- d. Some instructors will build international reputations for creativity in authoring and continually updating hypermedia learning materials made available on vast, worldwide education networks.

9. **You can react to appeals of the Accounting Education Change Commission.**

According to the Accounting Education and Change Commission, the number of high-quality students majoring in accounting has been declining in large measure due to the boring way technical details are focused upon in accounting, auditing, and tax lectures. In the next century, technical details will be taught better by networked hypermedia learning materials in virtually all academic and vocational disciplines. This will allow "live classrooms" to exploit what can be done better in face-to-face teaching (e.g., see Jensen 1993). Things that can be "done better" include visiting speakers such as accountants on a variety of career tracks, student group presentations, some types of case-method instruction, student role playing, field trips, etc. At Arizona State University, a concerted effort is being made to teach accounting principles of bookkeeping in computer labs (for credit) so that class lectures can be less technical and more inspirational. The lead professor for these lab courses is Ralph Smith. This is an extensive project that includes tracking of student progress and computer examinations. The lab course is available from McGraw-Hill (See Appendix 4) and described in CETA Newsletter, November 1993, p. 4.

10. **You can use some CMS software to randomly select students to answer questions in class or respond in case discussions.**

Using a remote control button you might even flash names randomly on the screen. If students are aware that the process is random, it avoids criticisms that the instructor is biased in calling on certain students at certain times (although nothing prevents the instructor from also selectively calling on students if such bias is intentional).

11. **You can achieve greater curriculum uniformity (e.g., in 10 discussion sections of basic accounting taught by doctoral students, for instance), you can have multiple instructors teach using identical CAL aids, thereby, facilitating greater uniformity of coverage.**

Instructors may use different teaching styles, but students will have all seen the same examples, demonstration problems, etc. This facilitates preparation of common examinations for multiple sections. Examinations can even be administered from the computer in class or in computer labs. Since we personally think total uniformity is seldom ideal, it is also possible to have a uniform base with added materials customized by individual instructors.

12. **You can interact in class with students via electronic response pads or ideally via entire keyboards.**

For example, one of the frustrating aspects of teaching is having to wait until examination periods to discover that you just were not reaching some students. With electronic response pads, you can ask key questions at any time, get instant frequency distributions of right and wrong answers, and take remedial action while there is still time in the course to reach the students needing added help. Students may also anonymously vote on what material they want covered or reviewed.

13. **You can set up remedial lessons and tests on networks that allow slow learners and students who miss class opportunities for self-help.** For example, in most CMS software it is possible to ask true/false, multiple choice, or short open-ended questions or problems and then have programmed branches for anticipated right or wrong responses. Conditional branches may be programmed so that the student is automatically taken to appropriate remedial lessons depending upon responses given to questions. This allows instructors to concentrate on matters of greater importance during class time, reducing technical detail and allowing time for more overview and case analysis material.
14. **You can become a part of a world wide movement of researchers experimenting with new and creative ways to utilize modern technology in education.** CAL has become of vital concern worldwide. For example, the Delta Project is a European Economic Community (EEC) funded project of the Commission of European Communities. With a budget of over \$100 million, this is probably the world's largest attempt to apply modern technologies to distance training and education. Partners in the project include major universities, telecommunications companies, and business firms of all sizes across the EEC. Collis and de Vries (1994) report on 27 major projects with over 300 sub-projects in network education and multimedia development. There's an old saying that "You have to join in the game for any chance to win the game." Researchers probably fail more often than they win, but new and creative ideas are born in earlier failures (Edison had a succession of colossal failures before he had his first inventive success). On the cutting edge of this medium are the computer-created worlds of "virtual reality" such that we could take our students into "virtual" Japanese factories, auditing simulations at "virtual" sites, or "virtual" training centers for training students in the use of Lexis computers to perform database searches in financial reporting. Wheeler (1991) has stated:

In the simplest version of the virtual worlds, computers generate images on goggles worn by the users, creating the sensation they are in a different place. Those developing the virtual realities hope they will open up new intellectual vistas in education entertainment, art, and architecture, as well as in science (emphasis added). (p. A6)

Since accounting and business must compete for student talent, it is important that we also explore new approaches of generating career interest. Scientists are making a concerted effort to use new multimedia technology to interest students in science. Although virtual reality most of its applications to date in training and entertainment, there are some applications in data analysis such as the use of VR to analyze international portfolio data in the TIAA/CREF Pension Funds. Winn (1984) contends VR will become a major part of university curricula. He cites evidence that VR is especially successful for learning disadvantaged and physically handicapped students.

15. **You may become part of future efforts to educate the people in other nations without having to physically leave your campus.** The American Accounting Association recently undertook a project to solicit accounting books to ship to Africa. As wonderful as this sounds, most of the books will be obsolete by the time an African student finally reads them. Also, shipping tons of hard copy is expensive and limited to one repository (library) where a particular book happens to end up. **One day it will be more efficient and effective to ship pocket-sized discs with updated graphics, text, illustrations, and data monthly to thousands of repositories or to an entire Third World computer network.** There are still problems to surmount, but the United Nations and other organizations promoting Third World education are now providing and will continue to spread computer technology into underdeveloped nations. Hardware will become available at many sites around the world. The tough part will be providing suitable educational materials to make students want to learn and to keep them abreast of the latest happenings. You can help undertake an effort to customize CAL materials for their eventual needs. Academic potential of distance learning in business administration is discussed by Frand (1994).

16. **You will find funding sources for technology research and application increasing at a much faster rate in the future.** Faculty who gain early experience in these technologies will have a head start in applying for funds. Already funding sources such as NCAIR are making grants to accounting educators. See Eckstein (1991) for a discussion of funding and its sources. In Europe, a major funding opportunity arises in the Delta Project.

17. **You may discover that new technology can lead to more cross-discipline research and applications.** International networking facilitates joint efforts and collaborations across vast distances.

18. **You can avoid teaching toward obsolescence.** The worlds of communications and commerce are changing dramatically, and students need to be prepared for the present world of electronic communications, JITT, international networks, and random access databases. Burke (1993) found in a survey of barriers to firms adopting electronic data interchange that lack of education in technology was a major barrier.

19. **You can play a greater part in developing and sharing learning materials with professors and students in foreign nations** notably underdeveloped nations. Rather than **old** books you can send **new** computer files. The American Accounting Association recently undertook a project to solicit accounting books to ship to Africa. As wonderful as this sounds, most of the books will be obsolete by the time an African student finally reads them. Also, shipping tons of hard copy is expensive and limited to one repository (library) where a particular book happens to end up. **One day it will be more efficient and effective to ship CD-ROM discs or network server files with updated graphics, text, illustrations, and data to thousands of repositories or to an entire Third World network.** There are still problems to surmount, but the United Nations and other organizations promoting Third World education are now providing and will continue to spread computer technology into underdeveloped nations. Hardware will become available at many sites around the world. The tough part will be providing suitable educational materials to make students want to learn and to keep them

abreast of the latest happenings. You can help undertake an effort to customize CAL materials for their eventual needs.

20. **You can provide aids to handicapped learners** Computers are a tremendous aid to many paralyzed persons. They are also becoming a more important aid to other handicapped learners such as the deaf. Linda Wilson (1993) reports on Cynthia King's research at Gallaudet University in Washington DC on four projects to bring multimedia learning to deaf students through innovative captioning tools.
21. **You can obtain both higher student performance and evaluations.** Education research from kindergarten through graduate school have shown improved student learning performance can be achieved when instructors adapt technology to suit their own teaching methods and biases. Student evaluations obviously are subject to many variables. Using technology badly won't help instructors achieve high evaluations, but using technology wisely has been shown to improve student evaluations of their instructors.
22. **You will discover that new technologies are vastly superior and cheaper than anyone anticipated.** Desktop recording of CD-ROM discs holding 16,000 pages of text and/or audio and video clips is now within reach as easy as desktop publishing. With newer compression techniques such as PKZIP, JPEG, and MPEG, the amount of capacity can be increased to the equivalents of over 100,000 pages. Video recording, editing, and digitizing that used to require professional studios now can be done for under \$25,000 in faculty offices. Technical explanations that are hopelessly complex on paper may be much easier and more interesting to follow in animation and video formats. Since users have limited time to devote to the report, having animated graphics, videos, and audio segments may make it easier to absorb more information in less time than that required for reading through printed pages containing the same information. Paivio (1974) reviewed early psychological studies have shown that visual patterns are more easily comprehended and retained than text and table presentations. The ability of listeners to recall song lyrics versus memorized readings of text demonstrates the importance of audio for long-term memory. Hypermedia is in many ways a natural extension of the demonstrated significance of graphics over text in accounting reports as shown by Beattie and Jones (1992), DeSanctis and Jarvenpaa (1989), Leach (1989), Steinbart (1989), and Wood (1990).
23. **You can create interactive and animated hypermedia graphics and simulations that bring students closer to realities and experiences of the outside world. Students may also create hypermedia in their own learning projects.** You and/or your students can go on site to a factory, refinery, warehousing center, department store, government accounting office etc. to videotape/photograph and systems and people. Video (multimedia) boards allow you to play videotapes on computer monitors. Frame grabbers may then allow you to capture realism and enhance images for presentations. New hardware and software on the market make it possible to import (digitize) scenes from videotapes, 35 mm slides, and photographs into your CMS lessons. You can add full motion video files and audio files that students can interactively select and repeat from campus network computers. Financial analysts at TIAA/CREF enter a world of virtual reality to conduct security analyses for international portfolios. Possibly our students would benefit immensely from having an opportunity to see first hand such simulated realities and data mining.

24. **You can share the same cart computer or network server used by other instructors.** For example, suppose instructors for ten sections of Principles of Accounting I all share the same courseware on a campus server. Instructors can share common files and also add their own customized files for teaching a course. Instructors using the same materials need not teach in exactly the same styles or even at the same lesson pace throughout a semester.
25. **Professors at The University of Northern Iowa (UNI) have conducted a two-year effort leading to a paperless classroom for instruction in accounting and finance at the UNI** according to Wyatt and Heian (1994). By using computerized spreadsheets to facilitate concept/technique presentation and examinations, these educators feel that the rigor of the course material has been increased while the per student labor intensity of evaluation has been decreased. A by-product is that students gain mastery of spreadsheets by using them to resolve test problems. In addition, the use of this testing tool enhances students' ability to deal with real-world complexity rather than using simplified data. The computerized testing uses complex multi-step-to-solution problem databases. Students and instructors must learn to manage detail rather than avoid it for lack of time or sufficiently powerful computational tools. Wyatt and Heian (1994, p.10) assert the following advantages that they have noted in their use of computer-assisted testing (we have slightly reworded their listing):
- a. Students can be given complex data intense real-world problems rather than simple abstracted problems designed to be computationally-friendly.
 - b. Students work in a professional environment with professional tools.
 - c. Students are no longer passive but must research and master complex concepts and tools.
 - d. Professors minimize the drudgery of examination scoring thus permitting an increased focus on the design and pedagogy of the examination (with overall reduction in time spent per student on examinations and concomitant larger class size).
 - e. Because working computerized solutions to problems may be shared with students before and after classes and test periods, professors can devote more classroom time to conceptual issues and to qualitative factors (such as data access and quality) an outcome sensitivity
26. **Publications, videos, workshops, and conferences are available for training educators for authoring and/or using hypermedia learning materials.** For example, the IAT Institute for Advanced Technology (See Appendix 6) has course materials, training workshops, the INFOBITS Electronic News Service, videotapes, satellite broadcasts, the Express Author front end to Multimedia ToolBook, and prepared hypermedia learning materials. Apple Corporation offers a variety of similar products and services for Mac and Power PC users. See Appendix 6 for listings of training programs around the world. Two accounting educator networks on the Internet help to the academy informed on technological developments and opportunities. These networks are as follows:

PIC-AECM = **P**acioli **I**nternational **C**entre for **A**ccounting **E**ducation using **C**omputers and **M**ultimedia, Loyola College in Maryland, 4501 North Chales Street, Baltimore, MD 21210-2699 Phone: (410-617-2478). Fax: (410-617-2006) email: pacioli@Loyola.edu. The AECM-L mailing list is also available. A description of services is contained in the CETA Newsletter, June, 1994.

ANet = The International **A**ccounting **N**etwork, Southern Cross University, New South Wales, Australia and Bond University, Queensland, Australia. The email address is ANet@scu.edu.au. A description of services is contained in the CETA Newsletter, June, 1994. Mailing lists are also available on ANet, including CDI-ACC-AUDIT in the United Kingdom and AC-CHANGE from Maricopa College in Arizona.

Dangers of Computer-Aided Teaching

You may expect to have classes where electronic aids will receive lavish praises and blistering complaints in student evaluations. We will now share with you some things learned to date:

1. **Don't overwhelm students with masses of visual material and/or rapid successions of images.** We have tried to develop complete courses for network users who can then proceed at their own pace. Using this same material in class has tended to overwhelm students and leave them bleary-eyed as we set a rapid pace to cover a fixed amount of material by the end of class. We are discovering that it is probably best to have two sets of discs for every course: (1) complete lectures for network use, and (2) condensed lectures for in-class delivery.

2. **Be reasonable about the time expected for network learning outside of class.** Some students really resent having to spend as much as five hours per week on a computer terminal outside of class. Some resent having to do it at all, especially those who think everything they have to know for tests should be confined to slow in-class presentations and the textbook material. Some even resent having accounting material required that is not contained in the text chapters. Since much of our electronic material contains material not in the textbook, some students get very frustrated. These are often students who feel everything they need to learn is in the text or on the CPA examination. Moreover, excessive time required in computer labs or networks will frustrate virtually all students.

3. **Plead with your students to be patient with your "first- draft" presentations and possible limitations of your display equipment.** Since instructors may be so eager to present a lot of electronic animated screens, they may rush material into lectures right up to the starting bell. This sometimes leads to content errors (e.g., incorrect problem solutions), programming errors (from bad spelling to incoherent sequencing), and poor judgments on scope and timing of coverage. As with research papers and books, the second and third drafts become markedly better than the first-time efforts. The best professors will continuously change their electronic courses so that each course is different from the last time it was presented. New material should be added almost daily and other material deleted or skipped. Adding volumes of new material creates pedagogical hazards. Our students complain that in some parts of lessons we have added so many literature updates that the lessons often are badly in need of pruning and editing. Details of "the trees" get in the way of seeing the proverbial forest. We experience frustrations when teaching if we do not carefully choose which items to skip prior to showing them on screen and then have to apologetically explain that we "didn't really intend to get into that today."

4. **Avoid displaying masses of text that students can more easily read or search outside the classroom.** In classroom presentations, masses of text take too much time to read and are distracting to students when the instructor is trying to paraphrase the text mass. In general, it is better to use more text and smaller fonts in hard copy or hypertext lessons. For example, we tend to have two types of text fields. The first text field has long paragraphs and small fonts just are not suited for CAT. These take time to read and are usually boring to students as a standard bill of fare. Also it is tempting for instructors to grow impatient and to flip screens too rapidly for student comprehensive reading. Extending the text requires more highlighting maneuvers, clever programming, and patience in delivery.

In long passages of text it is probably best to use one font size. In general, frequent shifts in font sizes or styles may be both exhausting and distracting to readers. Conversely, use of different font sizes, colors, and styles may be very useful in outline formats or graphics screens. Font contrasts sometimes make it easier to read rapidly or scan text, but they also encourage this type of reading. One of the advantages of animations are that they can be used for in-class highlighting of passages from text that appears initially in one font size, style, and color.

5. **Avoid pointless animations.** Pointless animations take time and are overly distracting. Animations are great for evolving graph components, showing algebraic manipulations, sequencing bookkeeping entries, building or breaking apart financial statements, highlighting text, etc. They occasionally have humor or entertainment value. But don't use so many animations that they take excessive time to watch and/or are distracting to the learning objectives of the lesson. Most, not all, college students have progressed beyond the Sesame Street age where animated cartoons are continuously needed to hold learner attentiveness.

6. **Avoid overuse of color or frequent changes in color schemes.** When we first started presenting our CMS shows on other campuses, members of the audiences frequently complained about how we repeatedly changed background colors and color combinations. Part of our reason for doing this was to illustrate the wide variety of color choices, but we now concede that repeated changing of colors are bothersome to many learners. Now we tend to author in one combination of colors and change color combinations for reasons we think are appropriate in the lessons. On a given graphics screen, use one color throughout except where differences are to be highlighted or main points are to be stressed. In a table, different colors might be used to block sets of rows or columns, but pointless rainbow coloring in tables should be avoided.

7. **Plan ahead in making color choices by knowing what colors work best on your LCD or other projection device.** On some LCDs, pastel colors do not show up well. With portable LCDs, white backgrounds sometimes light up the room better than dark backgrounds. With some portable LCDs, however, white is a poor background for vivid contrasts. Cursors tend to show up better on dark backgrounds. If you plan to convert your computer lessons into analog videos (e.g., videotape), avoid reds and other colors that tend to bleed and/or show more flicker in digital-to-analog conversions.

8. **Be willing to experiment by trial and error using a wide variety of display material and teaching methods.** What you think works best the first time may not be as good as things you attempt later on. Don't be content with one good approach or bore students to death with its overuse.

9. **Don't necessarily display all of your lecture notes.** Our LCD has a nice feature in that it can also be connected to a monitor pointed at the instructor in class. Instructors can flip through lecture notes and selectively decide which screens to project to the entire class. This helps to reduce reading fatigue of students and highlights the material to be stressed.

10. **Vary your teaching methods and by all means don't overdo electronic media.** You will give electronic media a bad name if almost everything you attempt in class entails videos or computer projections. The old ways aren't necessarily bad; it's just that they are easily overdone like anything else. Chalk boards, videos, compact discs, visiting speakers, and field trips may all play a part in varying the class to gain student interest and attentiveness. We find our electronic teaching aids work better if we schedule longer (three-hour) classes than more frequent short classes. This reduces start-up time losses and allows more flexibility in varying parts of each class rather than having to vary separate classes.

11. **Don't simply become a parrot reading aloud what you flash on the screen.** Interject anecdotes, questions, and comments that are not programmed.

12. **Don't expect a lot of advanced preparation to eliminate the need for before-class preparation.** You usually cannot or should not program every detail of both a problem and its solution. It is tempting in the rush of all we do to think that you can avoid last minute preparations and will recall enough detail as your electronic show evolves. It's really embarrassing when you are presenting detailed steps in solutions to problems that you cannot recall at the moment.

13. **Don't use electronic materials as an excuse to not change textbooks.** One technique which can be used to avoid teaching on automatic pilot is to change textbooks (not just new editions) nearly every time a course is taught. If you have sunk a great deal of time into authoring your own electronic solutions to end-of-chapter problems, however, it becomes frustrating to throw all that sunk time down the drain by changing texts and having to program a new set of problem solutions. Thus CAT may become added excuse for some faculty not to change textbooks. We urge you to avoid automatic pilot teaching with electronic aids just as we urge you to avoid it without such aids. Be willing to change texts often and program new materials each time you teach the course.

14. **Try to avoid getting the image of being a computer hacker more interested in the machines per se than what they can do for your teaching and research.** Unfortunately, it takes time to stay intellectually current on hardware and software, especially since technology is continuously and rapidly changing. Striking a balance between time devoted to staying current on computer technology versus course content is increasingly difficult! There are no easy or general answers to this dilemma other than to use extra effort and to develop close ties to specialists in technology who can keep you briefed on the latest developments. Unfortunately, computer technology is now so varied that specialists in one area may not be very helpful in other areas. You will probably have to devote some time to doing your own tracking and software learning.

15. **Remember that it is usually more important to inspire students to want to learn than it is to have them learn technical content in any particular course.** Probably the most important things you can do as a professor is know your students on a first name basis and motivate them into life-long action. Remember this when programming your electronic materials! Your graphics can be devoted to motivational materials and social concerns as well as technical problem solutions. Try to be creative in presentations and not simply reproduce the solutions manual in colored animation.

16. **Undertake formal research on the efficiency and effectiveness of this new technology in the classroom and on networks.** Except for a very small controlled experiment at The University of North Texas in 1987, most evidence is anecdotal. Results of the North Texas study are available in an unpublished paper by Darrell Ward at HyperGraphics Corporation (800-438-6537). Dr. Ward, President of HyperGraphics, was the principal investigator. The study focused primarily on the impact of response pads on experimental groups versus none for the control groups. These results point to positive impacts on student motivation, student interactions, and evaluations. Much more formalized research on a much broader scale by independent investigators is badly needed, however.

17. **Keep it as simple as possible.** In an extensive "secret" two-year study of multimedia learning conducted by AT&T Corporation, the initial results indicate that multimedia learning becomes easily bogged down with complex materials. Keller (1993a) reports: "the new services will have to be mindlessly simple to operate and presented as an advanced form of entertainment. Interactive consumers won't play on souped-up PCs." Although students in controlled learning environments may be both able to handle more complex material and willing to expend time and energies on multimedia materials assigned by instructors, lessons from the AT&T research study headed by Vincent Grosso should be heeded in any authoring endeavors.
18. **Watch out for copyright protections.** Because academic authors have become accustomed to citing ideas and short quotations from academic literature without always formally obtaining written permission for such citations, it is tempting to carry this practice over into hypertext/hypermedia authoring. It is terribly inconvenient to have to obtain permission for each item cited. Also there is a tendency to photocopy (without permission) longer portions of the literature for use by students on a nonprofit basis. Carrying such practices into hypertext/hypermedia authoring may be unethical or illegal in many instances even if works are cited and no profits are involved. For a summary of the dangers in copyright infringements, see Rodarmor (1993).
19. **Watch for reviews by professionals.** Since there are so few interesting hypermedia products for business and accounting educators, there are very few useful reviews available on a periodic basis. In other disciplines, especially k-12 education materials, reviews are now available such as the CD-ROM PreView from Intellimation (800 346-8355) that is free to some educators and \$5 to others.

Modern Technologies and Antiquated Copyright Laws

Because academic authors have become accustomed to citing ideas and short quotations from academic literature without always formally obtaining written permission for short quotations, it is tempting to carry this practice over into hypertext/hypermedia authoring. In the past, scholarly publications tended to cite and insert short quotations without formally obtaining written permission for each quotation. There is more legal risk in continuing this practice today. And yet, it is terribly inconvenient to have to obtain permission for each item quoted and possibly even dysfunctional if the inconvenience and delays lead to more paraphrasing of ideas without formal citations and original quotations. Also there is a tendency to photocopy (without permission) longer portions of the literature for use by students on a nonprofit basis. Carrying such practices into hypertext/hypermedia authoring may be unethical or illegal in many instances even if works are cited and no profits are involved.

For a summary of the dangers in copyright infringements, see Rodarmor (1993). Zimmerman (1994) discusses record company policies with respect to music clip inserts into multimedia. Most charge royalties of three to nine cents on each item (e.g., disc) reproduced (not necessarily sold) unless the clips are taken from "royalty free" music byte files or copyrights have expired. Copyrights on music and video, however, extend much longer into time than patent rights.

Network and satellite broadcasting delivery of learning materials create special problems discussed in Switzer and Switzer (1994). For example, do rights to a single copy of a video clip, a music clip, a text segment, a published paper, etc. carry over to presentation to a "class" of students that are geographically dispersed across

50 states and foreign countries? Is there a legal difference between a class assembled in Room 214 on campus and a class assembled in front of geographically dispersed computers? The use of audiovisual works by a non-profit educational institution are governed by the fair use guidelines, including the 1976 Copyright Act Section 110 that sets guidelines for use of copyrighted works. Section 110 extends those guidelines to retransmissions. There are clearly defined exemptions of copyrights for classroom presentations and retransmissions, but how does this apply to materials on databases that are available online at various time continuums and widely dispersed "students?" The bottom line conclusion of Switzer and Switzer is the the" 1976 Copyright Act should be revised and clarified in light of the technologies involved in education today. For now, copyright issues in distance learning remain a gray area." Clearly, legislators and courts dance on a fine line between responsibilities for stimulating creativity and stimulating learning.

One Classroom Experiment

An experiment was conducted to compare traditional teaching of accounting theory with computer-aided teaching. In 1989, one of the authors (Jensen) taught a theory course to seniors accounting majors at Trinity University using traditional lectures and cases. Three textbooks were assigned plus nearly 500 pages of photocopied handouts. The final essay examination allowed students to use open books and notes. All examination copies were retained on file and not made available to future students.

In 1991, Professor Jensen taught the theory course using mostly the same (somewhat updated) materials. But the style of teaching was greatly altered with in-class computer-projected lectures and case analyses. All electronic HyperGraphics classroom materials (including many reviews of books and articles) were made available to students on the campus and/or floppy discs loaned to students.

The same final examination (with only slight modification for updating) was administered in 1989 and 1991. However, in 1991 the only aids students were allowed to bring to the examination were their hand written notes (which were not to be photocopied from source material or other student notebooks). Printed material allowed during the 1989 examination was not allowed in the 1991 final examination. This was an added incentive for students to take extensive and organized notes while reviewing course material on the computer network. The average time reported on network by students was nearly five hours per week outside of class time. In 1989, final examination scores in this course ranged from 126 to 197 with a mean of 159 for 20 students. In 1991, final examination scores ranged, for the 14 students in the course, from 172 to 260 with a mean of 229, constituting a 70 point increase in the final examination mean scores in the electronic classroom group.

Performances on the final examination improved dramatically in spite of no longer allowing open books. Also, the improved quality of term papers in the course seemed to be due to students in the 1991 experimental group having a much better grasp of the literature. **It is Dr. Jensen's subjective conclusion that the main reasons for the improved performances were the interactive effects of two aspects of the course:**

- (1) The benefits of computer-assisted teaching (CAT). There was increased student interest in the course and better mastery of the course material which was displayed using colored animation and electronic technology in the classroom.
- (2) The benefits of computer-assisted learning (CAL). Better learning resulting from students being able to take advantage of network viewing of electronic course aids:

- a. when they wished, and as frequently as they wished (rather than struggling to take notes during the entire class period), and
- b. the strong incentives to take hand-written notes to organize and preserve material they wished to use for course review and reference material during in future examinations.

Although F-tests were performed to examine effects of some other factors, details are not reported here mainly because this one time experiment with only limited controls can hardly be viewed by readers as anything other than anecdotal at this point. No statistically significant differences were found in comparisons of the 1989 versus 1991 accounting theory students relative to SAT admission test scores, cumulative grade averages, and cumulative accounting course grade averages. There was, however, a highly significant difference in performance scores in the theory courses. Students seemed to work harder at mastering the materials in the CAT and CAL 1991 class. Student evaluations of the course and the instructor were also much better in 1991 even though some students complained about the added course burdens on the computer network.

Conclusions by Professor Jensen

One unfortunate myth is that CAL always entails passive learning from a student's viewpoint. This is true if instructors only make use of electronic transparencies or other multimedia while lecturing. However, hypermedia CAL is intended to be interactive and non-passive from a student's perspective. Students may be continually asked to type or speak responses into the computer and to navigate nonlinearly based upon discretionary controls (buttons, hotwords, and menus) or challenge controls that navigate based upon the type of response (e.g., the answer to a question) given by the student. These controls are what constitute the "**hyper**" part of **hypertext** and **hypermedia**. CAL materials may be placed on campus network servers or distributed in CD-ROMs and floppy discs such that students may access them outside the classrooms. These materials may be sophisticated simulations or even virtual realities that are in many ways better than real-life experiences, because simulations may be repeated over and over at the student's own learning pace and may take place in future and past settings for which there are no current opportunities for real world experiences. The virtual realities may take students to wanderings through complex data terrain, foreign lands, to flexible manufacturing systems, to Savings and Loan operations that are now defunct, to stock exchanges under varying market events, etc. I find that the most popular project assignments that I have ever made are those in which my students develop their own simulations or other multimedia presentations complete with video segments, hypertext, audio recordings, etc.

Assessment of new technology in learning is impossible to formally evaluate with both rigor and practicality. The main problem is the constantly changing technology. What can be done for students after my university installed a campus-wide network is vastly different than the before-network days. A classroom failure using last year's technology may not be appropriate to compare with a similar effort using newer technology. For example, early LCD panel projections from computers in classrooms were awful. In the beginning LCD panels had no color and had to be used in virtually dark classrooms. This was a bad experience for most students and instructors (including me). Then new technology in active matrix LCD panels led to color but the classrooms still had to be dark. Shortly thereafter, new technologies in overhead projection brightness allowed for more lighting in classrooms while using LCD panels. However, many classrooms are not yet equipped with light varying controls to optimally set lighting levels. Newer trends with even better three-beam projectors changed everything for electronic classrooms, because now classrooms can have normal lighting as long as lights are not aimed directly

at the screen. The point here is that early experiences with the first LCD panel technology are no longer relevant in situations where the latest projection technology, especially in fully equipped electronic classrooms, is available. Unfortunately, there is a tendency among some faculty to be so discouraged by one or two failed attempts that they abandon future efforts using newer technologies.

One of the most creative attempts to evaluate effectiveness from a Total Quality Management (TQM) perspective is reported by Prabhu and Ramarapu (1994). This is an attempt to measure learning using a TQM database that can be used to compare alternative teaching methods or entire programs.

It is easy to become discouraged with first efforts using older technologies. Many faculty and students became highly frustrated with the early complexities of using the Internet and/or campus networks that were not user friendly. Unless they took the time and trouble to become well versed in UNIX programming and became experienced hackers, the Internet turned into a totally discouraging nightmare. Now with Gopher, Mosaic, and many other user-friendly innovations in campus and international networking, the need to become an experienced hacker is vastly reduced.

I have never found assessment literature to be of great importance in my decisions about when and how to use computer technology for my students, although I have gotten ideas on how to better my efforts in some areas. Readers interested in this literature can certainly find many studies praising the effectiveness of computer technology in gaining student attention, motivation, and performance. Numerous accounts of increased learning effectiveness at greatly reduced cost are available in the literature. For example, virtually all issues of Technological Horizons in Education Journal, Syllabus, Columns, and IAT Briefings contain reports of applications successes and failures. See Hodges and Sasnett (1993) for an excellent account about how college educators are successfully using multimedia technologies. A bibliography entitled Assessments of Multimedia Technology in Education: Bibliography is available free using anonymous FTP on the Internet using the following instructions from the Institute for Advanced Technology, P.O. Box 12017, RTP, North Carolina 27709, phone (919-405-1942):

1. FTP gandalf.iat.unc.edu
2. login as anonymous (no password is needed)
3. cd guides
4. get irg-11.txt

There are other IAT resource guides available using FTP from the IAT. See IAT Briefings, Spring 1994, p. 7 for details. One of the most interesting servers for technology in education is the MIT university "MIT EVAT Report-Models for the Future" at <<http://www-evat.mit.edu/report/>>.

There are also considerable formal evaluations of the impacts of technology on training. One of the better sources are the United States Air Force studies of J. Wesley Regian that are noted in Chapter 6 of Jensen and Sandlin (1994). There are excellent accounts of successes in applications of technologies in music by Robert Winter at UCLA and his multimedia CD-ROMs from The Voyager Company and Microsoft Corporation. For an account of a music multimedia network at Indiana University, see "Indiana's Famous Music School Builds Excitement, Multimedia Network," in Columns, Spring 1994, p.2. The system called "Variations" allows users to insert their own works or the works of others into multimedia presentations across campus.

I have devoted considerable effort to authoring my courses in CMS as well as revising and adding material to supplements provided in one of my textbook choices. I have subjected my students to my triumphs and my failures. I have made and will continue to make scheduled demonstrations of my work at universities and conferences around the globe. My audiences will often suffer less than optimal equipment until newer projection devices can be financed and/or come on the market. My classrooms were too dark using an LCD until my university equipped several new classrooms with three-beam projectors. I am nowhere near where I want to be

in evolving quality material. Hopefully both my support equipment and my materials will continuously evolve into better things.

Neither CMS nor CAL in general is for every educator. CAL has many new and emerging options that all educators should investigate. Some accounting educators will find selective uses for materials prepared by others, e.g., commercial videotapes, compact discs, electronic transparencies, and videodiscs. Others like me will become fascinated in authoring their own CAL materials and assigning student projects for both teaching and research endeavors. The considerable time devoted to hypermedia authoring forced me to make better course preparations and generated concern about how to make my presentations more effective. My presentations are more colorful and efficient since I don't fumble as much with acetate transparencies and chalk erasers. My students can concentrate more in class since there is less need for note taking. My students learn the material better when they are able to study technical content on our campus-wide network at their own learning paces. Classroom time is devoted more to inspiration and attention to matters that were not understood on network. My students also are engaged in participative learning on individual and group projects where they both conduct research and develop computer-aided presentations of their work. I become more involved with them by helping them author CMS presentations.

Education researchers will be devoting ever increasing energies creating new ways to use modern technology to help future generations want to learn. Educators of the future must teach more students than those in their classrooms and those who read their research papers and books. CAL is where our hopes of cost effective interactive education and training reside. It is important for educators to produce innovative instructional material for networks or for discs to be mailed to other colleges and libraries.

Two economics professors who, in studying applications of technology in economics education in the United Kingdom, came to essentially the same conclusion that we find in accounting and business studies:

Whilst there is a great potential for the use of computer-assisted learning in economics, this has yet to be exploited. Although researchers are making increasingly sophisticated use of computers in their work, a great deal of the teaching using computers lacks an innovative approach. Computer-assisted learning will not provide a panacea for addressing the questions of increasing student numbers, a growing body of knowledge and declining real resources. However it can contribute in a significant way to providing a variety of learning experiences for economics students. By this measure many economics lecturers are failing their students. (Emphasis added) Hobbs and Judge (1992, p. 71)

I encourage more professors to take the plunge like Professor Bartlett at Harvard University (with Sumatra Ghosahl from INSEAD) and commence authoring hypermedia lectures and cases. (See the CD-ROM section of Appendix 1 for a listing of what is offered by Professor Bartlett in international management.)

The conclusions of a Big Six accounting firm with respect to pre-college educators applies, in our viewpoint, to college educators:

Clearly, the potential savings inherent in transforming the existing labor-intensive system are enormous. Yet, there are attitudinal barriers that must be overcome before this transformation can take place. ... The first of these pertains to teachers themselves.

Arthur Andersen (1994, p. 8)