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ABSTRACT

Papers from a conference on microcomputers are: "Organizational Leadership through Information Technology" (John A. Anderson); "Multimedia in the Classroom--Rejuvenating the Literacy Course" (Stephen T. Anderson, Sr.); "Something New about Notetaking: A Computer-Based Instructional Experiment" (Donald Armel); "Reflections on Electronic Frontiers in Education" (Ron Barnette); "Planning, Developing and Installing a Campus LAN" (Francis Foley); "Multimedia Design and Development: Who, What, When, Where, How and Why" (Michael T. Fox); "Designing and Delivering a Summer Institute on Academic Information Resources" (Michael T. Fox); "Multimedia and Computer-Based Instructional Software: Evaluation Methods" (William J. Gibbs); "TestMaker: A Computer-Based Test Development Tool" (William J. Gibbs; Annette L. Lario-Gibbs); "Getting Everyone into the Tent (Even If It Takes a Big Top!)" (Thomas L. Hallman); "Wireless Data Communications Prototyping: A Flexible, High-Quality, and Cost-Effective Information System for Education" (Benjoe A. Juliano, Stephen J. Sheel); "Universal Access and Faculty Training: Keys to the Information Highway for a Small University" (Jerry Kandies and others); "Designing and Integrating a Fiber Optic Network with an Existing Copper Network" (Wallace C. Knapp); "'Mooving' to a Virtual Curriculum" (R. John LaRoe); "Connecting Classrooms to the Web: An Introduction to HTML" (R. John LaRoe); "Computers across the Curriculum: Teaching a Computer Literacy Course for Multi-Disciplinary Use in a Network Environment--Content and Pedagogy" (Dana E. Ormerod); "Information Technology Curricula: Business and Interdisciplinary Perspectives" (Thomas A. Pollack); "Conducting Political Science Research Using Multimedia" (David P. Redlawsk); "Video and Computer Technologies for Extended-Campus Programming" (Edgar L. Sagan); "Macintosh Computer Classroom and Laboratory Security: Preventing Unwanted Changes to the System" (Gary J. Senn, Thomas J. C. Smyth); "Cooperative Efforts To Integrate Computer Technology into Teacher Education Curricula" (Wagih Shenouda, Gretchen Johnson); "Netware-Specific Network Security" (Robin M. Snyder); "Designing Effective PC-Based Multimedia Presentations" (Nancy S. Thomson); "Mosaic as a Vehicle for Collaborative Learning" (Robin Wagner, Bill Wilson); "Distance and

Distance Research: The Need for Internet Proficiency in the Shadow of Shrinking Resources" (Arthur E. Williams); "Mobile Computing at Grove College" (Frederick J. Jenny); and "Electronic Portfolio: Assessment, Resume, or Marketing Tool?" (Dutchie Riggsby and others). (AA)

ASCUE

Association of Small Computer Users in Education

Our Second Quarter Century of Resource Sharing

Proceedings of the 1995 ASCUE Summer Conference

28th Annual Conference
June 18-22, 1995

North Myrtle Beach, South Carolina

Edited by:

Association of Small Computer Users in Education

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About ASCUE

ASCUE, the Association of Small Computer Users in Education, is a group of people interested in small college computing issues. It is a blend of people from all over the country who use computers in their teaching, academic support, and administrative support functions. Begun in 1968 as CUETUG, The College and University Eleven Thirty Users' Group, with an initial membership requirement of sharing at least one piece of software each year with the other members, ASCUE has a strong tradition of bringing its members together to pool their resources to help each other. It no longer requires members to share homegrown software, nor does it have ties to a particular hardware platform. However, ASCUE continues the tradition of sharing through its national conference held each June, its conference proceedings, its newsletter, and its Professional Services Directory. ASCUE proudly affirms this tradition in its motto "Our Second Quarter Century of Resource Sharing".

ASCUE's GOPHER SITE

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Papers

Keynote Speakers

Michael Zastrocky is the Vice President of the Kaludis Consulting Group in Denver. Many ASCUE members have known Mike as the Vice President of CAUSE, The Association for the Management of Information Technology in Higher Education, where he was responsible for managing information resources of CAUSE, including the Institution Database and Exchange Library. He also worked with member institutions on issues of information technology resources and management. Previously, Mike was Director of Information Services and Director of Academic computing at Regis University. Mike received his Ed.D. in Technology and Mathematics Education from the University of Northern Colorado. Mike's keynote presentation "Transforming Teaching/Learning and Management of Small Colleges and Universities through Information Technologies" addresses this issue: Information technology continues to provide ways for higher education to change the teaching and learning environment and the management of campus resources. What are some of the current trends and driving forces that are shaping how colleges and universities plan for and manage their information resources and technologies? Can we learn from each other and plan for the future in a realistic way in spite of the constantly changing environment and technologies? Mike will address current trends and how small colleges and universities can survive and prosper in these uncertain times.

George Brett serves as Director of the Center for Networked Information Discovery and Retrieval (CNIDR) in the Information Technologies Division of MCNC. The Center is an international clearinghouse for the development, support and dissemination of software applications for the utilization of networked resources. CNIDR has been active in supporting emerging communities' efforts to integrate NIDR tools into their work. Programs include the Global SchoolHouse and the NC SchoolTech Project. The work of the Center is funded through a cooperative agreement between the National Science Foundation and MCNC. George Brett has been working since 1989 on issues of networked information resource discovery, access and utilization with the Internet Engineering Task Force, the EDUCOM Educational Uses of Information Technologies and the Coalition for Networked Information. Previous to his current position George spent nine years managing support for all levels of academic computing for the seventeen institutions of the University of North Carolina system with the University of North Carolina Educational Computing Services. George has a Master's of Fine Arts degree in Fabric Design from the University of Georgia and has recently received a Certificate of Advanced Studies in Information and Library Science from the University of North Carolina at Chapel Hill. George's keynote presentation, "The InfoBahn - Overview and demonstration" will illustrate connections between and among technology, education and people In his address, George will demonstrate NIDR tools to search and retrieve information, enhance computer-mediated communications and to enable discovery of unknown resources. George will share evidence from more than ten years of academic computing support that there will always be an important place for human intermediaries in education. George will present the current attitudes of federal agencies with regard to funding information technology.

Preconference Seminars

Information Resources on the Internet
by Sheila Castaneda, Clarke, College

Management Workshop for Computer Center and Information Technology Services Professionals
by Michael Zastrocky, Vice President of Kaludis Consulting Group, and Leon Daniel, Metropolitan State College of Denver

Creating a Monster Gopher Site and Developing a Mosaic Server
by Bill Wilson, Information Resources, Gettysburg College

Hands-on Multimedia Development Using Toolbook
by Morris Weinstock, Pennsylvania State University

Organizational Leadership through Information Technology

John A. Anderson
Director of Information Services
Loras College, Dubuque, IA 52001

The very idea of Information Technology staff leading an institution of higher learning is probably very frightening to executive level management of colleges and universities. But as solutions to the multitude of crises are determined, it is becoming clearer that the role of Information Technology is changing rapidly and is becoming more important for the overall success of colleges today. I am not talking about power or control within an institution, but the empowering of IT professionals to advise, plan, and coordinate technical development on our campuses. There is probably some reluctance for executives of colleges to accept their "techie" counterparts as acceptable sources of information, advice, and know-how to solve many of the problems, challenges, and opportunities that reside at many colleges. For once in the lives of computer professionals they are able to take the initiative to climb their way into the once-improbable positions of higher level management and are afforded a view of the "whole picture" even though their normal habitat is in the basement with no windows.

The structure of Information Technology has not changed that much through the years, but we are experiencing a greater amount of institutions where multiple areas of technology are being merged back into a single IT organization. The simple model of Information Technology that I envision has the three major components of hardware, software, and personnel. These basic resources are the core of IT with communication as the gravity that holds everything together and enables all functionality. Communication technology is growing at an alarming rate and is the largest contributor to the changes in Information Technology. Surrounding the trio of resources with their "gravitational pull" of communication, are the structural layers of organization, management, planning, policy, and procedure. To complete my IT paradigm are the internal and external forces that are always trying to alter or deteriorate the structure that keeps IT operational, efficient, and self-sufficient. Some of these forces are:

- executive management
- innovations in hardware/software/communication - government and other external intervention - user demand
- obsolescence
- image and attitudes

Obviously, I cannot adequately cover these topics extensively in this paper, but my aim is to provide some insight into each component.

Hardware/Software/Personnel

There is a substantial amount written about the changes in hardware and software. I feel that most of this can be summarized as hardware getting cheaper and software more expensive. Every year hardware capacity and speed grow exponentially, while software systems become more function-rich and complex. Productivity has improved immensely, while the productivity of technical staff has been hampered. Without adequate training programs, technical staff are becoming obsolete faster than the software and hardware they utilize. The traditional emphasis when a deficiency of resources has been detected has always been to purchase hardware and software with little attention being paid to the human resources necessary for adequate support, maintenance and operation. We may still need to purchase the technology, but we must acknowledge the additional burden this places on existing staff. I believe the foundation of this problem lies in the continued belief in the myth that you can replace staff by purchasing more computing resources. This certainly doesn't appear to be true, now or yesterday.

Although the technical staff writes less computer code, they are spending much more time evaluating hardware and software solutions and modifying how end-users interface and use their technical resources. We have become enablers and facilitators rather than programmers and operators. We no longer compute, we provide organization of information and act as liaisons between hardware/software systems and the end-users. All the advancement of leading-edge technology is worthless if you do not have well-trained personnel for design, operation, and support. Technology training is the biggest irony in higher education. Our primary product is educating students, so why is it so difficult for college management to see that training technology staff is one of the weaknesses in the advancement of technology on their campus? It only seems reasonable to me that as IT gets more complex, less manageable, and more integrated with other forms of technology, that personnel will need training that the institution can't provide for itself.

Communications

The area of communications is probably the largest factor that is driving development of technology on our college campuses. Communications techniques are improving at a much faster rate than any other form of information technology and costs are decreasing as rapidly as new services are being developed. As in computing, software is gradually catching up to hardware. But as communication methods are developed it is becoming clearer that acquisition and ownership of large communication systems will not be necessary, most capabilities will be available through networking and service offerings from multiple vendors. There will be much more emphasis placed on infrastructure to provide access, since it is no longer an issue of computing but more about access and connectivity. I feel that communication techniques are being developed at a faster rate than information technologists can develop applications to utilize them. Connectivity issues are far from resolved and standardized, but network users are more concerned about the speed of communication than any other aspect.

With the communications revolution, we have developed a whole new set of challenges and opportunities. We are able to connect users that have never been able to communicate electronically with each other, on and off campus. This connection is the root of the importance of technology in higher education. With networks, facsimile, telephony, video, and information affordable and available on every desktop, you can begin to see how these integrated functions will likely alter the way colleges do business. Bandwidth is being provided in many forms. Much attention is given to Category 5 wire, fiber optics, T-spans, and wireless, to name a few. Whatever you install, you can't be confident that it will last 20 years like the original cable plants that only had to facilitate voice communications. It appears that many of the latest developments will provide the capacity and speed required for the next five to eight years, but it is impossible to guess beyond 10 years from now. The communications infrastructure on most campuses has not nearly kept pace with the demands placed on it. A failing or deficient infrastructure is usually the most ignored aspect of technology development (until it is too late) and progress is delayed significantly. It is obvious that you never install cable with the needs of only the next few years in mind. You must install multiple types of cable mediums and in quantities twice to ten times what you feel will be necessary in the next 5 to 10 years. In addition, you must look for ways of improving the infrastructure without expensive installation costs. By laying additional conduit in trenches; making additional openings in building foundations; and allowing for more space in wiring closets on each floor with excessive bandwidth between floors, we can eliminate or at lease minimize re-cabling costs for future years. There is a new awareness around campus these days. Information that is not shared is worthless. Collaboration has already become a vital need in everyday operation at all levels in a college community.

Organization and Management

Now we start working on the outer layers of my IT model, that provide the substance and cohesion of the primary resources involved. The actual position of the IT group(s) in the institutional organization chart indicates what position the IT component actually plays in decisions of campus-wide importance (like technology). If there are many levels of management above IT, there is likely to be a more reactionary role rather than proactive. There is a great need for IT professionals and executive management to create a partnership that will direct the institution into informed decisions regarding the future of technology on their campus. This may require restructuring of the organization to eliminate middle-management between these technical and executive levels. Also it will be much easier to adjust the strategic position of the IT if it has centralized management and appears as a single entity, even though the various functions are decentralized (administrative computing, academic computing, networking, library resources, telecommunications, and video communications).

Many institutions have gone as far as having a single executive level position act as the Chief Information Officer (CIO) of the institution. As long as executive management recognizes the authority of this CIO, it would substantially increase the influence of IT on overall technical development in the institution. The advantage is that a single person can easily represent and project a common vision and consistent leadership for effective management of IT. I don't feel that this position is required for an institution to progress and compete in the technical arena, but it would be much simpler to implement and more effective leadership than alternatives. One alternative or interim step to this type of IT leadership would be to establish a single committee of executive management and IT professionals from all technical entities on campus. This would at least provide a forum for ongoing dialog, brainstorming, and formal planning. While the leadership must be centralized for effectiveness and to insure a common vision and mission, the actual areas that comprise IT do not necessarily need to be physically located in one area (although it helps). The individual resources may be distributed throughout the campus for convenience, efficiency, or necessity. With networking capabilities the physical locations of resources become secondary. The primary goal is to decentralize information systems, while centralizing the planning and management functions.

Policies and Planning

An integral part of the organizational structure of IT is the policies and planning that provide the rules and the road map to progress and hopefully to success. The planning and policies that have been developed on a campus are indicative of the progress that has been made and that will be made in the future. Unless there are policies in place, you will have little control over use and abuse of technology resources and if you have no formalized planning you will probably need to react to every situation that arises. An end result of improper or non-existent planning is that you are never prepared to defend a request, predict technology directions, compete for funding or represent the current situation. A good start for effective planning and policy-making is to be aware of the mission of the entire institution and to formulate a related mission statement for Information Technology. These will provide the benchmark that you need to evaluate every plan and policy in the future. Each document you prepare should complement and support both missions and definitely not contradict in any way. Any planning should directly relate to your overall vision of the future of IT at the institution and policies should not restrict access and creativity of users unless it is absolutely necessary. Some of the polices and plans that determine technology use and direction are:

- PC/hardware/software replacement plans - hardware/software purchase policies for faculty, staff, and students
- disaster/recovery plan (link with campus-wide plan) - strategic plan (link with campus-wide plan)
- copyright and distribution policy (including virus control and software duplication)
- ethical use of IT policy (including use of internet, e-mail use, security, authorized access, privacy, limitations of use, risks, legality, and backup/retention)
- PC ownership policies (access, services) - access policies for disabled users (faculty, staff, and students

This is not intended to be an all-inclusive list, but just enough to leave you with some ideas. Whatever the policy, it should be driven by the needs of the institution and not by political or private reasons.

In truth, the IT revolution has begun on our campuses and most institutions can't afford to ignore it or suppress it, they can only learn to plan for, design, and regulate the advancement. By regulation I am not implying limitation, but attention to current needs, technology alternatives, and desired growth. Unplanned growth is not going to be advantageous toward success, since direction and control aspects are necessary. Haphazard development may appear all right on the surface, but may cause many other more serious problems at a later point. Peter Senge points out in The Fifth Discipline that "today's problems come from yesterday's solutions." Institutions should resist the temptation of planning totally by financial limitation and percentage increases in operating budget for IT. IT planning should be a need-based long-range technology transition strategy with a single attainable vision derived from the partnership of executive management and IT professionals.

Image and Attitudes

Along with the campus library and athletic programs, technology is sometimes thought of as a "black-hole" for financial resources, where money disappears in larger quantities every year and no physical return is always realized. I really don't understand this attitude, but I suppose the reason that it exists lies in the assessment of results. Even if you can touch it and see it, what does it really do for the institution? Many benefits of success in technological advancement are intangibles and can't be easily measured (morale, innovation, flexibility, diversity, community). Maybe the reason for this image is the misrepresentation of IT by computer professionals that made all kinds of promises that were never kept. Whatever the reason, it still exists. The increased requirements for accountability should gradually change this image over time. Another impression that seems to be prevalent on most campuses is the image of IT being a "service bureau" that performs functions only when requested to do so. In the past IT has been limited to the scope of the requests and the resources we could muster to resolve most of that demand. It has been difficult for IT to climb out of this rut. We do not intend on deserting our customers and downsizing our service level, but we must change the image that we only respond to commands. The creativity of design, the knowledge of integrating various technologies, and the vision to progress as a team of professionals overwhelmingly requires that we join the executive management of our institutions in planning how we will thrive in the future through the development of technology. It is time that IT is realized as much more than number- crunchers. We now provide leadership with information and the organization of that information which develops into knowledge. In the accountant's view we become less of a liability and more of an asset to the institution. The only way to dispel some of the stereotypes and attitudes toward IT professionals, we must continuously take the offensive and demonstrate to management that IT is an essential component to the achievement of short and long range goals of the institution and that by our direct involvement, their roles are simplified and not threatened. The value of IT and the perceived value can only be demonstrated by showing what functions on campus would be impossible if it were not for technical developments. The advance of technology will enable colleges to survive and even flourish in a time of competition, reorganization and strategy. The partnership between IT and management will be the strongest weapon against obsolescence and elimination in the world of technology.

Executive Management and Financial Issues

Most of the issues involved between IT and institutional executives have been dealt with in some way in previous sections, except for financial limitations, the root of most differences. It is no surprise that funds for IT development compete with many other essential areas for priority (salaries, library, physical plant, and financial aid). This is notably a very difficult task for the executives of a college to pick and choose where funds will be allocated. We are way beyond the point of realizing that the operating budget is not going to supply the amount of financial resources it will take to maintain current levels of technology let alone all the funding that will be necessary to gradually advance. The only other creative financing is to either borrow money or seek grants and gifts specifically directed toward technology development. In order to successfully receive grants, you must research for donors that are a good match and have a vested interest in your success. You must demonstrate to the donor that you will be successful and you must be able to project the vision as an attainable goal that you have engineered to achieve nothing but success. Regardless of how funds are obtained, when you receive the funds necessary for a project, you must already be prepared to be working on the funding for the next project.

Technology Innovations

I don't really want to get technical in this area, but I would like to mention some of the latest innovations and the probable effect they may have on IT in general. I have listed some of the areas below: - storage systems (RAID, video disk, optical disk, CD-ROM) - cable systems (cat 5, fiber, wireless) - telecommunications and networking (fast Ethernet, ATM, wireless, video conferencing, cellular, ISDN, frame relay, client/server)

- peripherals (imaging, VRU and speech recognition, universal ID cards, optical readers)

- application methods (data warehousing, object oriented programming, image databases, EDI, CASE tools, GUI, EIS) Many of these are not even new technologies, but have not had widespread acceptance and are experiencing some interest as other factors develop.

These external influences can become a real problem to the most informed technology manager, because it seems our users know about new developments before we have a chance to explore them. Faculty, staff, and students are arriving on our campuses with more technical expertise and naturally have a much higher expectation of institutional technology resources and access to them. This really puts pressure on an under-staffed IT department. Networking technologies, alone, have changed the whole culture of the college campus by connecting faculty, staff, and students that you would have never envisioned as meeting each other, let alone exchanging e-mail and data files. Networking has opened up the whole area of security, privacy, and information access. And as most managers have already experienced, networks are far-reaching, costly, and unavoidable. In dealing with new technology, it is most important to be sure that the services and connections are available at your location to facilitate what you wish to do. With the convergence of computing, storage, and communication, it is not always possible to have the three technologies coexist, since these areas are all emerging at different paces. Although the future still appears to be digital in nature, our local voice and data service providers have not reached our level of technology. We will, however, be seeing great strides in the area of communication with the CTI technology being pushed by application demand. A few years ago, all we heard about was how we would become a paperless society. Well, I'm still waiting for this to happen, because my paper budget grows larger every year. Imaging technology coupled with storage systems development seems to be the answer for the future, but we must be patient. IT managers can only read technical journals and attend trade shows to learn about what technology is available and whether it would apply to the overall vision for technology on their campus. Listening to vendors (instead of avoiding them), is also an available source for learning about new equipment and techniques. College campuses need to share new ways of doing things with each other by visiting other campuses. If management takes the time to ask your opinion or include you in planning sessions, you must know what is available and what it will cost your institution. You must be prepared to defend or deny new technologies when requested and users making the requests should be able to explain why they require the new technology.

Government Influence

There might be other external influences, but the government is undoubtedly the largest. Each year we get more changes in reporting rules in almost every facet of computing. Some of the most demanding changes have taken place in the area of financial aid reporting. We have seen financial aid software become one of the largest and most complex subsystems in our administrative software systems. Our recruiting process for new students has become extremely competitive with other institutions solely because of stringent information requirements by the government. Now the newest governmental change is in the area of fund raising, in the form of FASB 116 and 117. These two rules deal with accounting for contributions received and financial statements of not-for-profit organizations, respectively. This changes the way we record gifts and how they are to appear on computer prepared financial statements. This has the attention of most accountants and auditors, with most IT staff nervously trying to obtain timely information to make software adjustments by the time results are expected. Another government entity has also played a threatening role to computing stability, that would be the US Postal Service. I say threatening, because we have been warned of impending requirements for all bulk mailings. For at least 5 years, we have been expecting "zip plus four" and bar-coding to be mandatory for all our bulk mail. Although this has not materialized we have planned to alter our databases to match possible specifications, while investigating PC-based systems for continuous update of zip+4 address information via CD-ROM and bar-code printing devices for out-going envelopes. Proper preparation for external influences is more important than the changes themselves. Probably the most widespread influence on technology on college campuses will be whatever the government decides to do with the existing internet and the National Information Infrastructure. Whatever state, local, and federal network infrastructures are built will determine what role communications will play in our overall connection to the rest of the world and how much it will cost individual institutions.

User Demand

It is obvious that as more faculty, staff, and students are connected to campus networks, there are greater numbers of users making demands on the IT staff. Most times the growth of that staff has not kept pace with the growing customer base. One of the grim realities of IT is that demand always runs way ahead of supply. Not only is the demand increased, but the level of support has become more complex with the higher expectations of users with more training than the staff that supports them. To our users it is no longer acceptable to say "we don't know how" and "we can't do it" they expect us to build whatever is requested. In many cases, we have started using a team approach involving end-users in the planning, design, and implementation phases of system development. This assists IT when there is a shortage of staffing and also allows the end-users to learn their applications from the ground-up and they don't require much in additional training. We have also shifted the "ownership" of data to our customer base and made them responsible for distribution of information from our institutional database. This relieves the IT staff of some of the burden of reporting and data query, allowing us to become designers and directors rather than data processors. Much of the user demand has shifted from application development to general resource and information access. Accessibility is not limited to on-campus resources and their is increasing demand for non-institutional access and sharing of information and communication. With the advent of the new technological college library there has been much more interest in material access, searching, indexing, and retrieval of data, text, and images.

The most requested access by any user group on campus has been for internet access, for a multitude of reasons. I don't expect this demand to decline in the near future. As IT professionals, our biggest concerns besides physical connections for this access, is the controlling and limitation of access for security and privacy concerns. Separating ownership from access of data has been a huge industry change, but it also creates new problems with copyrights, licensing, and publishing. These issues used to be someone else's problem...now they are probably your problems. The solutions that you develop will probably change the way you look at information technology and how your users view technology and you.

Obsolescence

The aging of systems is a force that exists and there is little we can do with the issue, but acknowledge that it is an issue. We typically lease our hardware, software, and maintenance contracts for a fixed length of time, which forces a decision at the end of the lease period. Another approach is to have a fund that is accumulated throughout the expected lifetime of your current configuration, so the financial resources are available when it is time to convert to new technology. You must exercise extreme caution when acquiring hardware and software to insure that any promises you make to management and your users you can keep. A less traditional issue related to aging systems is that technical staff becomes obsolete faster than the equipment. This can be solved with consistent and extensive training programs. In most cases what the technical staff knows is worth more than the information they administer, making this another major asset of the institution. This asset, like any other, needs continued maintenance and support.

Conclusion

There are many other internal and external forces that continually challenge the organizational structure of IT, but these will continue to change and accumulate while the management of IT will continue to find solutions to each situation. The important factor here is the acceptance by the entire college community of IT as a group of professionals devoted to the technological health of the whole institution. It is our responsibility to be as knowledgeable about current technologies, demonstrate an image of professionalism, and encourage the use of technology as the most important tool for faculty, staff, and students. With increased complexities, increased costs of administration, scarcity of funds, deteriorating facilities, increased competition, and growth in government intervention, IT professionals must show that they can be relied on for leadership and solutions.

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Multimedia in the Classroom-- Rejuvenating the Literacy Course

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Abstract

During the past academic year, I have utilized ASTOUND™ multimedia software in the development of lectures and support learning materials in our computer literacy course. We have also implemented a hardware setup known as the Tech Commander in our instructional lab (computer classroom) which provides immediate feedback for both the students and instructor as work is being done in the lab. I will summarize the use of both of these tools and then outline the perceived benefits and costs associated with their utilization. During the session I will demonstrate the use of ASTOUND™ and many of its most useful teaching/learning tools. I will summarize my experiences, emphasizing those techniques which worked most effectively and those which I would avoid if I were starting over. There should be time for questions, and any interested parties are encouraged to contact me via e-mail or phone.

Background

USC Sumter is a branch campus of the University of South Carolina System with an approximate enrollment of 1,000 students which offers the first two years of liberal arts course work in all disciplines, four years of course work in Education, Business and Interdisciplinary Studies through articulation agreements with other system campuses, and graduate courses through our Graduate Regional Studies Office. The computer literacy course, while not required, is taken by virtually all of our students (unless they already have the background from previous studies/experiences). It is a typical mixture of lecture/discussion/lab work and the custom text book includes a complete text on Computer Concepts, and modules on Windows, WordPerfect for Windows, Quattro Pro for Windows, and Paradox for Windows, as well as home grown modules on the Internet and the library information systems.

Introduction

I have been using some form of computer projection since the late 1980's though it was mainly for demonstration of the software introduced in the Computer Literacy (CL) course. I gradually began to supplement my lecture material with Harvard Graphics to create slide shows, but utilized only linear slides without multimedia activity such as sound, motion video, scanned images, etc. In 1994, I attended the ASCUE Pre-conference Seminar Using COMPEL to Create Multimedia Presentations and learned how to incorporate full multimedia effects in presentations as well as utilize the run-time version to create learning guides and support material for my students. During the seminar I visited Wills Bookstore in Barefoot Landing (a good bookstore right across the street) and found an article which reviewed some multimedia packages, including COMPEL, ASTOUND, Freelance Graphics, and PowerPoint. ASTOUND was the most highly rated, and after contacting various vendors, we purchased a ten-pack to install in our multimedia development center (affectionately called the hi-tech room) and computer classrooms. In the Fall of 1994, we adopted a new text book. I have spent the past two semesters refining the support materials for the CL course, and to my surprise, the materials themselves, as helpful as they are, are not the only positive outcomes of my transition to multimedia tools.

Benefits

Some of the benefits include:

1. I have totally rethought the course content as I have been forced to update the materials electronically. I have been reinvigorated as a professor.
2. I have been much more organized in my coverage--being more certain that I cover all the intended material, especially since I teach multiple sections of the CL course.
3. I have been able to increase the amount of material they "take notes on" and thestudents and I both perceive this as a benefit.
4. I have been able to construct support materials directly from the lecture materials and put them "on the network" so students can review any lecture notes at their convenience utilizing ASTOUND Player (the run-time version of ASTOUND) without additional paperwork.
5. I have been able to revise materials "on the fly" as well as immediately following a lecture.
6. I have been able to demonstrate to my computer literacy students first hand how computing can become an integral part of an effective multimedia information delivery system.
7. I have begun to introduce these multimedia techniques to our non-computer faculty through luncheon workshops/demonstrations and their interest level is increasing as they see it in action.
8. The library staff and I are developing library "tour" multimedia presentations which will help free up library personnel resources.
9. We are exploring grant opportunities to enable us to help bring this knowledge to our area K-12 educators.

Software

ASTOUND™ was chosen since it was particularly straightforward in its multimedia "linking" allowing even the raw novice to include motion video, sounds, clip art, animated actors, etc. by simply learning the functions a few icons. I wanted ANY faculty member to feel comfortable utilizing the software to prepare learning materials with as little frustration as possible. I did discover that the review I read on ASTOUND™ which stated that the only challenging aspect was the use of the "time-line" to control the timing of a slide was accurate. I did experience a learning curve but I had the foresight to wait until I felt confident before sharing some of the more subtle aspects of slide control to my peers.

ASTOUND™ also allows you to create cross-platform presentations for the MAC or PC world, as well as totally self contained presentations. It also allows you to install the run time version "Player" on all network systems to enable a system to "play" a presentation even if the system does not have the full blown ASTOUND™ installation.

Hardware

We recently received a Title III Grant to improve our library information system and part of that grant supplied the following hardware:

Hi-tech Room

Our hi-tech room has a Macintosh Power PC, a multimedia Pentium system, a color scanner, a color printer and soon we will be adding a video capture board and a digital camera.

Projection Classroom

We have a three gun ceiling mounted Electrohome Video Projector, a multimedia Pentium 60 computer system, and will soon add a MAC platform.

Computer Classroom

We have 24 work stations all connected to our campus file server. They are also connected to the Tech Commander™, a hard wired control center which allows the instructor to "tune in" any workstation's monitor, to project the instructor's image to any/all work stations and to project any student's screen to any/all other work stations without disrupting their work. It also allows the instructor to blank out all workstation screens in order to direct their attention to the instructor and in general "facilitate their attention span."

Costs

Some of the costs include:

1. The costs of the hardware and software necessary for developing and projecting multimedia presentations, covered mostly by a Title III grant.
2. The extra setup time necessary to learn the presentation software, approximately 20 hours in the early stages of the Fall, 1994 semester.
3. The extra time necessary the first two semesters to create the presentations. I did not complete all the chapters in the Fall semester. I finished MM presentations for Ch 1 - 8, leaving the other 6 chapters for Spring, 1995.
4. The coordination of resources between development centers, projection rooms and instructional laboratories. There were some interesting security issues to deal with as well as logistics issues regarding file storage and accessibility due to network limitations.
5. The added time necessary to help the other faculty and staff who wish to jump on the bandwagon and learn multimedia techniques.

Demonstration

1. I will demonstrate the most beneficial aspects of the techniques I have implemented including:

2. the use of templates to speed up development time

3. the use of ASTOUND™ 's "time line" to control the transitions in a slide

4. the use of hyperlinks to facilitate non-linear slide presentations

5. the use of sound and motion to enhance presentations,

6. the use of scanned images to enhance lectures,

7. the embedding and linking of objects to facilitate real life examples of software applications

8. the use of the outline feature to speed up development time

9. the use of speaker's notes to support a presentation, and

10. the use of posting self contained presentations to the network for student review.

Conclusions

I am convinced that both I and my students have benefited greatly from the utilization of multimedia software in the CL course, and that those benefits do in fact outweigh the investment in time and effort to learn and continue perfecting its application. We are covering more material in a more organized and less overwhelming way than the "good old days" and I am able to revise my materials nearly instantaneously to reflect the quickly changing computing environment we all teach and live in. They seem to respond well and I am better able to guarantee a consistency of coverage between sections, better preparing them for exams and projects. Without an experimental design, there may be some difficulty in measuring the effectiveness of this approach to teaching/learning on the part of our students, but there is no doubt in my mind that I have found the benefits of utilizing the approach outweigh the costs.

Something New About Notetaking: A Computer-based Instructional Experiment

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Introduction

Notetaking as an instructional strategy has had little research conducted related to its integration into computer-based instruction (CBI). The fashionable phrase related to CBI is interactive. Notetaking has been lauded for its ability to increase student activity in the learning process. It would seem a natural progression of notetaking to move into CBI, but documented studies and instructional development experiences are lacking.

Notetaking has often been studied determining the effects of its process or product attributes. Consideration is given to notetaking's media attribute by studying its effect on both achievement and instructional completion time when part of CBI.

Computer-Based Instruction

The focus for most current education research is centered around improving learning, and to do so, educators attempt to facilitate the information processing of the learner. In theory, the media by which instruction is delivered should not have an effect on the learning process. Clark (1983) attributes differences in learning from instruction delivered via different media more to the design of the instruction or to the novelty effects of new media.

The challenge to education is to make media selections that are appropriate, cost effective, and which will provide the greatest educational benefit. Computers in education have proven themselves to be a very flexible medium, able to adapt to a variety of uses and thus offering instructional designers many attributes in one medium.

When computer-based instruction is used for an individualized instruction setting, it offers students experiences which may only be available through a personal level of interaction. Research on computer-based instruction has generally shown that it is at least as effective as other instructional delivery methods but cannot claim to be better (Kulik, Bangert, & Williams, 1983); however, well developed computer-based lessons can be effective instruction (Kulik, Kulik, & Schwalb, 1986).

Notetaking

Notetaking has been proven to be helpful with information processing (Ladas, 1985). Carrier (1983) found that teachers and students alike place a high degree of importance on notetaking as part of effective learning. Students almost universally employ notetaking during lecture, "even though they have never been explicitly instructed to do so - this seems to indicate that some importance is attached to notetaking" (Hartley & Marshall, 1974, p. 225). Students believe that the taking of notes will improve their recall of information and that they will perform better on examinations. It has been noted that students have been upset at their inability to take notes or frustrated with insufficient notetaking time during research experimentation (Hartley & Marshall, 1974; Reese, 1984). Much of the research conducted on notetaking supports the idea that learning is facilitated through the notetaking process and by note review.

Virtually all of the research has been conducted on paper and pencil notetaking and not on computer-based notetaking. Some research studies have used the computer to assist notetaking during text reading (Monty, 1991), or to assist the organization of traditional class notes (Grubaugh, 1985). Neither of these studies were set in computer-based instruction. Only Wambaugh (1991) has completely integrated instruction on a computer with a built-in notetaking facility. In his treatment, Wambaugh provided space on each screen where the student could enter information, just as would be done on paper; simultaneously the notes were collected on one screen, but the review of notes was not allowed before testing.

Whether notetaking is part of computer-based instruction, used in conjunction with computers, or in the traditional lecture setting, the strongest directive has been to tell students to take notes. The notetaking process has virtually been left in the total control of the notetaker.

Although notetaking may not be the most enjoyed aspect of education, most students engage in it unquestioningly. In general, taking notes does in some way enhance the learning process and gives those students who take notes a learning advantage over those who do not (Carter & Van Matre, 1975; Kiewra, 1985a).

Problem

Given the same amount of effort toward instructional development, computers are effective as instructional delivery resources. The problem with developing instruction for computers has been using methods and strategies that are effective.

Notetaking has been shown to be an effective learning strategy related to academic achievement through both the process of taking notes and the product of taking notes. Kiewra (1985a) observes that research has mostly focused on the process of notetaking by developing and studying notetaking techniques. The product of notetaking has been paper based and research "has not thoroughly investigated how to facilitate and enhance those functions" (p. 245).

Adding a notetaking facility in computer-based instruction provided an opportunity to test an instructional strategy that could only be achieved in a computer environment. This strategy was forced notetaking where the student was not allowed to advance the instruction until notes had been taken.

Not only had computerized notetaking been little tested, but forcing a student to take notes appeared to have been untested to date. The purpose of this study was to test the effects on both achievement and time of forced notetaking and optional notetaking when incorporated into computer-based instruction.

Experiment

A computer-based instructional experiment was conducted at Eastern Illinois University using 81 undergraduate novice students in one test and 53 undergraduate expert students in a second test. Students were randomly assigned to one of three groups: control group, optional notetakers, or forced notetakers.

The lesson content selected for this study was The Human Heart and its Functions (Dwyer, 1972; Dwyer & Lamberski, 1980). The content is an instructional unit describing the human heart, its parts, and the internal processes that occur during the systolic and diastolic phases. It consists of three sections: 1) Parts of the Heart, 2) Circulation of Blood through the Heart, and 3) Cycle of Blood Pressure through the Heart. Selection of this instructional material was based on its use in several previous research studies which creates a body of supportive analysis for its tests' reliability. The lesson was accompanied by a "terminology" (Dwyer, 1972, p. 124), and a "comprehension" (p. 128) test, each of which contains 20 questions. The lesson was adapted into a computer-based lesson using HyperCard software.

The computer-based lesson was developed in HyperCard on a Macintosh at The Pennsylvania State University's Department of Instructional Systems. The software was adapted to collected student responses during the evaluation, to collected typed notes, and to kept track of the time each subject spent on the instructional unit. After the instruction, the computer presented the knowledge level test. In Dwyer's (1978) previous research, test reliabilities were 0.83 for the "terminology" test and 0.77 for the "comprehension" test. The tests required students to have a thorough understanding of the heart, its parts, its internal functioning, and the simultaneous processes occurring during the heart's systolic and diastolic phases.

The test was administered at the end of the instruction. Before students took the test, a simple math problem was presented, a tactic used to empty short term memory and prevent continued rehearsal. By dumping short term memory, students needed to rely on long term memory to answer the questions correctly.

The computer tracked total time for each student on the lesson portion of the instruction only.

Procedures

Upon entering the computer lab, students could choose to use any computer. The first stack they used, called Beginning, chose which treatment they would get. The stack rotated the treatments consecutively (first control, then optional notetaking, and then forced notetaking) so that the next student using any given machine had a different treatment from the previous student. The beginning of the experiment had the treatments staggered as to which treatment the rotation began. This served to assign the students evenly to the various groups and prevented any treatment from having a proportionally larger group of subjects.

After the instructional unit was completed the notetaking groups were allowed to review their notes for five minutes. The notetaking students chould choose to leave the review before five minutes were up, while the control group immediately left the instruction.

Treatments

In all treatments subjects received the identical lesson content and posttest. Two treatments were employed in the study:

1) Forced notetaking,

2) Optional notetaking, and the

Control group with no notetaking.

The notetaking conditions differed in that a phrase reminding the subjects of the notetaking requirement appeared to the forced notetaking group if a subject tried to continue the instruction without taking notes. Subjects were required to write at least five words. The optional group was only directed to take notes at the beginning of the instruction. In both notetaking groups, students typed notes using the keyboard.

During the lesson, students had access to only one button, a forward button to advance the instruction. Learners in the notetaking treatment groups were allowed to create and modify their notes as they progressed through the lesson. Learners were always able to see all their notes, and were given a five minute review period before advancing to the test; however, they did not have access to their notes during the posttests, and were not allowed to retreat to the lesson.

Forced Notetaking Group

The forced notetaking group typed notes about the lesson content into the notetaking field provided on every screen. If a subject attempted to proceed without taking notes a message appeared indicating that at least five words had to be entered about the content before they could continue. And in fact, the lesson would not advance until five words were entered into the notetaking field.

Optional Notetaking Group

The optional notetaking group appeared to be essentially the same as the forced group, but was not required to take notes. Subjects were directed to take notes only at the beginning of the instruction.

Control Group

The control group did not have an opportunity to take notes during the lesson.

Results

The novice subject tested showed significant differences between all three groups based of instructional time and on achievement. The expert subjects tested showed significant difference between all groups for the instructional time but only a difference between control and forced groups on achievement.

The achievement differences for the experts subjects were mostly due to differences in variances. The novice subjects had significant differences based on mean scores.

Discussion

Notetakers vs. Non-notetakers

Notetaking in a computer environment seems to provide the same learning advantage as evidenced in traditional notetaking methods. The results of this study are consistent with those of traditional notetaking where the achievement of the treatment groups, optional and forced notetakers, was significantly better than that of the control group, non-notetakers.

It has been assumed that notetaking aids information processing by building and reinforcing links between old information and new (Ladas, 1980). At the same time, having notes for review has been shown to be effective in increasing learners' ability to achieve (Kiewra, 1985b). Both the process and product of notetaking attempt to meet the same goal, improve learning by aiding the encoding process. The process of notetaking facilitates encoding during the instruction, while the product of notetaking allows encoding and the practice of associations to occur after the instruction is completed.

This study was designed to force some treatment subjects to take notes while it allowed others the chance to take notes, and it provided both treatment groups the opportunity to review their notes before the posttest. This study treated notetaking as a single function, i.e., did not separate the functions of process and product. Carter and Van Matre (1975) stated that the combination of notetaking process and product are most beneficial for learning than either function separately. That is why both functions were designed into this study.

Forced vs. Optional Notetaking

The optional notetaking treatment operated much like traditional notetaking in that subjects could choose when to take notes and how many notes to take. Providing the element of choice made this group more varied in their use of notes. Three of the novice subjects had completion times at or below the control group's mean time of 13.5 minutes. This seems to indicate that they took few, if any notes while four other novice subjects exceeded the forced group's mean time of 54.2 minutes, showing that some subjects in this treatment took extensive notes.

The optional notetaking group had a significant learning advantage over the control group. This should be expected since the design of this treatment reflected a traditional style of notetaking. Before the current study, it was unclear what effect forced notetaking would have on achievement. The results were positive, with the forced notetaking group performing slightly, yet statistically significantly, better on the posttest than the optional group.

Forcing an individual to take notes is a thoroughly new variable which can only be achieved with the aid of computer-based instruction. The computer environment allows users to be monitored, measuring whether or not they take notes and, if so, how much they have entered in the notetaking area. In the present study, the taking of notes was judged by quantity, requiring the subject to have five or more words in the notetaking area. The quality of content was not monitored or measured.

Forcing an individual to take notes is much different than mandatory notes or required notes. In both of the latter cases the only way to guarantee that notes have been taken is to review the notes after the fact. Questions of concern while reviewing the notes are: were the notes created by this student, and when did the student take the notes, during instruction or at some later time separate from instruction? Computer-based notetaking in computer-based instruction virtually insures that the notes taken are by the student using that lesson.

Subjects forced to take notes spent a considerable amount of time on the lesson. For that time spent, this group did have higher achievement on the posttest. Perhaps by forcing notetaking, subjects created more links between old and new content, or they had more forced rehearsals.

Implications for Use in Computer-Based Instruction

There are three implications for the design and use of computer-based notetaking in computer-based instruction as a result of the outcomes of this study. First, computer-based notetaking is an effective strategy for facilitating information processing within computer-based instruction. Incorporating notetaking in computer-based instruction can enhance the encoding of information. There may be a variety of methods by which computer-based notetaking should be designed into instruction including: an unlimited review period, allowing students' notes to be printed, adding an element of guidance for the notetaking process, having the notetaking facility hidden from view and having students request its use, and allowing the copying of text into notes.

Second, forced notetaking may have advantages for learning. Subjects in the optional notetaking treatment commented that many screens seemed to have repetitive content, therefore they did not take notes on every screen. This study forced the taking of notes on every content screen. Design consideration should be given to when notes will be forced and when they will be optional.

Third, forced notetaking could be strengthened by developing the ability to monitor users' content rather than using quantity as the measure. Although students did not take time to defeat the forced system, doing so would be quite easy and could turn the forced user into an optional user by inputting five nonsense words or even nonwords.

Implication for Future Research

Reflecting on the results of this study, the field of notetaking, and the newer area of computer-based notetaking, it is obvious that, as Ganske (1981) noted, not enough investigation has been done on a broad range of variables related to notetaking. That alone should be enough to stimulate new research, but now adding to the process and product of notetaking is a mediated variable which causes one to rethink the use, importance and place for notetaking. There is a need to replicate this study where the content is related to a real class. This may show a change in the way the optional and forced notetaking group approaches selection of content for notetaking. The positive effects of the forced notetaking group may disappear when students have the motivation to study real classroom content.

Conclusion

This study is consistent with other studies that have tested a variable of notetaking against a non-notetaking group. Although it is not viable to make a blanket statement about the effectiveness of forced notetaking, it does stand true for this investigation that forced notetaking did improve achievement on an immediate posttest.

Computer-based notetaking is a different way to take notes. It possibly will require students to develop a different schema to make the best use of this strategy.

It is difficult to make generalizations about the efficacy of forced notetaking based on one study; however, the results are encouraging for its use in computer-based instruction. Continued studies investigating the use of forced notetaking may prove it to be an effective attribute of CBI construction. The ultimate objective of this investigation was to study a new method of notetaking which may facilitate the process of notetaking and encoding, and provide the product of notetaking, i.e., notes for review. The use of computers in the classroom continues to grow. Traditional instructional methods which have proven effective in the classroom need to be adapted into the computer-based instruction environment. Notes are only the by-product: the focus of future investigation should be on ways to facilitate information processing.

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Reflections on Electronic Frontiers in Education

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As a concerned educator, I constantly seek ways of improving my teaching and learning effectiveness in the courses for which I am responsible. In this respect I am an experimenter. Educational experiments, however, must be undertaken with sensitivity and care, and implemented with a clear and thoughtful direction in mind; otherwise, professional integrity, and one's ethical responsibility to students, could be compromised. So the inevitable question becomes "Just how much deviation from traditional educational techniques and methods is warranted?"

With this question in mind, I contemplated offering a Special Topics in Philosophy course during summer quarter, 1994, to be conducted totally through the computer electronic medium. Utilizing the information highway of the international Internet, how would a class, whose members know one another only through their thoughts written down and exchanged, differ from the standard context, where bodily presence is an integral part of communication and class discussion? No body language for cues, no pre-disposed attitudes based on race, gender, age, etc.---just each other's ideas to go on, as crafted in text and exchanged for debate and critical discussion, including my own?

How would library research projects fare in this medium, where on-line resources available through an electronic source would constitute the only research infrastructure, instead of physical trips to the Library? Where individual critiques would be prepared, and essays shared, between authors whose personal identities and attributes are shaped mainly for others by what one writes and expresses? Where 'you are what you write'? How indeed would cyber classmates develop their relationships with one another and with me? How would I fare in this virtual educational community, where disembodied ideas reign?

After discussion with colleagues and students, I decided to develop and conduct such a course. Titled 'A Virtual Classroom: the Electronic Agora', the course was accessible on-line twenty- four hours a day, seven days a week, for the eight-week quarter. Twenty-one members made up the class, with eight taking the course for university credit. Most participants were university students, with one in Texas, another in New York, one in Illinois, and yet another in North Carolina, in addition to the remaining 'on campus' Georgia members ('on campus'...hmm). Several Valdosta State faculty were active members as well.

Two main activities, addressing the central objectives of a philosophy course are: research, and class discussion and critical dialogue. Through Valdosta State University's Philosophy Internet Gopher service, a Virtual Library was created, with over one hundred philosophical texts available. Course handouts were posted here as well, with all resources being fully searchable electronically. Additionally, this electronic-text resource is now featured as the international Philosophy Subject Tree by the American Philosophical Association, and is available for scholars world-wide. Physical limitations for geographically-removed library visitors suddenly vanished, substituted instead by cyberspace accessiblity that would transcend these spatial/temporal inconveniences. And no cost for classroom materials, at least in the traditional sense.

All classroom discussion and dialogue was to be conducted through e-mail, via PHICYBER (Philosophers in Cyberspace), an electronic list subscribed to by the class members. The list continues to serve as a forum and electronic marketplace (hence Agora) for classroom exchanges. It was remarkable to watch interpersonal relationships unfold, based only, as agreed, upon one another's ideas criticized and expanded. Members would respond to the discussion topic, defend their positions, raise critical objections, respond to challenges, reflect on implied new directions for analysis and further critical thought. As one student put it, "It is so different when you have to think through your ideas, put them in writing, and be prepared to back up your views, knowing that once expressed they are out there for the permanent record!" This student alludes to the fact that all classroom work and discussions were placed in a course archive, and available for ongoing retrieval and review. Indeed, all course materials and assignments, as well as all log-on activity, were part of the record. Think of the course as a transcript. There were no voices or accents, no noises, no smells, no people- --only ideas, and ideas on ideas, formulated, written and re- written, expressed and re-visited.

During the final two days of the quarter, those who could physically arrange it met together for the first time in flesh to discuss their experiences, and watched, listened and talked to each other, in part to re-identify in human form those whose personal identities had been formulated by means of thoughts alone! It was plain that far from the virtual reality of a classroom, this Electronic Agora was the real Marketplace of Ideas, where thoughts seemed to take on a life of their own, and we thinkers were but vehicles for their transmission and replication. And now, face to face, we had the business of physical metamorphasis to straighten out.

The experiment was too good to let go, and after a piece descibing it came out in the Chronicle of Higher Education, I received numerous inquiries, which helped shape plans for PHICYBER II, the summer, 1995, version. Global in scope, the new Electronic Agora will involve participants from some nine countries, and will explore in the cyberspace medium multicultural themes in this multicultural Marketplace. The dynamics should prove to be fascinating to explore, especially in light of computer-mediated world-wide communucation and collaboration. A World Wibe Web site will provide additional benefits over last summer, in particular the multimedia aspects. Whether one climbs aboard as a full-credit student or as a cyberauditor, the electronic voyage is meant to be quite an odyssey. As an aside, it might be mentioned that there are current deliberations related to what cyber-tuition might be for future cyberversity attendees!

To wrap up: I am convinced that the electronic medium can provide unlimited opportunities for those whose personal situation marries well with the occasion, as long as responsible, mature participants are those who seize the opportunities. Example: disabled students whose creative ideas and abilities can be enhanced without the encumbrances of unfortunate spatial/temporal logistical problems, or those whose physical arrangements might otherwise preclude engagement in university scholarship and dialogue. I am equally convinced that the Virtual Classroom model should be a supplement to existing university life. I am old fashioned and wise enough to realize that face-to-face interactions are indispensable educationally. After all, these occasions are those that shape real-world involvement, even if such involvement is becoming more and more computer-mediated.

Responsible choices and alternatives in the new electronic frontier should be made only upon thoughtful, reflective balance; given that, electronic education experiments can bring out the best of what diversity in quality education has to offer. Such are some exciting resources for learning on the Information Superhighway.

Planning, Developing and Installing a Campus Lan

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Abstract

We have installed a new library computer and operating system. We have connected five buildings via a campus LAN. We have added eighty faculty/staff offices to the LAN. We have completed an Internet connection, and have a name server operating. We have established e-mail and limited campus accounts for three hundred of our two thousand students. Some of the activities and problems encountered are discussed; how to determine the community/customer needs, how to educate them on the use of the technology, and its capabilities and limitations, and how to convince the administration of the need, not only for increased technology, but also for the people necessary to support the program. These issues and more faced us on our journey into the "Information Age". Berry College is fortunate to have faculty with considerable initiative andmotivation a substantial number of faculty had been using computers with little systematic planning from the College. Faculty were and are eager to use computers in their courses, and many did so with some difficulty.

Berry's academic computing system was originally designed with a central mainframe computer for instruction in computer science and a small microcomputer laboratory for instruction in business. The completion of a major capital campaign in 1988 enabled Berry to develop a new computer system for the library and add computers to support laboratory instruction in the sciences. In the latter part of the 1980s, computer technology became available to facilitate undergraduate studies in most academic and professional disciplines. By 1990 a plan was needed to develop computer resources for instruction campus-wide.

Berry sought the most efficient and cost effective approach to upgrade academic computing equipment and enlisted the help of the EDUCOM Consulting Group of Princeton, New Jersey. EDUCOM consultant, Dr. H. David Todd, Director of University Computing, Wesleyan University, Middletown, Connecticut, visited Berry College for two days in December, 1989. During his site visit, Dr. Todd met with representatives from each academic department, academic deans, administrators, and campus wiring technicians. He examined facilities where all academic computers were located. He submitted a report and recommendations for long-range planning in January, 1990. This report was evaluated by selected Berry faculty and staff during the following spring semester. Berry personnel concurred with the consultant's findings and recommended that the school proceed with developing an integrated, comprehensive plan for the purpose of designing a new campus-wide computer system based on Dr. Todd's recommendations. The President agreed.

The following major weaknesses in the current academic computing system were identified:

Limited access to computers for all students. Because of demand, the two computer laboratories on campus were almost exclusively limited to the use of specific departments;

Outdated, inadequate central PDP-11/44 computer for meeting the computing needs of the majority of faculty and students;

No existing means for networking computers to support the academic program.

Following three months of planning (by a committee of faculty, staff and administrators) based on the EDUCOM consultant's recommendations, Berry decided to replace the PDP-11/44 facility with a network of personal computers for academic support, personal computers being preferred by faculty members for instructional support.

The objectives for developing the network of personal computers were:

To remove the old mainframe computer from the central academic computing center in Evans Hall;

To increase the capability for networking computer equipment in all academic departments;

To increase compatibility of computers used for computer science instruction with computers in other departments;

To increase availability to faculty and students of personal computers for general instruction and improve access to these computers for common use.

In the spring of 1990, I was hired to assist in the development of the institutional computing plan and teach in the School of Business. I began devoting full attention to the needs of academic computing and conversion to several independent, stand-alone, local-area networks from the configuration of isolated campus personal computers.

Berry established a fund for the maintenance and replacement of computer hardware and software purchased during this project. Allocations from the operating budget to this fund were expected accrue to $150,000 over five years for this purpose.

The EDUCOM consultant strongly recommended that "although the development of local area networks of personal computers is not technically more difficult than the process of installing and managing a time-sharing computer such as the PDP-11/44, the technology is different and requires development of special expertise. Berry should plan to develop networks slowly, initially, to develop that expertise."

Berry followed the advice of the EDUCOM consultant and implemented Phase I of the project in August, 1990, with development of a local-area network for a general instruction microcomputer laboratory in the Lamar Westcott Building at a cost of $46,905. When completed, this microcomputer laboratory served all students at the north end of the campus including the Departments of Agriculture, Consumer and Family Science, and Music, as well as three student residence halls.

Phase I was completed in June, 1991, with the installation of new equipment in the Lettie Pate Evans Hall computer science laboratory. This stand-alone computer science laboratory network, centrally located on campus, supports instruction not only in computer science but also in math, communications, and language arts.

The objective of Phase II of the academic computerization project, completed in December 1991, was to upgrade equipment in the computer laboratory located in Green Hall. This laboratory serves the south end of the campus, including the Departments of Business and Economics and Social Sciences.

All students majoring in business and economics, were then and are now, required to take "Business Information Management." In this course students are introduced to computer packages to facilitate problem solving and become skilled in the use of computer software, including word processing, database management, spreadsheets, and statistical analysis. A newly equipped computer laboratory would not only strengthen the effectiveness of this course but also enable the School of Business to introduce more computer problems and simulations into upper level courses.

With the completion of Phase II, there were three general computer laboratories with a common network design for academic use. This permitted greater flexibility in scheduling laboratory classes during the day and ensured access to computers by students during the evening hours and on weekends.

Phase III was to connect the existing computer labs and extend the network service to faculty/staff offices, in the buildings housing the networked computer labs. After considerable study it was decided that the most cost efficient method would be to install the campus LAN ourselves using on-campus resources rather than contracting the installation out. We were very fortunate to have a recent Berry graduate employed by Data Cable of Atlanta, GA, a cable and networking firm. He provided us invaluable assistance in the design of the network and in procuring the right equipment at reasonable cost.

In the fall of 1992, upon my appointment as Director of Academic Computing, I began investigating the possibility of an Internet connection for Berry. After considerable investigation, it was decided we would approach the State of Georgia and request a connection to PeachNet, (the Georgia educational network). After approximately two years of negotiation, we became one of the first private colleges in the state to be connected. Our connection is via dedicated 56Kb phone lines, and we maintain our own name server.

At the same time we were negotiating with PeachNet we came to the realization that our library computer (another PDP11) installed in the late 1980s, was no longer adequate for our needs. After extensive consulting with the librarian and her staff it was decided the existing system would be replaced with a turn-key system from GEAC. We now have a Motorola 9100 Unix-based system running GEAC's Advance Software. This system which is expandable should meet our needs into the foreseeable future.

Following discussions with faculty/staff to assess their needs and consulting with our "mentor," it was determined that the most efficient method would include building a campus-wide system from the two centrally located labs. We would use fiber optic cable between the buildings and Category 5, Plenum rated, unshielded twisted pairs (10baseT) in the buildings. We would continue to use Novell Netware and build a self installed and maintained Ethernet environment.

In the spring of 1994, I was given permission to hire an assistant. He would become the network manager. I chose to hire a young man who had been my student assistant for two years and had already demonstrated his knowledge, ability and intelligence. Interestingly, h(is not a computer science major, but rather has a degree in communications. This has been invaluable in dealing with the campus community. After a year he is in the process of taking the Novell CNA exams.

With the assistance of student workers and employees from our physical plant, we began the tedious, and sometimes frustrating, process of installing the cable. Trenches were dug between buildings and 12-strand fiber optic cable was installed between 3 buildings the library, Green Hall (Business & Social Science), and Evans Hall (the largest academic building, housing Mathematics & Computer Science, Education and Psychology, English, Foreign Language, Religion and Philosophy, Media Center, and others).

At the same time we were installing the UTP in the buildings, setting up concentrator/hubs and configuring servers, we decided to install separate servers for each building and a common student mail server. We chose as our host an Intel P-90 based computer running LINEX.

As we installed the campus net, we became painfully aware that the axiom "It's not about hardware, it's about people" had to be dealt with. We were installing hardware and software and teaching our customers to use them. The instructional librarian came to our rescue. She had some familiarity with networks and their use in education and research. She took over the initial training and introduced a series of workshops to assist the users in developing their skills on the Net. Additionally, we offered through Academic Computing hands-on application workshops.

Dr. Todd was invited to return to Berry College in December, 1994, to again consult on the state of computing, and make additional recommendations. He concluded that Berry was moving in the right direction, but perhaps not as fast as it could. Some of his recommendations were:

Complete the campus LAN as planned. Budget funds sufficient to replace one-fourth of the faculty/staff personal computers per year. Plan to replace the network electronics every five years.

Ensure current hardware and software are available to all students in public computer labs. Expect to replace one-fourth of public use computers per year and budget accordingly.

Provide faculty with appropriate development opportunities in the use of technology, and in its integration into their specific curriculum. Provide academic support staff with contiuing in-service training.

Increase Academic Computing staff. Expect to add at least 3, but more likely 5 positions. l ositions that would likely be critical would include additional network support, additional support for the public computer labs, and training and support.

Provide easy modem access for faculty/staff, and in the interim, for students to the campus LAN.

Anticipate the need to extend the network to the dorms.

Anticipate that faculty/staff, and students will need access to administrative information.

As the Net continues to grow, the problem of training and assistance continues to multiply. We are in the process of developing a help-desk which can be reached by phone or over the net.

We have completed the plan for a WWW server and hope to have it operational this fall. We are continuing the expansion of the campus LAN this summer with plans to connect at least two more academic buildings and the hopes of adding two of the five dorm areas.

We have provided system accounts, including e-mail and net browsing tools to 80 faculty members and approximately 20 academic staff members. Approximately three hundred (300) students of a student body of about one thousand eight hundred have applied for and received e-mail accounts. By the beginning of the Fall 1995 semester, we will be able to provide the same services to the students we are now providing to the faculty and staff. Selected members of the non-academic community have been encouraged to request connection to the LAN. The plan includes the connection of the Registrars Office, the Office of The Dean of Academic Support (for whom I work), The Office of the Vice President of Academic Affairs, and The Office of Institutional Research. This summer we will have completed connecting the Dean of Students Office, the Admissions Office, the Student Work and Financial Aid Office and the Internal Auditor. It is expected we will add the Office of Institutional Development late this summer. This office includes among others Development, Alumni Affairs, and Public Relations.

Multimedia Design and Development
Who, What, When, Where, How and Why

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Those new to multimedia or those still considering its value will find it beneficial to take a journalistic approach to examining the virtues, limitations and components of the multimedia process. Formulating simple questions based on Who, What, When, Where, How and Why can provide a good starting point toward discussing issues involved in the multimedia design and development process. Who should be involved; what are essential tools and guidelines; when is the time and content appropriate; where can you get help, are a few questions essential to examining the qualities of multimedia and its development process.

What is multimedia? Perhaps this is the first question which needs to be asked. A quick glance into any dictionary might find a definition similar to the following. multimedia (multimedia , mul t -) n. (used with a sing. v.)1. the combined use of several media, as films, video, music, etc. adj. 2. of, pertaining to, or involving the use of several media simultaneously. 3. having or offering the use of various communications or promotional media.

[1960 65]

multimedial adj.

For the purpose of this discussion of multimedia design and development the definition needs to be refined and extended as: pertaining to a computer mediated software program or document containing media such as text, audio, video, animation, and graphics combined or hyper linked and presented in a non-linear and interactive mode for the purpose of exploring one or more ideas.

The use of multimedia is increasing at a substantial rate in both the home and on college campuses as a tool for enhancing learning. Multimedia shifts the traditional learning paradigm of listening and researching to a more visual and interactive learning system. Multimedia supports the pedagogical model of student-centered learning where faculty are no longer the only resource but are simply another vital resource used to guide students in their learning experience. The use of multimedia, or any computer mediated learning, will never be a substitute or replacement for faculty. Computers don t teach or instruct; they allow students to explore and discover. Terms like Computer Based Instruction or Computer Aided Instruction are outdated and should be replaced with Computer Enhanced Learning. Unlike faculty, multimedia can not aid the student, for example, in evaluating the quality of information. Faculty serve as an invaluable and irreplaceable resource for guiding and advising students.

An important use of multimedia as a learning tool in academia is the process of designing and developing a multimedia project. The process itself, rather than the resulting multimedia program or document, provides a new pedagogical tool for enhancing learning. A students search for knowledge understanding must involve more than just discovery and authentication. The multimedia design and development process empowers students to explore, discuss, evaluate, and articulate their knowledge in a richer medium. It provides students the opportunity to engineer and build their own knowledge base.

The multimedia process is changing the role of students and faculty. The distinction between teacher and learner is becoming less notable and less important. Student are able to enlighten one another as they collaborate together. Students expose faculty to new and different ways of expressing ideas and thus faculty stand to learn from the new knowledge base developed by students. As multimedia changes how the curriculum is taught it will inevitably change the shape and look of the content as well.

HOW?

It is difficult to imagine any discipline which can not make practical use of multimedia. The use of hypertext markup language (HTML) can be used to construct an integrated document based on connected themes in individual documents. The process of discovering relationships and links between various individual papers encourages collaboration. Students must closely examine and truly understand each paper and thus are exposed to other issues not focused on in their own paper. Therefore, the multimedia process is useful to any instructor willing to empower students to discover and explore independently as well as collaboratively.

Multimedia design and development requires time and energy. Designing and developing multimedia should be an activity which substitutes for another. If a course already involves a collaborative component then the multimedia process can be introduced to encourage collaborative work. In a course where students must write several papers on similar topics substitute the last paper with a collaborative exercise designed to create a large hypertext document in HTML which links related issues or ideas in a previous writing assignment. A course on medieval French culture, for example, could designate a portion of the semester to designing and developing a multimedia program which explores a day in the life a women in France during the 15th century. Students would collect or create images of people, city buildings and architecture, goods and produce, record dialog and create writings in French.

Multimedia serves the learning process best when more than one person is involved, but having too many people involved in one project can dilute its benefits. A large class of students should be grouped into teams to develop group projects. The most efficient and effective multimedia process involves a team composed of two to four people. Each person should be assigned to specific responsibilities. Every person in the team need not be involved in every aspect of the multimedia design and development process. Students can be assigned to various tasks such as leading the design stage, creating or acquiring textual, graphic, and audio material, and programming specific segments of the multimedia program or document. Assigning specific tasks to each student makes it easier to assess the quality of their work and involvement. Students learn essential skills required for collaborating as they learn to bring together their independent skills and responsibilities to support the goals and objectives of the team. As students lead and push one another they learn they must accept accountability for success or failure.

As students acquire new skills and knowledge to contribute to the project they become a resource to one another. Students should be encouraged to share their skills and knowledge with other team members. Peer-to-Peer teaching foster a collaborative learning environment and allows students the opportunity to extend beyond the role of learner and occasionaly become the teacher as well.

When is the time or content right for the use of multimedia and its process? The content should be an idea to be explored, examined, and open to interpretation and not simply expounded upon. The idea must lend itself well to multimedia and demand the use of multimedia in order to be presented fully and effectively . An idea which can not stand on its own with pure text, which not can not otherwise be completely conveyed without the use of pictures, sound, video, or animation, is appropriate content for multimedia. When the content is appropriate then the time is appropriate.

Getting support for the use of multimedia relies on its success. To insure success keep the multimedia process simple. To keep the process simple keep the project simple. Avoid using unnecessary media and be careful not to overuse any paticular medium. Keep focused on the goals and objectives of the idea. Remember, the use of multimedia is not the goal but rather the tool for expressing an idea. Design your project to allow free exploration by allowing the viewer to navigate along multiple paths through the media. The key is to be flexible and responsive to different learning styles.

Start off small and build on previous successes. It is important that the use of multimedia be focused on courses which have the most to benefit from its use. Courses in the natural sciences are always good candidates for multimedia as a means of illustrating difficult or abstract concepts not readily apparent to the naked eye. Interdisciplinary courses have much to gain as well as much to draw from when using multimedia. The inherent nature of multimedia to combine text, graphics, audio, video, or animation can provide an eloquent method for exploring the relationship of one or more ideas across disciplines.

Once the project is completed share it with the community. Demonstrating various multimedia programs or documents allows the academic community to assess the value of using multimedia to enhance learning. Demonstrations can help build support for the continued use of multimedia and provoke other faculty to consider the value of multimedia in their own courses. Provide opportunites for colleagues and senior administrators to see and understand the importance of the multimedia design and development process as a new teaching tool and its pedagogical importance. Early adopters of multimedia can serve as mentors to other faculty getting started.

With an understanding of what multimedia is, how it can be used, when to use it, and why, it is time to get started. The implementaion of the multimedia process begins with an idea, but having a great idea is not enough to get started and succeed. You need to have the appropriate microcomputer and equipment to support the design and development of a multimedia project. The typical multimedia development system is often something more powerful and better equipped than the system upon which the finished project is intended to run on. The typical development system would be based on a 66mHz processor, 1 gigabyte hard drive, 16 megabytes of RAM, a VGA monitor with a resolution of 640x480 (512x342 Macintosh), 8 bit sound card, video capture card capable of capturing video at 15frames/second at 320x240 pixel resolution, and a color scanner capable of scanning images 1/4 to 1/2 the size of the screen display with up to 256 colors.

The 66mHz processor provides the speed and performance to work comfortably while manipulating multimedia material, as well as providing the speed to support the video capture. The specification of VGA video may seem mistaken considering all new systems are well equipped to handle 1024x768 at 256 colors and perhaps even higher resolutions. But a successful project shouldn t require an older system to be upgraded. If a system doesn t have the capability to display at least 640x480 with 256 colors then it most likely isn t intended to be used for multimedia. The key here is to design and develop for the lowest common denominator; the microcomputer most likely to be found on the college campus. In addition the 8 bit sound and 320x240x256 15 frames/second video should perform sufficiently on these type of machines. Also, you should be prepared to demonstrate your program by having it projected on a large screen in front of an audience. Again, plan for the lowest common denominator, which would be a color LCD plate used with an overhead projector. Currently, LCD plates can display and project a maximum resolution of 640x480. If your multimedia project is designed to display at a higher resolution the LCD plate will not be able to display the full screen. If important material or controls are located in the non-displayable area of the screen then the impact of your demonstration is compromised and interaction is limited or disabled.

Designing and developing a multimedia project that exceeds these criteria limits the number of microcomputers on which it can be used, and this in effect may reduce its usefulness. Though the design and development process is, pedagogically, the most critical consideration the function and practicality of the final product is crucial as well.

Only two or more media need be present to establish a multimedia program or document. It is crucial that only those media are used which are essential to the idea being explored. The program or document must allow the associations between related ideas or concepts to be virtually linked together by controls so as to allow it to be interactive and navigatable in any direction. Links which allow nonlinear navigation and interactive exploration allow the program or document to be responsive to different learning styles. If the program or document does not allow interaction then it defeats the purpose of exploratory learning. The ultimate goal of any multimedia program or document should be to enhance learning through exploration.

The two major efforts for any multimedia project are the design and development stages, and obviously the design stage comes before the development stage. But before even beginning the design stage it is important to develop a few goals and objectives for the design and development stages. The goals and objectives can be summarized as:

1. Define what ideas, issues, and/or concepts the project is intended to explore.
2. Determine who your audience will be.
3. Determine what resources are available for developing as well as using the final project.
4. Determine which aspects of the design and development process each person involved will have responsibility for.
5. Organize a schedule for each stage and various tasks involved in each stage.

It is important to write down your goals and objectives and have them easily visible throughout your project so that you can refer to them frequently.

Begin by summarizing in one or two sentences the ideas, issues, and/or concepts you wish to explore. This summary can be developed in several sentences which define or illustrate what the ideas, issues, and/or concepts are. In addition, identify how these ideas, issues, or concepts might be presented or dealt with in the program or document. Your summary should be the corner stone of your project and something you refer back to frequently during the design and development stage to insure that you stay focused.

The next step is to identify and understand your intended audience as precisely as possible. The keyword here is intended. Trying to design a multimedia program or document to meet the needs of everyone can be a mistake. Narrowing your focus on a specific audience will help to steamline the development process. Knowing that your program or document is intended for first year biology students interested in exploring the fundemental concepts involved in the process of photosynthesis dictates a different look and feel from one intended for upper level chemistry students who need to explore the biochemical processes involved in photosynthesis.

Next, determine what resources you will need and which of these will be available for your project. The resources you need will be determined by the various media you plan to use. Using text is the easiest medium to use. The degree of complexity in dealing with various media increases as you to begin to include graphics, audio, animation, and video respectively. Identify what sofware programs; such as for authoring, audio and video digitizing, animation, graphic design, and associated equipment you will need and how each will be used. The quality of the software for creating and manipulating various media effects has a significant effect on how easily the various media will be to implement in your project. If any items of software or equipment are not available or inappropriate for your needs then you must be prepared to make adjustments in order to accommodate the goals and objectives.

At this point you should have a pretty good idea of what is going to be involved in your project and can therefore begin to assign various parts of the design and development stages to those participating in the project. There are two approaches you might take to assigning tasks. You can identify which individuals are best suited to a task and assign each task accordingly. Or, you can do the opposite and provide an opportunity for participants to build skills and knowledge from new experiences. Keep in mind that the latter approach can impact the time in which the project is completed and perhaps the quality of the overall project. Therefore it is important to determine what is most important about the project: the learning experience it provides or the final multimedia program or document.

Finally, organize a schedule which provides specific details as to when the various tasks are to be completed. Determine which tasks need to be started or completed before others. Carefully determine how long each task will take. If time permits, allow yourself to be generous with the amount of time required for various tasks. Keep in mind that you can t expect everything to go smoothly, and be prepared to run into a few snags. It is difficult to anticipate each and every detail so don t try. Be prepared to compromise or eliminate components deemed less important if you become pressed for time.

Designing

With your goals and objectives clearly identified and written down you are ready to begin the design stage. The design stage is arguably where the majority of the work is done. The design stage involves creating a flow diagram which illustrates how your multimedia program or document will be constructed. Time well spent creating a flow diagram minimizes time spent later making changes. A typical flow diagram might look like this:

Begin by using pencil (you ll need an eraser too) and paper to draw symbols which illustrate various components of your program or document. The various components include text graphics, audio, video, animation, and buttons for navigation; such as CONTINUE, BACK, RETURN to MENU, HELP, EXIT, which provide the means for interaction. Keep in mind the flow diagram does not show the actual text, graphics, sound, etc., and instead it shows symbols which represent these components. The flow diagram illustrates the relationship between the various component, how components act upon or respond to one another and what type of transition effects you will use (i.e. fading, sliding, dissolving images). It is important to allow the person viewing your program or document to follow any one of multiple paths through your program or document. Multiple paths allow unrestricted exploration and the ability to focus on specific areas important to the user. Be prepared for your flow diagram to be a series of a dozen or more sheets of paper taped together, some top to bottom and some side to side, which illustrate an expansive web-like structure. Each symbol must be identified and annotated as to its purpose and function. A portion of a flow diagram might look like this:

The flow diagram is crucial in its illustration of how all the controls and media components function together. A clear illustration allows you to move into the development stage knowing exactly what sequence these components will be laid out with your multimedia authoring program.

Another step of the design stage is the gathering of your various media. This will involve creating original works in the form of text, pictures, music, voice, video, and animation. If you need to use materials which already exists be sure to get appropriate permission so as not to violate any copyright laws. It is important to have all your materials ready in their digital or electronic format before continuing to the development stage.

It would be best to decide at this point what multimedia authoring program you want to use. Your decision should be based partly on whether or not the authoring program can accept the types of media you want to use. It is best to let the content and media in your program or document influence your decision on what authoring program to use rather than letting the authoring program dictate what media you can use. It can be rather easy to implement a multimedia project using Microsoft Word or WordPerfect. These two word processors provide the capability of imbedding images, sound, video, and hypertext. Some slide presentation programs, such as Microsoft PowerPoint, also offer the capability to play back sound and video. HTML is a very popular way to present hyper linked multimedia documents on the Internet as well as linking documents stored locally. Any software program that provides these capabilities may be a suitable platform for authoring a multimedia project. A few of the most common multimedia authoring programs to date are Asymetrix Multimedia Toolbook, HyperCard, Macromedia Authorware Professional, Authorware Academic, Macromedia Director, SuperCard, and HTML Assistant.

Development

When planning the types and quality of media to use in your program or document it is important to know what your authoring program will or won t allow you to do. The following are some general guidelines for what to expect from most authoring programs and how to prepare specific media material.

Text can easily be entered directly into your project using text tools built into most authoring programs. If you want to create your text with a word processor (WordPerfect, Microsoft Word, etc.) you will need to convert your document to ASCII text before pulling it into your multimedia program or document. Some authoring programs will recognize Rich Text Format (.RTF) files. These files can be moved from a word processor to the authoring program and still retain many of the text formatting attributes (boldface, underline, indenting, fonts, etc.). Plan on formatting your text (boldface, underline, italics, etc.) from within the authoring program once it is in place.

Simple graphics can be designed with built-in graphic tools or those included as a separate program. If you want to create your graphics with a more sophisticated graphic design/paint program be sure that it can be saved to a format that the authoring program will recognize. Most authoring programs will recognize Bit mapped (.BMP), Tagged Image Format (.TIF), General Interlaced Format (.GIF), or .PICT format (Macintosh Picture). Use an optical scanner for digitizing existing still images. Limit images to 8-bit color depth (256 colors) if possible. More colors require more advanced equipment, more storage space, and a faster video system. Limit image size to no more than 1/4 - _ the size of the screen display. Single images displayed using the full screen are less effective than those of a smaller size and accompanied by text which might explain the use of the image.

Most authoring programs don t provide any built-in method of capturing audio and converting it (digitizing) to a file on disk, so a separate audio digitizing program will be required. Most authoring programs will accept either MIDI (Musical Instrument Digital Interface), .WAV, AIFF or System 7 (Macintosh). You should be able to digitize sound from audio tape, compact discs, microphone, or anything else that plays sound and can be connected directly to the sound recording device in your multimedia development system. Limit audio quality to 8-bit resolution at Radio or Tape frequency. Use CD quality sound sparingly since every 10 seconds of CD quality sound requires nearly _ megabyte of storage space.

- 8-bit resolution (256 sound levels)
- Radio : sampled at 11kHz
  - = 11,000 times/second
  - = 11,000 bytes/second
- Tape : sampled at 22kHz
  - = 22,000 times/second
  - = 22,000 bytes/second
- CD : sampled at 44kHz
  - = 44,000 times/second
  - = 44,000 bytes/second

The ability to display and overlay live video in your multimedia program or document from a laserdisc is common in most authoring programs. Your program or document will be able to communicate with a laserdisc using control statements for playing, pausing, reversing, forwarding, stopping, and quickly locating the next video selection. But if you lack a laserdisc player you will need to capture your video and digitize it. The digitized file can then be loaded directly into your multimedia program or document. Video capture and digitizing is a feature not often found as part of most authoring programs, so a separate video digitizing program will be required. Most authoring programs will accept either AVI (Audio-Video Interleave), or QT (QuickTime) video files. You should be able to digitize video from a video cassette recorder (VCR), video cameral (camcorder), television, compact discs, microphone, or anything that plays video and that can be plugged directly into the video capture card in your multimedia development system. Limit video quality to no more than 24-bit color depth at 160x120 or 320x240 resolution (pixel width x height) and 15 frames/second. Typically, you will need 3.5 megabyte of storage space for every second of video captured.

- 24-bit color depth (16,777,216 colors)
- 30 frames/second = television frame rate
- 24 frames/second = motion movie picture frame rate

Video Size in bytes = (pixels wide x pixels high) x color depth (Bytes) x frames/second

Example: 320 pixels x 240 pixels x 3 Bytes (24-bits) = 230,800 Bytes/Frame

230,800 Bytes/Frame x 15 Frames/Second = 3,456,000 Bytes/Seconds

Most video capture cards come with software used to compress video so that it won t take up so much space. The playback quality will be degraded slightly, but it is possible for a 70 megabyte file to be compressed to 9 megabytes.

Simple Animation tools are provided in most authoring programs. Simple animations consist of moving one or more objects across the screen along a predetermined path. To develop animations with more detailed movement requires a separate animation program. Common animation formats are Autodesk Animator Flic files (.FLC, .FLI) and Macromedia Director movies (.DIR, .MOV, .MMM). Treat the use of animation like video. The more complex the animation the more disk space and computing power it requires to make it run smoothly.

Managing all of the acquired media in their electronic format will most likely exceed your storage resources within a short period of time. It is advisable to store graphics, sound, video, and animation files on an external storage device such as a large capacity disk cartridge. Reputable vendors such as Iomega and Syquest manufacture removeable disk cartridges which can hold, presently, up to 230 and 270 megabytes of data per cartridge, respectively. The cartridge drives themselves cost approximately $500. The cartridges, depending on the size, manufacture and vendor, cost $70 to $100. These cartridges can be issued to students for storing their work. With materials isolated on these cartridges, the possibility of the material being inadvertently damaged or deleted by another students is minimized.

So what equipment can you expect others to have to view your program or document and what equipment will you need to put your project together? You should plan on sound and video playback being available. Most systems come with or have available to them software for playing sound and video which does not require the expense of additional hardware. Keep the sound and video quality as low as possible without sacrificing too much. There isn t much point in providing CD quality sound if it will be played back on $30 speakers. And there isn t much point in trying to digitize your video at a 24 frames/second if it will be played back on a system that can barely keep up with 15 frames/second. The key here is to design and develop for the lowest common denominator.

Getting help with designing and developing a multimedia program or document may not necessarily always come from the folks in technical support who are responsible for the authoring program you are using. If you have access to the Internet you will find plenty of help available for every aspect of multimedia design and development. Among the many resources on the Internet are Listservs for discussing many of the popular multimedia authoring programs as well as graphic, audio, video, and animation programs. In addition, you can find many software libraries with demonstration, utility, and example programs for the beginner as well as the advanced multimedia developer. Some valuable starting points for multimedia information from the Internet are located on the World Wide Web at the following sites:

http://hakatai.mcli.dist.maricopa.edu/authoring/mm.html

http://viswiz.gmd.de/MultimediaInfo/

http://akebono.stanford.edu/yahoo/Computers/Multimedia/

http://www.firmware.com.au/

As information technology explodes into the twenty-first century students not only need to be proficient users of new information access tools, but they must also be able to capitalize on new and effective tools for learning and communication. It is apparent that multimedia offers a new means for engaging students and enriching their learning experience by allowing them to become more intimately involved as creators of their own knowledge base. The multimedia design and development process accommodates and fosters many different learning styles which are often restricted by the traditional lecture or seminar style of teaching. Focusing on the multimedia process rather that the product eliminates the concern for, and distractions of, the technical issues and allows the student and instructor to continue concentrating on the course goals and objectives. Multimedia and the design and development process offer new opportunities for effective learning and communication.

ilable to us has improved, we have made significant changes to our system. First, we were able to scan in and present still pictures of each of our candidates. These pictures were digitized and presented as bitmaps using Toolbook's ability to show both graphic images and text. Then, with the release of Multimedia Toolbook 3.0 and its greatly enhanced capacity to handle digital video, last summer we enhanced the system again to include video campaign ads, as well as our standard text-based information. Thus, the system has truly become a multimedia system, incorporating text, still pictures, video, and audio into a single simulation.

As subjects go through the primary campaign, choosing information of interest, they are interrupted from time to time by the campaign videos, which overlay the label boxes, and temporarily disable the ability to examine text-based information. Thus, subjects have little choice but to watch the videos. When an ad finishes, the label screen reappears. After a preset period of time, the primary election ends, and subjects must vote for their preferred candidate. At that point, the general election begins, featuring one candidate from each party. Subjects may or may not see the candidate they chose in the primary end up in the general election -- in other words, sometimes they vote for "winners," other times for "losers." The general election is basically the same as the primary, with video, text, and pictures available. At the end of the general election, subjects make a choice between the two candidates and then end the simulation. Finally, some information is collec! ted via a pencil and paper questionnaire.

The System and Programming Environment for Ballot Box

While the presentation to the user of the system is reasonably straightforward, and appears relatively simple, the programming environment is actually quite complex. The original system was designed using Apple Hypercard, and ran on Macintosh machines. In 1991, we began converting it to Toolbook 1.5, for two basic reasons. First, we wanted to make full use of color, and color Macintosh's were relatively rare. Second, Rutgers political science had standardized on Intel-based machines. Conversion was relatively straightforward, and we began running experiments with it in 1992. As the technology improved, and available PC's became more powerful, we took advantage of new capabilities and the system grew more complex. With the arrival of Toolbook 3.0, both power and complexity increased again. In 1995, we are running the Ballot Box system under Toolbook 3.0a, in a Windows for Workgroups 3.11 environment. We acquired two IBM Thinkpad 750Cs portable computers in order to take the experiment into the field, rather than requiring subjects to come to our offices. These computers have 80486 DX33 processors, 8 Mb RAM, and 340Mb hard drives. The Thinkpads come standard with sound chips, eliminating the need for any kind of external sound device in order to play the videos. While they also possess good quality screens, we needed to present the simulation on relatively large screens, to make using the system easier for subjects. So along with the portable computers, we added two 15 inch external monitors by NEC. Each portable computer was configured in exactly the same way, so that there would be no variations in the way the system ran on either machine. The machines were also equipped with docking stations and ethernet adapters so that when returned to the office, ! all data on them could be accessed across our office Windows for Workgroups based network.

Because of the addition of video to our system, we needed to acquire a system powerful enough to produce and edit videos. We chose an 80486 DX2/66 machine initially, which has since been replaced with a Pentium-90 machine. This video production system has 32Mb RAM, nearly 2 gigabytes of fast hard disk space. It has been equipped with an Intel Smart Video Recorder card for video capture, along with a Soundblaster 16ASP card for audio capture and playback. We are using Adobe Premiere 4.0 to capture segments from videotape and create our own digital campaign ads. Voice overs are then added to the video and a complete 20-25 second campaign ad is produced and compressed. Even with compression, though, the campaign ads take up to 3Mb of disk space for each ad. Working with Toolbook means learning object-oriented programming (OOP). For programmers used to the more traditional languages like COBOL or BASIC, OOP based languages can be very confusing. Toolbook functions under a hierarchical structure. Messages are sent from the level at which they occur on up the structure until a script is found to handle that message. Clicking a button sends a BUTTON UP message to the script for that button. If there is no BUTTON UP handler defined for the button, the PAGE that the button is on will get the message. If it has no BUTTON UP handler, the message will be sent up to the BACKGROUND level, and so on, until a handler is found or an error generated. Every object that is defined on a screen can have a script associated with it. If there is a script, that script will define the events that occur when the user selects that object. If there is no script, the object is generally simply a graphic or a field into which data can be typed. ! It is the interaction of the scripts, and the messages that get sent through the hierarchy that define how the application operates.

Scripts are programmed in Toolbook using a language called Openscript. Openscript is very English-like in its syntax and use. It may remind programmers of BASIC in its simplicity. However, that simplicity masks a great deal of very powerful function. Openscript has a wide range of pre-defined functions which, when built into a script, allow for the complete control of every object on the screen. As will be seen in the examples below, Openscript is structured, and programming in it is a good test of the ability to master structured programming techniques. This structure is critical to Openscript, as there is no GOTO construct. Everything must be managed through looping structures, calling structures and through the hierarchy of objects. Perhaps one of the biggest culture-shocks for traditional programmers who face an OOP language is that there is no one place in which you can see the complete flow of the program, since the program does not have any kind of typical top to bottom flow. Instead, objects are identified and grouped together as needed. Scripts are defined for each object only once, and then re-used at an appropriate place in the application's hierarchy. Consequently, trying to see the big picture of an application can be difficult. Added to this is the fact that Toolbook does not have any way to print out all of the scripts associated with an application in one pass. Also, the data associated with an application is stored in a special format, within fields that are themselves objects. So, while it is very easy to manipulate the data from within a particular application, creating large amounts of text is better done outside of the application with a word processor. The text can then be imp! orted into the application and placed into appropriate fields.

The strength of Openscript and Toolbook is the ease with which it handles graphical objects and video. Candidate pictures in Ballot Box are bitmaps, which are stored on disk outside of the Ballot Box application. When a subject access a picture, the Openscript programming merely reads the bitmap in and places it on a predefined "stage" on the screen. This works very quickly, and provides incredible flexibility. For example, if we wish to vary the pictures of our candidates, while holding constant all other information, this is easily coded. Multimedia objects, such as videos, are handled in a similar way. Toolbook contains a number of functions which open, play, rewind, and close digital video and digital audio. Coding these objects is simply a matter of placing a pointer to the disk file and reading it.

Future Directions

We have now used our simulation to run six sets of experiments, though we have so far analyzed data from only three of them. (See Lau and Redlawsk, 1992; Lau and Redlawsk, forthcoming; Redlawsk and Lau, 1995 for reports of the data analyses.) Our studies have included manipulation where we have varied the number of candidates in the primary election -- so that some subjects got two candidates in their party and others got four -- as well as varying whether or not the preferred primary candidate becomes the general election candidate; that is, whether the candidate for whom the subject voted in the primary win the nomination. We have also varied the number and content of the campaign videos that are shown, as well as changed the gender of candidates. In our next study, to go into the field this month, we are varying the attractiveness of the candidates, to assess how personal factors influence the way people process political information. From the standpoint of our system, we have some plans for change. The campaign videos were currently use are very rough -- their quality is not as good as we would like. In addition, because we chose to use Microsoft's Video for Windows, and our portables do not have local bus graphics, we have been limited to running the videos in very small windows. Our plans include upgrading our equipment so that the videos can run in at least a 240 X 320 window. Further, as video capture technology improves, we expect to be able to get better images in our videos. The recent upgrade of our video production machine gives us a platform to improve this critical are of our application. Finally, the Ballot Box program is not unlike many programs that have been developed and changed over time. It contains code that is no longer used, as well as inefficient structures that need to be streamlined. Most importantly, for our purposes, we hope to simplify the system so that any researcher interested in similar questions would be able to use the program without the necessity of recoding large amounts of the system. For the kinds of questions were are asking in our research program, Rick Lau and I needed to have a methodology that is radically different from that employed by most political scientists most of the time. Thus, we borrowed the information board concept from psychology and consumer behavior studies. We then changed its very nature by making our system dynamic, where we could match the flow of campaign information over time, in order to understand how information affects the voting decisions that people make. We see this technology as continuing to support our research, as we find additional ways to apply it over time.

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* Portions of this research were funded by National Science Foundation grants (SBR-9411162 and SBR-9321236). 1 The National Election Studies (NES) have been carried out on a regular basis since 1948, and originated out of the research done by Campbell, et al., authors of The American Voter. The studies are surveys carried out during an election cycle, which ask nationwide representative samples of eligible voters a number of questions on politics, and on the issues of the day. Questions include both open-ended queries where respondents answer in their own words (which are coded in the dataset based on key words) and closed ended questions of various types. These data then form the basis for many of the studies which have developed models of voter decision-making. 2 In order to make analysis clearer, and to limit the amount of knowledge about the real political world that might contaminate the experiment, we developed eight fictitious, but realistic, political candidates, four from each party. These candidates, rather than real-world figures like Bill Clinton, or Bob Dole, are used in the simulation. Thus, subjects know nothing at all about the candidates before the election simulation begins.

Designing and Delivering a Summer Institute on Academic Information Resources

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The Summer Institute on Academic Information Resources (SIAIR) at Kenyon College has been funded by the Pew Charitable Trusts. The goals of the Summer Institute on Academic Information Resources are to expose a select group of faculty and students to the many academic information resources available both on the Internet as well as locally on campus and to promote the use of these resources by faculty and students to affect innovative changes in the curriculum of the first and second years of undergraduate study.

To achieve these goals, an intense four day workshop is conducted each summer. This workshop involves presentations by staff members of the Information and Computing Services (ICS) division and Library, demonstrations, hands-on exercises and panel discussions which concentrate on specific information and learning resources. These resources are organized into three themes: Information Discovery, Communication and Collaboration, and The Empowered Learner. The workshop is structured to permit ample time and opportunity for open discussion and independent exploration. Thus the workshop is both structured and unstructured in its approach to meeting these goals.

The institute instructors developed a 280 page workbook which provides documentation to accompany each presentation, hands-on exercises, and group discussion. This workbook has twice won the ACM (Association for Computing Machinery) SIGUCCS (Special Interest Group for University and College Computing Services) first place award for Printed Materials in the Education and Training Materials Competition (1993, 1994).

This paper discusses what went into designing and delivering the summer institute and will attempt to highlight important aspects of the institute and workbook which have led to its success. The summer institute has been held once in both of the last two years and is scheduled to be delivered twice this summer (June, August).

SIAIR's success is partly grounded in its widespread support by senior administrators who were some of the founding authors of the PEW Charitable Trust grant proposal. Having senior administrators involved at the beginning who understand the importance of information technology in the curriculum and its ability to enhance learning was a key to creating and sustaining a high level of energy and motivation. The summer institute generated a great deal of interest and excitement in the participants. This excitement and enthusiasm spread to non-participating faculty as well as the participants shared the wealth of their new knowledge. This interest and excitement built momentum into the second summer s institute. The third year finds the level of excitement and interest exceeding expectations such that a third and fourth institute is being planed to accommodate the increase demand.

SIAIR begins each year with a steering committee made up representatives of the ICS and the Library (all of the staff instructors), faculty and students. There are approximately sixteen members of which three are faculty and three are students. It is absolutely essential to include representatives of all constituencies: faculty, staff, and students. Students provide a unique perspective on how the goals and objectives of the institute will relate to the student population as a whole. The students comment on how other students will react to ways faculty might implement the various resources and information resources in their classes. Their input provides valuable insight into what strategies might be most effective. And of course the faculty members provide their unique perspective on issues they feel will be most important to the faculty. Thus the committee has direct input from each constituency during the planning phase on how to design, organize, and schedule the summer institute.

The committee establishes goals and objectives, resource topics, participant selection criteria, solicits participant applications, chooses participants, and establishes the date for the summer institute. This steering committee meets approximately every two weeks beginning four months prior to the start of the first summer institute. The steering committee concludes a series of approximately four to five meetings having decided who will participate, who will teach, what will be taught, when it will be taught, what documentation needs to be be prepared, and having assigned a pre-institute assignment to the faculty participants.

Faculty participants must apply by submitting a description of why they feel their participation is necessary and what they expect to gain from attending. The Pew grant allowed the funding of $500 for each participant for the four day institute. Though payment was seen as a necessary method to encourage participation for the first summer institute the value and success of the summer institute alone now seems adequate to spur new participants. Another, and perhaps more resourceful, alternative to paying faculty to participate would be to award faculty some tangible item (i.e. computing hardware or software), of equal value and important to their academic endeavors.

The pre-institute assignments provide the instructors with a mechanism to insures that all the participants are comfortable to the same degree with certain fundamental resources and tools. The assignments include detailed instructions on how to use some basic information resources. The information resources are both electronic and paper based. Information resources of most interest are composed of both computing hardware and software tools used to access electronic information as well as periodicals, abstracts, indexes, and media traditionally found in the library. The information resources identified as fundamental are electronic mail, Internet discussion lists (listservs), the library s online public access catalog (OPAC), netnews (Usenet News), and VAX Notes (VMS based conference software). A subgroup of instructors serve to provide support to the participants in seeing that they are able to complete the assignments.

Shortly before the start of the institute the instructors follow up with the participants in a group meeting to survey the participants and determine which of the information resources they have experience with other than the fundamental resources identified in the pre-institute assignment. The instructors explain the summer institute in more detail and discuss what to expect. This is also an opportunity for the instructors to ask specific questions of the participants as to where their academic interest lie, what sorts of information they seek to use in their courses, and based on what they know so far of the summer institute, what they expect to get out of it. This survey allows the instructors to tailor the institute to meet the needs of the participants. By the time the summer institute begins the instructors should know as much as possible about the general goals and expectations of the participants and should have the institute custom designed to meet those goals and expectations. It is important to make the institute experience relevant and worthwhile.

A functional goal of Kenyon s SIAIR is to cover the major computing resources for accessing information on the Internet as well as materials in the college library. These resources include Gopher, Online Public Access Catalog, KCInfo (campus wide information service), Lexis/Nexis, FirstSearch, Dialog, government publications, audio visual material (microforms, slides, video, music), Internet discussion lists, newsgroups, VAX Notes, Netscape, courseware and multimedia, and software which supports or enhances collaborative learning. The resources explored are appropriate to the goals of the summer institute.

It is important to distinguish the function and purpose of each information resource so that the participants have a clear understanding of when the use of each resource is appropriate.. Each presentation is scheduled to support the three themes (Information Discovery, Communication and Collaboration, The Empowered Leaner). Each theme is explored through a series of presentations, hands-on exercises, and individual explorations. The key here is that the institute must be designed and presented in a logical fashion so as to impress upon the participants that each tool has a unique purpose.

It is not important to focus on the mechanics of the individual tools used to access information as much as it is to focus on how to apply the tools, the issues involved in their use, and the information they access. The summer institute offers and opportunity for faculty to explore and discover new resources. Faculty should leave the summer institute with a better understanding of on how to incorporate the use of the various academic information resources in their courses. Each presentation and hands-on exercise is carefully designed to provide basic instruction in the use of each resource so that faculty can achieve competency while at the same time exploring the pedagogical implications of these information resources.

Another significant goal of the summer institute is to empower faculty to incorporate the various information resources in their courses with limited support from the staff in either the Library or ICS. Faculty should be able to empower students to extend their reach for information and allow them to critically evaluate new information. Reducing the amount of support from ICS and Library staff is a beneficial side-effect of empowering faculty and students.

Each individual instructor is responsible for presenting the tool(s) or resource(s) for which they are responsible for supporting or teaching under normal circumstances. Therefore, each instructor prepares their own documentation, hands-on exercises, and presentation. The documentation is prepared in a generic format by each instructor with minimal page formatting. It is crucial that the documentation contain many samples of what the screen will look like when using various computing tools. There should be an ample number of exercises within each document as well. All included exercises should be up-to-date and tested to make sure they still work.

Each document is submitted in its electronic format to one person whose sole responsibility is the overall formatting, based upon a predetermined format, and printing of the final documents. Having one person responsible for formatting the document ensures that all the documents have a consistent look. This person is responsible for combining the documents into the final workbook. Each document appears in the workbook in the same order as it is presented during the workshop. A table of contents and index is created after all the documents are finalized. Each instructor contributes to a glossary and bibliography which result from their individual documents.

It is important to encourage the participants to take notes. Therefore, the workbook documentation is designed with large left margins of three inches. This provides ample space in the margin for participants to take notes. An alternative to this might be to provide a Notes page at the end of each individual document. The workbook is designed for a three ring binder which facilitates the easy addition of material as changes become necessary. Invariably, something changes about one or more of the information resources from the time the document is printed to the time it is presented. The three ring binder allows simple changes to be made at the last minute. A page can be reprinted and handed out before the start of the day's presentations or just prior to the presentation itself.

The binder used is one which contains pockets on the inside of the front and back covers to hold additional material distributed later but not inserted into the workbook. The front of the binder contains a transparent plastic cover under which a cover sheet can be placed. For each workbook the name of the participant is printed on the cover sheet in the lower right-hand corner. This gives the workbook a nice personal touch and also helps minimize the chance of workbooks getting lost or picked-up by the wrong person.

The workbook is organized in the same order as the schedule of the institute and then delivered to each participant on the first day of the institute. Faculty can easily follow the flow of each presentation, exercise, and discussion with the aid of the workbook. Filled with many examples and exercises, the workbook becomes a valuable reference well after the institute. In addition the workbook is provided to the Internet community via FTP or Gopher (and soon WWW browsers) as a series of ASCII text and Postscript files). In order to protect the identity and integrity of the workbook, it is not offered in the original WordPerfect file format since this would allow its format to altered.

In addition to the workbook each participant receives a coffee cup premium (Koozie Kup) custom designed with the instituted title and logo. Though the cups serve a functional use, they also server a strategic purpose for advertising the institute. A simple and yet practical public relations device for promoting the summer institute.

Each of these themes are presented and explored in several sessions designed for the academic information resources or tools for which they support, or a panel discussion which engages faculty to discuss pedagogical issues (see schedule on page 9). The presentation and hands-on sessions involve one presenter leading the participants through an explanation of a tool or resource and sample exercises.

Other instructors remain as coaches roaming among the participants and available to assist them with the hands-on exercises. Each presentation is followed with ample time for hands-on exercises. The hands-on exercises need to be applicable and provide some sort of beneficial reward that suits the interest of the participant.

The panel discussions have evolved from the first summer institute in which the instructors served as the discussion facilitators to the current model in which selected faculty from the previous summer s institute return to facilitate the panel discussions. Returning faculty (Summer Institute alumni/alumnae) provide an invaluable resource to the participants by sharing their experiences of how they are incorporating new academic information resources in their courses or research. The past participants are able to provide practical examples as well as tips and pitfalls which fuel lively discussion. Discussions should be designed as an opportunity to explore ideas and concerns and a chance to assure participants that the summer institute is an opportunity to examine ways to enhance learning and not a prescription for tenure and promotion.

A period at the end of each day is assigned for general discussion. This allows the participants the opportunity to voice any questions, concerns, or issues they may have with the material being presented. The participants are encouraged to lead this discussion and the instructors an opportunity to listen and make any necessary adjustments for the next day.

Throughout the presentations, exercises, and discussions the instructors attempt to weave in important issues dealing with tradeoffs, costs, and technology. Such issues as copyright, censorship, quality of information, attribution, source of information, morality, and netiquette are repeatedly brought up as they affect or are affected by the various academic information resources being explored. In addition, topics dealing with pedagogical goals such as preparation, support, credit toward promotion and tenure, empowering and enabling students, developing an individual knowledge base, extending the classroom, and assessment are explored. It is important to discuss the negative sides of information technology as well as the positives.

Discussion topics include how time spent teaching and using these new resources in class might be managed, the cost of implementing and supporting information technology, how reliable are these resources and the tools used to access them.

The four day institute begins each day at 8:30 a.m. and ends at 4:30 p.m.. Since the institute is an intense exposure to new resources it is important to keep participants involved and engaged. The schedule for the hands-on exercises and panel discussions should vary from day to day so that the schedule does not become predictable and monotonous. There should be at least one 15-20 minute break in the morning and afternoon. Additional breaks are beneficial after a series of hands-on exercises to prevent participants from feeling too overwhelmed. It is important to design the schedule so that participants move periodically from one location to another and are able to stretch and relax between sessions. The Kenyon Summer Institute is designed to present the various resources in one of the college s public computing labs (reserved in advance for the summer institute). Library materials and resources are presented in the Library, a short walking distance across campus. Panel discussions are conducted in various large and small groups and located in a room with comfortable seating and informal atmosphere.

It is important to schedule room assignments with the necessary resources and number of participants in mind. Good acoustics, air conditioning, and lighting are a few crucial factors which significantly influence how engaged or distracted the participants become. It is vital to make sure all audio, video, and computing equipment is running properly and reliably. Backup equipment should be ready in case of any problems. Light snacks should be made available during the breaks. It is important to keep in mind that the participants will be seated through most of the day and the snacks should be prepared with this in mind. Providing ample hot coffee and juice is important as well. The success of the summer institute depends partly on minimizing, if not avoiding, distractions, discomfort, and frustration experienced by the participants.

Expect the participants to come with varying learning styles. Instructors who aren' t presenting, but who are assisting the participants, become coaches, and need to be sensitive to the needs of the participants. Some participants will need to have difficult concepts explained so that they understand the big picture. Other participants will need to be shown exactly how to perform difficult tasks. It is important to be patient and identify what learning style each participant is accustomed to and share this information with other instructors who will then be prepared when they encounter these participants. Monitor the participants for frustration or confusion and attend to them immediately. Take extra time to bring slower participants up to speed. The goal is to avoid or minimize the chance of any participant becoming disengaged.

During the latter stage of the summer institute the participants are assigned to one of three teams. The teams are predetermined so that each will consists of participants from various academic disciplines. Each team is then assigned a hypothetical course for which they must design a portion of a syllabus, lecture, or research project. This activity requires that the teams seek out various academic information resources to either research their topic or support their hypothetical syllabus. The participants must become more intimately aware of what materials the various information resources offer for their topic. Thus, this activity becomes a practical exercise from which they are better informed and prepared about information resources they might want to introduce to their own students.

Before beginning their group assignment each participant is allotted two to three hours to explore the various information resources with the assistance of individual instructors. This allows participants to visit any resource they might be interested in reviewing with some one-on-one assistance. Participants must then work together in their teams to develop a plan and assign individual tasks. This activity is assigned in the afternoon on the third day and continues through the morning on the fourth day. It culminates with three team reports which describe what information resources their hypothetical course would utilize and how each resource would be implemented. The teams are encouraged to speak to pedagogical goals and issues related to the use of technology.

A small percentage of the participants are often a bit skeptical about the value of information technology and its use in accessing academic information, even after four days of hearing, seeing and experiencing information technology to access academic information. These participants sense that they are being presented with a big sales pitch. They 're not sure if they want these new resources or if they really need them. Some perceive that new institutional standards for teaching are being established to fix something they don t think is broken. Therefore, it is important not to appear prescriptive or imposing. The summer institute is an opportunity to prepare faculty who then can provide informal advice on strategic planning for information technology and resources.

The week ends on a positive note with a little fun and entertainment by demonstrating software and equipment which are examples of the future of information technology. This is a time to show off some of the leading technology and how it might be incorporated into the academic environment. Focus on technology that supports the goals of the institute. For example, the participants especially enjoyed a demonstration of white-board software with which two users modified and annotated a document. One used a desktop computer connected to a local area network and the other used a pen-based wireless palmtop microcomputer connected to the network and was able to move around the room during the demonstration.

The institute steering committee reconvenes the participants for a reunion approximately six months after the completion of the institute. The six month period between the institute and the reunion allows the participants to further explore and implement new academic information resources and determine their true value. The reunion provides an opportunity for the participants to share success stories and discuss, in specific terms, how they are implementing new academic information resources in their courses. The participants provide vital feedback on how they feel the summer institute went, how valuable the documentation is, what material could be left out or enhanced, and suggestions for designing the next summer institute. In addition paper and e-mail surveys are conducted to get specific feedback for assessing the value and effectiveness of the summer institute.

During the year following the summer institute, faculty participants from the previous summer's institute are encouraged to apply for a Course Development Opportunity. Faculty submit a proposal for redesigning an existing course or developing a new course which implements new academic information resources. Their proposals are judged on the basis of the goals presented during the summer institute, the number of students impacted by the course, and whether the course is designed for freshmen and sophomore students.. Faculty chosen to complete a Course Development Opportunity receive a $1000 stipend to be used to support the completion of their proposed design over a four week period during the summer. Faculty are encouraged to have the assistance of one or two students who also receive a $1000 stipend. Students are chosen based upon an application they must submit which is judged on their knowledge of the academic information resources involved and their knowledge of the course material or discipline.

The Summer Institute in Academic Information Resources at Kenyon College will no longer be funded after the summer of 1995. Regardless, current plans are to continue offering the summer institute while there are still faculty who need to learn about the various academic information resources. Due to the increase demand by prospective participants, as evident in our need to schedule two institutes this coming summer, we do not expect to compensate faculty participants for their involvement in future institutes. This should reduce the required funding to only the costs of the materials involved in producing the workbook. Of course, there is still the hidden cost of the time instructors spend preparing new and modifying existing documentation, exercises, and presentations, and the time spent involved with instructing and coaching during the week of the institute, all of which is time spent away from normal job duties.

As information technology becomes more prevalent as a means for storing, delivering and managing vast amounts of academic information, and the Internet becomes the vehicle for accessing that information, faculty must learn how to implement the various information resources and tools throughout the curriculum. An intense week long summer institute provides the time, expertise, and environment to tackle the challenge of getting faculty to learn and understand the various resources that can serve as valuable teaching or learning tools. Involving staff, faculty, and students in the design and planning process insures total representation and helps to foster a learning centered environment while diminishing the importance of roles and hierarchies. In addition, broad representation encourages campus support and promotes a strong sense of commitment to achieving success.

Multimedia and Computer-Based Instructional Software: Evaluation Methods

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Introduction

Testing and evaluation are important components of effective instructional software development. While in development, computer-based instructional systems are typically put through a variety of evaluation procedures. There are a host of methods available to researchers to evaluate and study such things as software execution, operating efficiency and the human-computer interface. Many approaches today are multifaceted, employing a combination of methodologies and multiple data collection techniques. These provide researchers greater capability to evaluate and study computer-based instructional systems. Moreover, given developments in cognitive learning theory, they may also be useful in studying learners' cognitive processing while engaged in technology-based instruction.

In this paper, several approaches to evaluation are discussed. Computerized tracking systems, videotape recording techniques, and verbal protocol analysis are presented as means by which to conduct more direct comprehensive evaluations of multimedia and hypermedia learning environments. Results from inquiries that have employed these approaches are discussed and their potential to affect the study of learners' cognitive processes reviewed.

Background

Multimedia is the integration of media (e.g., text, audio, graphics, and video) into a computer-based system (Jonassen, 1995). "It dynamically links and manages organized nodes of information containing multiple symbol systems and images within a given medium and across different media" (Park & Hannafin, 1993, p. 63). Multimedia is often structured as hypermedia (Jonassen, 1995). Hypermedia, characterized by an arrangements of nodes (concepts in text or graphical form) and links (semantic relationships between concepts), allows users non-sequential access to mediated content based on personal need and interest (Kumar, Helgeson & White, 1994). These complex interactive learning systems pose significant challenges for those researching their effects on learning and learners (Gay & Mazur, 1993). For example, the flexibility of a hypermedia system allows for the creation of unique lesson structures reflective of individual learning requirements (Park & Hannafin, 1993) and provides multiple knowledge representations in a variety of media forms (e.g., graphics, sound, animation, and video). While powerful from an information processing perspective, flexible, non-sequential, user-centered designs make it more complex to examine how learners interact with a system (Gay & Mazur, 1993). As Wadlow points out,

> It is difficult to make definitive statements about user-interface design, even in areas which have been studied in great detail, such as text-based processing and command-oriented systems. When this territory is broadened to include multiple windows, color, multiple input devices, and new object types such as animation and video, the user interface design task becomes quite challenging (1990, p. 181).

Learners' interactions with a computer-based system is vitally important for design and development. The success of a system is often contingent on an appropriate human-computer interface.

Formative Evaluation

Formative evaluations are iterative in nature whereby program features are evaluated and modified and then reevaluations are subsequently made (Hannafin & Peck, 1988). Methods have been devised to assess the human-computer interface and to collect data about how learners interact with learning systems. Initial program designs, for example, are sometimes given to "experts" for review. Interviews, observations, and pilot testing are other forms of evaluation. Often in pilot testing, students write down their reactions to programs and their feedback is used to refine the courseware. According to Allessi and Trollip (1985), "pilot testing is a process whereby representatives from a target audience use and test lessons while their progress and performance are monitored" (p.384). Various aspects of the systems are evaluated such as program execution, program efficiency, and instructional soundness.

There are several techniques by which to collect data on the human-computer interaction, as well as to study users' cognitive processes. Formative evaluation practices often employ computers to record key stroke data and learner responses: data helpful for evaluating a program and its usefulness to learners. However, in attempts to develop a practical understanding of how computer-based systems are used, recent evaluatic ι approaches have taken a more holistic view (Winograd & Flores, 1986) which advocate qualitative methodologies (Card, Moran & Newell, 1983) using multiple data collection instruments (Marchionini, 1990). Techniques for monitoring the interactions between learner and computer now compile visual, textual, and auditory information. Among other things, this data helps to identify learners' use patterns, reactions, needs, and interactions and portrays, to some extent, a more fuller representation of them in the learning environment. From it, researchers can potentially design more powerful learning environments. Furthermore, in recent years there has been much interest in methods that help researchers understand cognition and the interplay between learners and computer-based learning environments. Since interactive systems designed as hypermedia can, to a degree, resemble learners' knowledge structures, they can be used as devices to gain understanding of processes of cognition (Kumar, Helgeson & White, 1994). A learner's interactions with a computer can be collected using multiple data collection instruments and analyzed to obtain a fuller awareness of their thought processes.

Formative Evaluation Approaches

The discussion to follow will present several potential methods for evaluating learning systems and observing learners' information processing.

Use Pattern Tracking and Student Commentaries

Gibbs and Armel (1994) developed an interactive self-study computer-based module called Imposition designed for students to supplement class lectures. The program provided a visual experience to convey concepts including graphic demonstrations, testing exercises, electronic note taking, on-line glossary, and hypermedia access to key concepts. Also included in the program were two modes of data recording; 1) an on-line tracking system which kept logs of how students navigated through the program; 2) and a facility which enabled students to record comments and notes. All data were written to a file at the end of each program session. Table 1 depicts selected data collected by Imposition's tracking system. The system recorded, 1) the events or concepts a student examined and the sequence in which there were examined (column 1); 2) user number (column 2); 3) number of times events were examined (column 3); 4) amount of time spent on each event (column 4); 5) students' typed notes (column 5); 6) students' typed comments (column 6) and 7) options (Notes, On-line Glossary or Comments) selected.

Several observations can be made from this data. For example, the student comments in column 6 of Table 1, may indicate that program revisions are necessary to alleviate confusion as to the system's directions on an exercise segment. This is evident by the following student comments, "Are we to number pages? I missed the directions." The designer must determine the reasons for the student missing the directions. Such information is important to alleviate further problems and misunderstandings. The data also reveal that this particular student took a cursory look at the module and spent slightly more time on events in the beginning of the program than those toward the end. Moreover, while an on-line glossary and note taking facility were available, they were not used and only two comments were recorded. Thus, this tracking technique recorded student comments, their navigational paths in the program and provided a chronological record of selections; all of which are useful for design purposes and for monitoring user-computer interactions.

Table 1
Selected Data: Imposition's Tracking System

Screen	User	# of Times on Screen	Sec. on Screen	Notes Comments
TitleScreen	1	1	20	
Purpose	1	1	34	
Help	1	1	26	
Purpose	1	2	9	
Menu	1	1	14	I do not like the
DummyFold1	1	1	12	background
DummyFold2	1	1	2	pattern of the
Animate	1	1	20	menu area.
ExeStep3	1	1	22	
Step 4	1	1	8	
Exercise Y/N	1	1	1	Are we to number
Binding	1	1	13	pages? I missed
DummySum	1	1	18	the directions.
Menu	1	2	4	
Menu	1	4	62	

Options:	Glossary	Notes	Comments
	0	0	2

When using Imposition, students typed comments which gave them the opportunity to express their likes and dislikes. These on-line capabilities permitted students to take notes, make comments and pose questions to the designer or express concerns while working. While some comments are more valuable than others, student narratives during formative evaluation helped effect many improvements in the software. In this case, they gave evidence of student frustration, confusion, likes, dislikes, ideas, etc. Collecting student narratives turned out to be an effective way to obtain data about the design of the module. The comments feature was useful for getting direct feedback from users in narrative form while they worked.

Video Recording (Video Split-Screen)

In assessing multimedia, potential users are often asked to explore a prototype and to write down any reactions they have to it. Paper-based written narratives, while useful, may provide limited information for several reasons. First, collecting written assessments (a laborious task) places the burden of evaluation on the subject. Thus, the richness of feedback may be compromised based on whether or not the subject is motivated to actively participate in evaluation. Moreover, depending upon what is being studied, written assessments may jeopardize the type of mental processing that can be observed. For example, a written assessment may not fully reflect a subject's instantaneous processing of stimuli or the way in which one explores and links conceptual events presented by the learning system. Second, subjects often fail to note all their reactions and comments or make critical observations. Third, the value of a written narrative is largely contingent upon an individual's ability to clearly communicate. Ambiguities can be left open for the researcher's interpretation. Fourth, immediate responses or physical and verbal expressions are frequently lost with written assessment.

With current technologies, multifaceted approaches to evaluation which include audio and video records have become possible. These provide researchers instruments by which to improve evaluations methodologies, as well as to study human cognition. The computer's ability to record students' actions combined with visual and auditory records such as video depictions of students working and thinking aloud can give insight into learners' cognitive processes (Ericsson & Simon, 1982). "The integration of computer and video records allows for powerful analyses of qualitative data, and the sharing of these analyses among researchers." (Kosma, 1991, p.206).

In determining methods by which to evaluate interactive multimedia learning systems and to study students' mental processes in such environments, Gibbs and Shapiro (1993) developed a video split-screen data collection method. This method simultaneously video records subjects' actions and decisions in a program, their verbal commentary and elaborations, observations, and nonverbal and attitudinal reactions. Subject and computer screen are each simultaneously video recorded. One camera records the subject and the other records the computer screen. The two images are integrated through a video effects generator to create a split-screen effect. This technique provides a permanent visual and auditory account of evaluation for subsequent analysis.

The split-screen method was effective for assessing a multimedia prototype. The video recordings allowed the researchers to visually and aurally reconstruct the actions taken by subjects. This is beneficial for several reasons. First, it enables one to simultaneously monitor, among other things, how a program is used, the types of options selected and the order in which they are selected. It also shows where learners appear confused, what they like and dislike, and their observations about the program. Second, the technique allows for learners' direct feedback about their interactions with the program. Third, it enabled program developers to readily identify and correct program execution errors by reconstructing the actions taken by learners. Fourth, it permits the review and validation of observations by several researchers.

Video-Split Screen and Cognitive Processing

Our understanding of learners' thought processes in various types of computer-based learning environments is limited (Nakhleh & Krajcik, 1991). The video split-screen method may aid researchers in studying mental processes. Cognitive information processing and cognitive views of knowledge construction provide a theoretical framework to support this claim. In explicating how this might be so, it is useful to review aspects of cognitive information processing and knowledge construction.

Cognitive Information Processing

An information processing perspective of cognition is categorized by transformation of information from stimuli in the environment to a response by the learner. The process is initiated as receptors receive information in the form of stimulation from the outside world. These stimuli get transmitted as information to the central nervous system. For a brief period, the information is recorded in the sensory registers and a minute fraction of it is sent on to Short-Term Memory (STM) and all remaining information is lost. STM has a limited information storage capacity and information, unless rehearsed, passes out of it in a very short time. STM is referred to as working memory which signifies the process of information encoding as new information becomes integrated with learned knowledge. Information in STM is accessible. Encoded information gets stored in Long-Term Memory (LTM) for extended periods of time. For information in long-term memory to be used, it enters working memory by a process known as retrieval. As new information enters working memory, the spread of activation prompts the retrieval of existing related knowledge. Through these processes, existing knowledge becomes integrated with incoming information to facilitate new learning (Gagne, 1985; Woolfolk, 1990).

The information processing model indicates that information in STM is accessible for verbalization and thus learners' verbal reports may indicate the contents of STM and/or the information to which learners attend (Nakhleh & Krajcik, 1991). Correspondingly, verbalizations made during an activity have been shown to reflect the thoughts in STM (Ericsson and Simon, 1984). Given this, the video-split screen along with think aloud verbal protocol analysis (e.g., Ericsson & Simon, 1984) may prove useful in understanding learners thought processes. Structured observations and protocol analysis as used by Nakhleh and Krajcik (1991), is a process whereby learners, when performing an activity are prompted to talk and think aloud. Their performance is video recorded and verbal commentaries subsequently transcribed. Each spoken phrase is coded with categories for protocol analysis suggested by Ericsson and Simon (1984).

A pilot study was conducted using the video split-screen and protocol analysis. Five subjects, all of whom were computer novices, were video recorded using identical content from a multimedia system. Evaluation sessions varied from 45 minutes to 1 hours and 15 minutes. Individually, subjects received a brief introduction to the evaluation session and the program. They were told to think aloud as they explored the system, to comment on it, to make observations, and to ask questions when necessary. Subjects used the system individually and could terminate it at any time. Selected verbal commentaries were reviewed and categorized and category frequencies tallied. The categorization scheme used (see Table 2) was a modification of that which Nakhleh and Krajcik (1991) employed in similar inquiries. Table 3 shows the way in which verbal commentaries were recorded. This table reflects a sample of categorizations for each of the 5 subjects' commentaries for approximately a 2.5 minute period at the beginning of their session.

While the selected reviews were from a very small sample and the categorizations were not checked for evaluator bias, the cursory review provides some indications as to the utility of such an analysis. For example, although viewing the same system and content, subjects were found to verbalize differently and for varying amounts. Accordingly, the multimedia systems was a prototype and required design modifications and thus many commentaries focused on procedural and interface issues related to the program (e.g., "When can I proceed?" "There were no other directions so I hit OK!"). Conversely, there were far fewer analytical statements (e.g., "The numbers are being highlighted in some random order and I don't know if there is a reason for that. I think the mouse cursor follows -- I see how it follows. It follows in a horizontal or vertical pattern.").

Table 2
Coding Categories

1. Procedural statements referring to (P):
   a. Reading or questioning directions
   b. Performing an action
   c. Stating a goal
   d. Deciding what to do next or admitting not knowing what to do next
2. Analytical statements referring to (A):
   a. Observing, interpreting, or explaining event or text.
   b. Understanding or not understanding observations or text.
   c. Hypothesizing about concepts.
   d. Recalling pertinent subject matter knowledge.
3. Emotional statements referring to (E): Puzzlement, frustrations, or satisfaction.
4. Statements of inadequate understanding of (S1): subject matter concepts
5. Statements of adequate understanding of (S2): subject matter concepts

(Modified from Nakhleh & Krajcik, 1991, p.11)

If it is assumed that verbalization reflect thoughts in short-term-memory, it appears that much of the processing, in this case, focused not on instructional content but rather program design and content access issues. Thus, if the purpose of the technology-based learning environment is to engage learners in higher order thinking and problem solving, then by using these techniques researchers may, with greater likelihood, determine the extent to which the system meets its purpose. This technique provides a visual representation and an auditory categorization scheme to profile learners thought processes and focus of attention. It may be possible to visualize a learners' navigation of the problem space, to monitor their thinking, the system's affect on thinking and the kinds of processes.

Table 3
Categorizations for Subject Commentaries (2.5 minute period)

(P): Procedural statements (A): Analytical statements
(E): Emotional statements (S1): Statements of inadequate understanding
(S2): Statements of adequate understanding

Ss 1	Ss2	Ss3	Ss4	Ss5
P	P	E	E	E
P	P	P	S2	A
P	P	S1	A	A
P	S1	S1	P	A
P	S1	S1	A	A
P	E	P	S1	E
P	E	P	S1	P
S1	S1	P	S1	P
A	S1	P	S1	P
P	P	S1	E	E
P	S1	P	P	S2
P	P	S1	P	
P	P	S2	P	
A	P	P	P	
A	P	S2	P	
A	A	P	P	
P	S1	P	P	
S1	S1	P	P	

used to derive solutions. As Nakhleh and Krajcik (1991) note, "...videotaped records capture the correspondence between students' observed actions and their verbal commentary about their prediction, explanations, observation, and procedural decision" (p.3).

Knowledge Construction

Based on cognitive principles of psychology, learning is no longer viewed as a passive process but an active one in which learners generate their own knowledge. Learning occurs as a results of students building their own cognitive structures (Wittrock, 1986, 1974) based on their background, experiences and attitudes. During learning, learners interact with their environment in constructing their own understanding of a subject (Jonassen, 1995). It is the intent of many designers to create environments in which learners are meaningfully engaged in ways that facilitate knowledge construction. If it is assumed that learners do create their own knowledge, then the instructional events in which they engage and their cognitive processes during these events become important (Nakhleh & Krajcik, 1991). Thus, analysis of learners cognitive processes during an instructional event (e.g., analyzing new information based on prior knowledge, modifying existing knowledge constructs) should be useful in more thoroughly understanding how they construct meaning, as well as how to design environments to facilitate these processes. With video split-screen and protocol analysis, it is possible to identify the type of thought processes in which learners engage. For example, by analyzing verbalizations, one may determine if and how a learner is accessing existing knowledge to integrate new information with it. More importantly perhaps, is the ability to assess how the system interferes or alters processing and/or how it is used based on individual thought processes. In this respect, the video split-screen and verbal protocol analysis, a few of the many possible approaches, can provide researchers insight in the design and evaluation of learning systems, and prove useful in the study of learners' thought processes.

Summary

This paper has discussed several approaches for assessing multimedia and hypermedia learning systems. To some degree, non-sequential hypermedia systems have increased the complexity by which to monitor the human-computer interface. Recent assessment approaches have become multifaceted and holistic in an attempt to more fully understand this interface. Data collection instruments such as computerized tracking combined with video recording techniques have the potential to provide more direct comprehensive evaluations. Accordingly, these approaches also provide researchers instruments by which to study cognitive processes. The cognitive information processing model and learning as a constructive idiosyncratic process provide a theoretical basis for directing the utilization of instruments such as those discussed in this paper to study learners' mental processes.

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TestMaker: A Computer-Based Test Development Tool

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Introduction

From the beginning of the 1900s paper-and-pencil testing has been the standard means of administering achievement tests and many other educational measurements to learners (Olsen, Maynes, Slawson, & Ho, 1989). The proliferation of computer technology in society within the last forty years and the decreasing cost of microcomputers have enabled computers to be utilized for a variety of educational purposes. Some of the more standard uses have been in the area of assessment (Eaves & Smith, 1986).

Computers serve numerous functions related to assessment. Advancements in technologies enhance the computer's potential for improving test administration, scoring and reporting (Olsen, Maynes, Slawson, & Ho, 1989). Computers are capable of managing many of the clerical duties embedded in the assessment process. Moreover, they broaden our expectations and provide worthwhile insights into what should be measured and the methods most conducive for measurement (Johnson & Harlow, 1989). They provide educators with a more accurate experimental tool with which to manage the delivery of instruction, as well as learner assessment. Computers are not only capable of presenting test items but evaluating them as well.

Several factors may be attributed to the assimilation of computers into educational assessment, some of which are presented below. With conventional paper-and-pencil tests there is a considerable time lapse between the time of testing and the time at which test results are reported. These shortcomings prevent them from having much use in assisting teachers and learners in everyday educational pursuits. Consequently, educators and instructional designers have directed their efforts to finding new techniques and tools in order to curtail the current limitations associated with many assessment methods. Their attention, in many cases, has been focused on computer technology and, as Johnson and Harlow (1989) point out, computers are the likely tools for enriching the theory and practice of educational assessment.

A second factor influencing trends toward using computers in educational assessment is the administrative advantage this technology offers. Eaves and Smith (1986), for example, support computer use for learner assessment because of increased efficiency in test duplication, administration, scoring, item banking, record keeping and analysis. The major benefit computers provide relative to printed test administration are evident in two primary areas: test administration and test evaluation. Some enhancements related to test administration are standardized test administration conditions, individually administered tests, immediate test scoring, increased variety of testing formats, and ability to collect test and item latency information (Olsen, Maynes, Slawson, and Ho, 1989). Johnson and Harlow (1989) point out that the primary advantages that computers offer evaluation are effective and efficient scoring, objectivity -- computers have the advantage of being totally objective which is not possible with a human, and more organized assessment.

Assessment is a fundamental part of education. Traditionally, multiple-choice, true/false and object type tests have been the predominant means of assessment. While used heavily and appropriate in many cases, current educational perspectives (e.g., constructivism) require that assessment also focuses on higher order thinking and problem-solving abilities. Operations and strategies which are incorporated in courseware must account for and facilitate deeper levels of cognitive processing (Jonassen, 1988). A potential advantage of computerized testing is the capability to allow users to interact with testing. Research suggests that allowing for interaction during testing promotes learning. For example, giving learners the opportunity to respond to feedback was found to facilitated higher levels of achievement. Activities during computerized testing which help learners relate new information to existing knowledge (e.g., responding to feedback) may prove beneficial to learning and should be considered by instructional designers. It is possible that as computerized testing procedures become more interactive and dynamic, higher order learning may be facilitated.

The research literature appears to support the claim that computer and paper-and-pencil test administration produce comparable results in learner achievement scores. Studies investigating this question generally indicate computer testing to be closely equivalent to paper-and-pencil tests in terms of achievement scores. Stile and Pettibone (1983), for example, found no significant differences in acquired scores when comparing computer testing to paper-and-pencil. Eaves and Smith (1986) report that undergraduate college students' achievement scores on computer administered tests are similar to that of paper-and-pencil. Olsen, Maynes, Slawson, and Ho (1989) show that the scores obtained from paper-administered tests, computer-administered tests, and computer-adaptive tests are equivalent.

The paper will discuss a computer-base prototype called TestMaker that enables educators to create computer-based tests. The prototype is being designed to incorporate student record keeping and scoring, techniques for interactive testing, and advisement on test creation. Strategies for creating interaction during testing are also reviewed.

TestMaker Objectives

Despite the fact that many programs that have been created for computer-based test construction, educators frequently rely on paper and pencil. Several reasons may account for this such as the unavailability of technology, unfamiliarity with technology and/or the inability to tailor test creation programs to meets individual needs. The development of TestMaker was initiated by several requests from faculty at Eastern Illinois University for a computer-based test development tool that , among other things, would: 1) provide instruction on effective strategies for creating tests and; 2) assist in the creation of computerized tests that evaluate and record student performance. The program is designed as an instructional and developmental tool for teacher-education students.

Given the functional needs of faculty, the host of research implications computer technology has for assessment, and current educational perspectives such as the constructivism and their impact on testing; the purposes for developing TestMaker were:

1) to create a test development module that provides instruction on test creation to meet an expressed need of faculty ;

2) to create a computer-based test development tool that facilitates easy test creation to meet an expressed need of faculty,

3) to create an experimental tool that helps examine computer-based testing processes and;

4) to develop a computer-based module that incorporates testing strategies aimed at facilitating higher order learning.

Overview of Prototype Design

TestMaker is presently a prototype that consists of three main components: a test creation module, an advisement module and a test module. The test creation module enables developers to select a test type (e.g., multiple-choice). Once a test type is selected the developer can enter questions, feedback, and subsequently create a student test file. With the current prototype, multiple-choice tests can be created. It will eventually include true/false, matching and open-ended response test types. Running concurrently with the test creation module is advisement . At any point during test creation developers have the option to execute the advisement module to obtain information about such topics as writing effective questions and types of feedback. The third component is the actual test. From the test creation module a student test file is created. This module is fully executable and thus a student sitting at a computer can take the test, interact with it and receive feedback on their performance.

The prototype was designed in HyperCard. The designers pilot tested the instrument to determine the type of design features potential users needed and wanted. After some initials trial tests it became apparent that the test development module would require greater flexible than could be provided with HyperCard. While HyperCard proved useful for getting a model up and running, the designers decided that when full development is implemented a programming language (e.g., C) will be used.

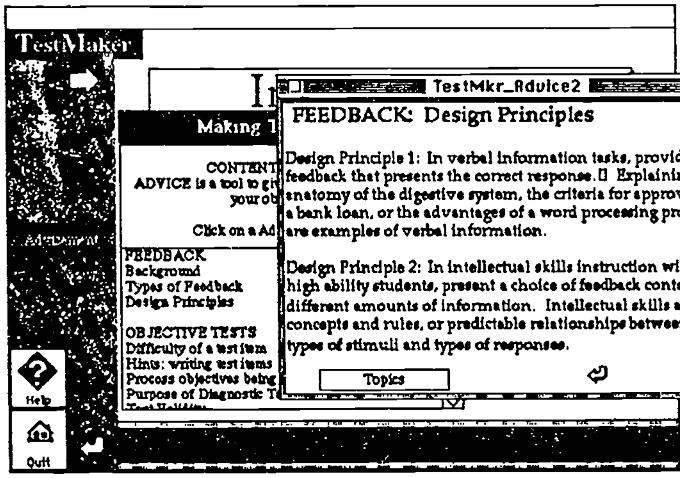
Modules of TestMaker

Advisement Module

Teacher-education students are the primary audience for which this program was designed. Many of these students have limited knowledge of effective test creation. Thus, the designer needed to create a facility in which developers could obtain advice on how to effectively create multiple-choice, true false, matching and open-ended questions. Two types of advisement are provided: user selected advice and system generated advice. TestMaker includes an advisement module which runs concurrently with the test creation program so that users can select key words to access advice on particular topics. For example, developers can get advice on types of feedback, hints for writing test items, test items length and complexity (see Figure 1). This advisement is referred to as user-selected advice. When developing a test, the prototype will automatically provide advice on effective testing strategies (e.g., suggesting an appropriate number of alternatives for multiple choice questions if the user attempts to enter too many). This advisement is referred to as system generated advice.

Figure 1

Screen Example: Advisement Module with TestMaker

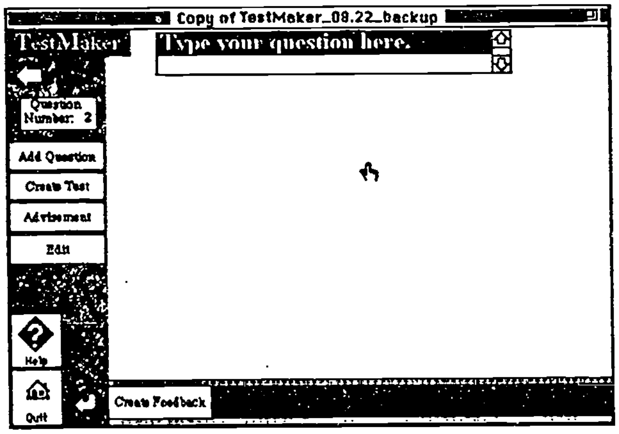


Test Creation Module

This prototype is being designed as a test development tool and an instructional module. To create a multiple choice test, for example, the user enters each question, a correct answer and alternatives simply by typing in predefined text blocks (see Figure 2). Previously created questions can be viewed and edited. Prompts guide users through the test creation process (e.g., "Enter the number of alternatives." or "Identify the correct answer.") and when necessary the system generates advice. For instance, if a user attempts to create 15 alternatives for a particular test item, the system indicates that too many alternatives are requested and it recommends an appropriate number to use for that test item. User-selected advice is available at any time during test item creation.

Figure 2

Screen Example: Creation Module



For each question, developers can incorporate feedback which will be displayed for students during testing. As a form of feedback, the correct answer can be presented for incorrect responses. Thus, if the instructor enters feedback and selects the correct answer display option, then; upon responding incorrectly to a test item, the student would be presented the correct answer along with the instructor's feedback.

Also available during development is an option for interaction during testing. While still being refined, this feature allows test takers to respond to feedback, explain their answers and to defend why they are right or wrong. For example, if the instructor had selected this option, then; upon responding to a particular test item, students would be prompted to elaborate as to why their response was correct. The student would then type an explanation which could later be reviewed by the instructor. Requesting students to elaborate on their responses is intended to facilitate the integration of new information or not yet learned content with their existing knowledge. Elaboration includes meaningful additions or constructions which help to improve an individual's recollection of learned content (Levin, 1988). Elaboration is hypothesized to facilitate information recall by generating alternate information retrieval channels and by providing additional information for the formulation of responses (Gagné, 1985). Marrone (1990) found that allowing students to respond to feedback in computerized testing facilitated higher levels of achievement. In this respect, the testing experience becomes itself a type of learning strategy which helps to facilitate learning.

Testing Module

From the test creation module the actual test file is created. This file can be given to students on disk or over a local area networks. Students, taking the test are presented questions to which they respond. All question items, correct answers, alternatives and feedback created in the test creation module are presented. Students are given a grade upon completion. During testing, student responses, elaborations and instructional time are recorded to a file which can later be reviewed by the instructor.

Summary

Computer-based testing has existed for several years. It appears to offer many advantages to educators including effective and efficient grade reporting and immediate feedback to students. A primary function of the testing program discussed in this paper is to help individuals learn how to construct effective tests and to provide them a means by which to do so. Thus, by creating an easy-to-use test development tool, which incorporates system-generated and user-selected advisement, it is hoped that the intended audience will be better able to create effective assessment instruments. Moreover, when considering assessment, in light of constructivist approaches, it is necessary to view measurement of learning in terms of higher order processing and problems solving. This module, while intended to meet faculty needs for objective tests (e.g., multiple-choice), includes features that will potentially help students generate their own meaning from information and subsequently construct knowledge. Features such as interactive testing and allowing learners to pose arguments as to why responses are right or wrong may be facilitative of higher order learning and are deserving of further research.

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Getting Everyone into the Tent (Even if it Takes a Big Top!)

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Overview

Thirty-four years ago, the seeds of rebellion were sown at the University of South Carolina-Aiken (USCA) in the form of a computing support operation grounded in large mainframe computers, complex operating languages, and a priesthood of expertise that exerted itself in every application of computing on the campus. This paper is devoted to a discussion of the conditions which led to a thorough review of the computing and information technology organization, policies and practices for this small, public institution.

Background

USCA is one of eight campuses in the University of South Carolina System and one of only two four-year institutions in that group located outside of Columbia. It serves the southwest region of the state, with baccalaureate degrees in sixteen disciplines, approximately 3,200 undergraduate students, and several graduate programs originating from USC-Columbia. The USC System shares a mainframe-based administrative computing system that provides student, financial, facility, and personnel support for all campuses. The move to personal computing at USCA got a major boost in the early 80's when charges were implemented for academic usage of the mainframe. In an effort to minimize these costs, the Computer Services Division was charged to develop alternatives to the mainframe in an effort to eliminate, or certainly to reduce, these costs. An advisory group composed of the primary computer users at the time was formed, and an alternative strategy was developed to make extensive use of PC's wherever possible. This served as the initial decision on the campus to move into the "PC Revolution." In a sense, we established a pattern that involvement in these decisions may require a level of expertise that the newcomer could not approach.

So, beginning in the early 1980's, USCA, like most other higher education institutions, began a slow transition from the environment that made this organizational style sensible to one in which personal computers are standard office equipment. Similarly, the changes manifested themselves in the myriad software programs that enable users not only to define their needs, but to dramatically increase the manipulations possible with it. The transition, it turns out, was so slow that many of the support mechanisms and operating styles that had characterized a complex and controlled approach to computing were applied to the new way of performing these functions with little or no review of their continued usefulness.

Problems Defined

At USC-Aiken, these issues, along with those associated with decision making authority, control of purchasing processes, and access to resources all became a point of major concern in the Fall of 1994. The Academic Council, composed of the heads and chairs of the academic units on the campus, began the development of a statement of their concerns with the structure, role, and leadership provided by CSD. Among the concerns were: CSD's control of the purchasing, installation, and maintenance of hardware and software; the administrative control of CSD, the ability of CSD to perform repairs and related functions on a timely basis, and whether or not certain services would be better provided on a contractual basis.

The tone and the depth of the distress were at a level that the Chancellor (the chief executive officer for the campus) put out a call for volunteers from across the campus to serve on a Task Force on Campus Computing. The group, with representatives from academic, as well as administrative, units, was formed in December 1994 and charged to "provide immediate counsel on operational issues in areas identified by the Computer Services Division or by members of the Task Force, and (to) develop a philosophy and action plans for future operations of campus computing that will meet the diverse needs of our institution," and to develop an interim report by May 15, 1995, with a final report due by December 15, 1995. To be included in the final report were to be "a plan for assuring the on-going assessment of satisfaction by all user groups..., as well as alternative strategies to meet the known and anticipated needs of the campus community in the area of information technology." The two senior administrators with responsibilities in these areas were named to co-chair the group.

The first sessions of the Task Force were dedicated to definition of the issues. Within two meetings, the group had determined that there were three general categories of concerns:

1. Issues of Short-Term Demand or Duration (those items which have a near-term solution ready to be proposed or fine-tuned, and which have the potential to be addressed before the end of the semester)

   Policies governing the purchase, installation, inventory control of software, and the timeliness with which it is handled

   Training (Initial and upgrading training for faculty, staff and students) Student Internet access policy

   Student access to laser printing after-hours Off-campus access (by faculty, staff and students) to computing resources

2. Moderate-Term Issues (Those items which are of immediate importance and which, due to the complexity or the requirements of gathering information about existing practices, may not lend themselves to recommendations in the near term. It was expected that issues in the category should result in recommendations for action no later than the end of the Spring Semester.)

   Excessive lag time in repairs

Need for improvement in "customer service attitude" on the part of CSD Staff and student workers

Value of campus standards for hardware and software; multimedia standards

Need for improved procedures for ordering, installing, and providing inventory control for computer hardware

Computer lab policies and staffing

Subcontracting some or all repairs

Campus-wide information service: gopher/www home page

3. Long-Term Issues (Those issues which demand immediate attention and considerable deliberation in order to develop the understanding and to set the `overarching' policies and priorities that will govern campus computing at USCA.)

   Development of campus and departmental information technology plans, resource allocations for information technology, migration planning for hardware and software, and allocation of computing resources

   Separation of policy/planning versus implementation/delivery, create Chief Information Officer for campus, and academic/administrative computing under same management

   Use of students in instructional support in relation to students in installation/repair/out-of-class support roles

The agreement under which the smaller groups were developed included an understanding that any changes to existing policy or practice, or any recommendations for future actions, would be brought back to the full Task Force for consideration.

Progress To Date

To date, there have been several key opportunities for a broader-based campus group to become involved in the decision-making process related to campus computing. There also have been many more discussions on the campus about the policies that govern our activities in this area than has been the case in some time. It should be noted that many of the policies and practices in place have been acknowledged to be effective until additional resources or alternatives could be developed.

What remains before the group are the toughest tasks: the development of a philosophy for campus computing that will guide the institution for the foreseeable future, as well as defining the best organizational structure to get us there. The ideas generated to date, which have not been forwarded for approval address the following points:

The campus is in need of a clear statement about the role of Information Technology (IT) in our mission. It should be unavoidable for a faculty or staff member or a student to become aware of the possibilities of this medium for the educational process.

In addition to an operating philosophy, there must be training and developmental opportunities for all campus citizens that will instill and nurture an appreciation for IT.

Planning for the best use of IT will be located at the unit level whenever possible, to assure the best application to the needs identified.

There must be resources committed on a regular basis for IT investments, rather than working from left-over funds or one-time allocations. Additionally, there must be some level of resource commitment over which the planning unit exercises final authority. This not only validates the planning process, it also creates a sense of ownership and control that is not present if the resource decisions are all made at a higher level.

Whatever the role of a central authority in IT, there must be a sense of value- added for it to be perceived as worthy of support. This translates into appropriate leadership into new developments, a readily apparent customer service attitude, strong infrastructure support, and an unwavering commitment to making the users the experts in their applications as opposed to the hat-in-hand seekers of good favor from CSD. Common Perceptions

In closing, it seems appropriate to quote from a recent presentation at CAUSE related to restructuring a similar unit at Depaul University (Chan, 1995). Dr. Chan notes that a similar process at her institution has resulted in a better understanding of the direction for the unit, increased productivity, new prospects for action and continued improvement. It is our hope at USCA that we could boast of similar outcomes.

Chan goes on to note that there are four considerations that must be addressed in any such undertaking, and we have made every effort to incorporate these concepts into our work:

Commitment to change from the chief operating officer and throughout the organization is critical to any successful restructuring effort.

Understanding that recommendations must incorporate the ability for continued develop and change rather than approaching outcomes as a final solution.

Communications among the participants and the campus community are critical to prevent surprises and resistance as outcomes emerge.

Providing people with the tools and the experiences necessary for their success in a new role is crucial to acceptance of sweeping change, by those directly affected, as well as by those who see it from afar. Conclusions

It is our sincere hope at USCA that the mechanisms we have put in place to address stated concerns will enable us to create a new support structure for IT on our campus that builds upon the distributed expertise, demands, and interest that we find there today. As opposed to our earlier model, we are now looking for ways to validate the ability of units to define and implement their plans for IT. Before the end of 1995, there should be a clear indicator of the future path that this technology will take on our campus, and it will have been developed BY the people and units impacted, rather than FOR them.

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Wireless Data Communications Prototyping: A Flexible, High-Quality, and Cost-Effective Information System for Education

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Abstract

In this paper, the authors describe potential applications of wireless data communications and mobile satellite communications technology aimed at improving education. The motivation behind this work is that the technology now exists for providing today's teachers and students with not only better access to educational facilities, but also instantaneous communications with distant sites and mobile units.

The proposed solution uses cutting-edge technology while maintaining cost-effectiveness. The authors experiences in developing a prototype vehicle tracking system based on wireless data communications and mobile satellite communications furnished some ideas for using the same technology in education. In particular, this may facilitate access to the Internet and distance learning, possibly via mobile units. Remote areas not accessible by modern transportation, much less fiber-optic cable for communications, will benefit from such links back to major learning centers. Teachers and students will have much greater access to each other and possibly to other resources as well. Furthermore, wireless technologies can be used to implement local area, metropolitan area, and wide area communication networks. Administrators will have the ability to track and to communicate with mobile units such as school busses, maintenance vehicles, etc. Incorporating these communications technologies with existing information systems will increase efficiency and productivity as well as educational opportunities for tomorrow's citizens.

I. Introduction

A. Overview of the System

Recent advances in wireless data communications systems - of which cordless phones, pagers, and cellular telephones are some of the most familiar examples - and its integration with mobile satellite communications have provided better access to remote resources as well as instantaneous communications with distant sites and mobile units. This same technology was used by the authors to develop a flexible, high-quality, and cost-effective vehicle tracking system. This system uses wireless radio packet modems for message transmission between a fixed dispatching center and mobile units.

These messages are relayed over a wireless data network. Mobile units are equipped with satellite receivers that read signals from Global Positioning System, or GPS, satellites. Much of the same technology can be incorporated into the educational environment.

In the next two subsections, the authors take a brief look at mobile satellite communications and wireless data communications. The authors elaborate on the prototype system developed they developed in Section II. Applications of this technology in education are discussed in Section III and future directions are projected in Section IV.

B. Mobile Satellite Communications

Satellite communications for mobile applications has only recently flourished. There are a number of global satellite systems for mobile communications. Among these are (i) the International Maritime Satellite Organization (INMARSAT), headquartered in London, which has been providing voice, data, telex, and facsimile services to ships through its satellites since 1982; (ii) American Mobile Satellite Corporation (AMSC) and Telesat Mobile Incorporated's (TMI) MSAT geostationary satellites; and (iii) the National Aeronautics and Space Administration's (NASA) Advanced Communications Technology Satellite (ACTS), designed to access the telecommunications tools of the 21st century [14,15,19].

1. What is GPS?

The Global Positioning System, or GPS, is a constellation of satellites that orbit the earth twice a day, transmitting precise timing information. There are 21 active and three spare satellites, each 10,500 miles above the earth. Transmissions may be collected by any GPS receiver at no charge at any hour. Receivers transform these signals into latitude-longitude- altitude information, or any other format that suits the user's application.

GPS receivers listen to 3-4 satellites at a time. Each satellite transmits two signals: a C/A-code signal for worldwide civilian use, and a P-code signal for U.S. military use only. C/A- code is a spread-spectrum signal broadcast at 1575.42 MHz. It is not affected by weather and electrical noise, and it is resistant to multipath and night-time interference. GPS receivers use these captured signals to determine the position of the receiver based on the computed distance from the satellites. Position and velocity information are quite accurate at C/A-code errors of less than 25 meters for the former and 5 meters/second for the latter.

2. The Magellan AIV-10 OEM GPS Module

Magellan Systems Corporation of San Dimas, California manufactures a variety of GPS receivers and modules. The Magellan AIV-10 OEM GPS Module [9] is one that comes with a Developer's Kit.

Communication between an external application software and the Magellan AIV-10 OEM board takes place via serial data transmitted between UARTs operating at CMOS levels. All data is transmitted as 8-bit bytes. Communication is asynchronous so that both input and output can be occurring in parallel. Input to and output from the board is at 9600 baud. There are two UARTs on the OEM board. The first, UART 1, is used by the OEM board to receive commands and to transmit information back to the external application software. The second port, UART 2, is dedicated for receiving RTCM-104 differential GPS corrections. The actual use of this port is optional and depends on the corresponding application.

There are eight UART 1 input messages and six UART 1 output messages that can be used to manage communication between an external application software and the Magellan AIV- 10 OEM board. These messages are outlined in Figure 1.

Input messages	Output messages
(1) Setup;	(1) Position/Velocity
(2) Message Request;	(2) Time;
(3) Initial Position;	(3) Receiver/Satellite Status;
(4) Initial Time;	(4) General Status;
(5) Altitude;	(5) Setup; and
(6) Restart;	(6) Almanac.
(7) Change Baud Rate of Port #2; and	
(8) Set Almanac.	

FIGURE 1. Magellan AIV-10 OEM Module UART 1 messages.

Status information include satellite healths, number of satellites being tracked, receiver mode, and others. This accommodates a wide range of uses for external application programs.

The AIV-10 is also capable of specifying position information in Geodetic (lat/long/alt), in Earth-Centered-Earth-Fixed or ECEF (XYZ in meters), or in Universal Transverse Mercator or UTM (northing/easting/alt) formats. Position datum can be in the World Geodetic System (WGS-84), North American Datum (NAD-27, NAD-83), Australia, Europe, Great Britain, Alaskan, Tokyo, and others.

3. Blue Marble Graphics MAIL Map, GeoView, and GeoCalc

A digital map displayer is needed for graphical displays of vehicular positions. Blue Marble Graphics (BMG) of Gardiner, Maine developed a Windows application called The Geographic View version 1.05, or GeoView [3]. It is a visual interface for digital maps. It supports a variety of graphics file formats, including Aldus's tag image file format (TIFF), Truevision's Targa (TGA), Compuserve's graphics interface format (GIF), encapsulated postscript, and Windows bitmaps (BMP). The package allows the user to navigate around a digital map using mouse clicks. A more recent version of GeoView is MAIL Map prerelease version 2.00. It shares most of the features of GeoView, but its support for dynamic data exchange (DDE) is cleaner and more improved. The digitized maps are accurate U.S. Geographical Survey renditions in TIF format.

Another application BMG developed is the Geographic Calculator version 3.0, or GeoCalc. This tool allows users to convert positional information from one format (see the previous section on the Motorola AIV-10 for more details) to another.

C. Wireless Data Communication

1. The ARDIS Radio Network

The ARDIS corporation operates the largest radio packet network in the world [1]. This company was formed in 1990 as a result of a joint venture between Motorola and IBM. Currently, ARDIS provides coverage to 90% of the population of the United States, Puerto Rico and the U.S. Virgin Islands. ARDIS provides service to over 10,700 cites and over 70 companies with approximately 35000 users. This service is provided 24 hours-a-day, seven- days-a-week. The system generates 45,000,000 messages per month [18]. In contrast to cellular wireless transmission, radio packet transmission provides both mobile coverage and in-building coverage at a fixed site. The performance and cost of a transmission on the ARDIS network are independent of location and distance between locations.

The ARDIS network (see Figure 2) consists of a subscriber unit, typically a personal computer attached to a radio packet modem, such as the Motorola 405i, which broadcast over a radio transmission medium to one of 1,300 base stations (RF towers) throughout the United States. Multiple base stations are positioned in major metropolitan areas to provide overlapping

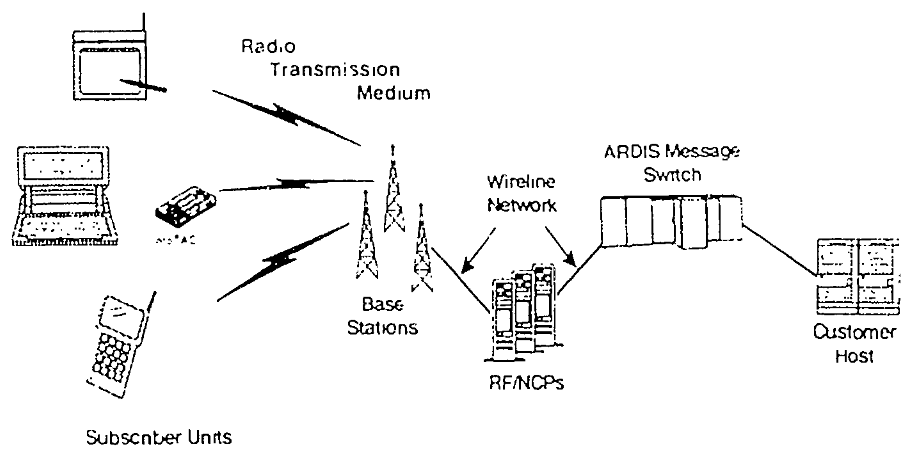

Figure 2 ARDIS network components.

coverage, which enables in-building transmission. The subscriber units and the base stations transmit and receive on a narrow-band FM signal operating at a frequency of 800 MHz. Separate frequencies are used for transmitting and receiving thus providing a full duplex channel that operates currently at 4800 bps in both directions. The base stations are connected by high speed digital lines to one of six intermediate level processors known as Radio Frequency / Network Control Processor (RF/NCP). The RF/NCPs are high speed specialized computers that interconnect multiple base stations with one of two ARDIS messages switches. The message switches are located in Chicago, IL and Lexington, KY. The message switch is a general purpose computer that coordinates the ARDIS RF data network. The network is managed from one of these two sites. In case of a disaster either site is capable of supporting the network.

Inbound wireless messages transmitted over the network are heard by the base station and transmitted to the by high speed phone to the intermediate RF/NCP processor, which transmits the message by high speed phone line to the ARDIS message switch for processing. Radio packet wireless transmission does not require a dedicated line for the duration of the transmission and there is no delay in establishing connections. Consequently, the ARDIS network provides real-time two way data transfer not dependent upon location. In contrast to cellular wireless transmission, the ARDIS network provides data encryption for security and Cyclic Redundancy Checking -16 (CRC-16) for error checking. Security is further enhanced by assigning a tamper proof unique ID to each subscriber unit (Radio Packet Modem) at the time of manufacturing [1].

2. The Motorola RPM 405i Radio Packet Modem

The wireless portable 405i, InfoTAC, radio packet modem (RPM) is manufactured by the Motorola Corporation. This device is the heart of the messaging system, allowing any mobile or fixed position microcomputer to be connected quickly to the ARDIS radio packet network. The RPM interfaces with all mobile and base units through a standard RS-232 9-pin connector. The unit weighs 95 grams and requires a power source of 7.2 volts [13].

There are two modes of data transmission supported by the InfoTAC, transparent presentation and native presentation. In transparent presentation, the unit supports asynchronous communication using 8-bit words, no parity, and one stop bit. In this mode the InfoTAC can be programmed using both standard and extended Hayes AT commands. The unit receives data from the UART chip on the microcomputer and transmits data to the ARDIS radio network at 4800 bps on a frequency of 806 to 866 MHz. Messages are limited to 255 bytes in the transparent presentation. In the native presentation mode, the InfoTAC can send messages of up to 2500 bytes in length. This mode is also capable of a more detailed analysis of possible error conditions, such as "low battery", "host down", etc. The advantages of the transparent mode are that modem is easy to program and that it can utilize terminal emulation software such as ProComm, etc., while programming of interfaces in the native mode are more complex [2].

II. System Design

Working as consultants for Signal Oriented Location and Information Systems (SOLIS), Inc. of Myrtle Beach, South Carolina, the authors developed a prototype wireless communications system for vehicle tracking. Constrained by a limited budget and a tight schedule, the successfully implemented prototype is capable of transmitting messages and vehicle locations from a mobile unit for real-time communication and digital map display at a central (dispatching) office. The system uses Motorola RPM 405i radio packet modems (to send and receive messages on the ARDIS network) and Magellan AIV-10 GPS receivers. Perhaps one of the most interesting characteristics of this system is that it was developed from off-the- shelf components. As described in [6], the system is cost-effective, and still flexible enough to deliver high-quality service.

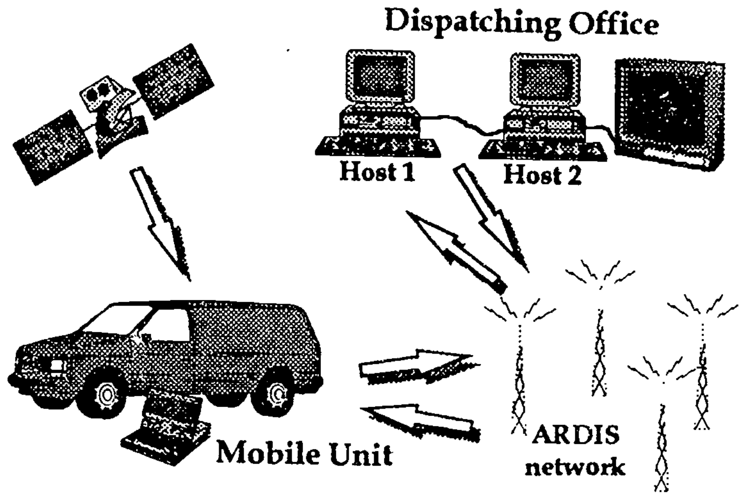

Figure 3 Overall system design.

The overall system design of the prototype developed by the authors is given in Figure 3. The main components include (at least) one Mobile Unit and a Dispatching Office. Details of each component will be discussed next

A. Mobile Unit Design

The mapping feature was taken off the prototype Mobile Unit developed (see the subsection on Development Issues for an explanation). Hence, only wireless data communication capabilities were provided for this component. In other words, this unit would require (i) a GPS receiver, to identify the vehicle location on the surface of the earth; and (ii) a radio packet modem, to send and receive messages to/from the Dispatching Office.

A simple split-screen design was used for the communications software. Messages from the Dispatching Office are received and displayed on the remote terminal. These are also saved to a file for future reference. GPS coordinates are automatically read and sent to the Dispatching Office at regular time intervals or these were sent upon request of the mobile operator. Of course, messages could also be sent back to the Dispatching Office.

B. Dispatching Office Design

The Dispatching Office consists of two hosts: Host 1 for messaging and Host 2 for tracking. The sole purpose of Host 1 is to manage both incoming messages from, and outgoing messages to, all Mobile Units. This includes managing databases that organize driver/vehicle information with radio packet modem numbers, databases that contain the current coordinates of all vehicles in the fleet, vehicle tracking information, and others. Hardware requirements for Host 1, aside from the network connection, is just a radio packet modem for messaging.

Host 2 will be running the digital map displayer to indicate vehicular positions. In the prototype developed by the authors, they used the Blue Marble Graphics application package. Host 2 may also be connected to a large screen monitor for better viewing. Both Hosts are connected to each other via a small network so they can share information between them (e.g. GPS coordinates).

C. Development Issues and Interface Requirements

The Magellan AIV-10 OEM GPS Module Developer's Kit comes with all the hardware required to receive GPS signals for use with an external application program. As far as the developer is concerned, the main task in correctly interfacing with this GPS receiver is to implement an asynchronous communications program that will read from (or write to) the serial port of the computer to which the AIV-10 is connected.

An asynchronous communications program was developed by the authors using Borland International's Turbo C++ for Windows version 3.1 compiler. The authors decided to dedicate the COM2 serial port for GPS functions (COM1 was used for the radio packet modem). The modules developed by the authors consist of routines to clear the registers of the serial port, set UART parameters, abstractions of various control messages to the AIV-10, and others.

After several trials and tests on how to initialize and startup the GPS receiver from an external application program, the authors used the following sequence: (i) set the initial time, (ii) set the initial position, and then (iii) restart. Position/Velocity information, for this application, was set to UTM (northing and easting values), with the altitude in feet and the velocity in miles per hour. The decision to use this format was for compatibility with the Blue Marble Graphics MAIL Map program.

In the authors prototype, the radio packet modem is brought on-line and transmits messages in the following sequence using the presentation mode:

(1) Read Source RPM ID
(2) Execute Modem AT Script
(3) Open Inbound Message File (PC to RPM)
(4) Create Inbound Message (User Generated or Automated Tracking Coordinates)
(5) Read Destination RPM ID
(6) Format Inbound Message
(7) Write Inbound Message to RPM for Transmission over ARDIS network

Outbound messages from the ARDIS network are received by the radio packet modem and processed as follows:

(1) Outbound message is received by the RPM (2) Transfer Outmessage from RPM's buffer to Microcomputer (3) Read Source RPM ID, Date & Time of Transmission (4) Classify Inbound Message (User Message or GPS Coordinates) (5) Process Inbound Message (Display, Write to Disk, Printer, etc.)

The authors decided to use FoxPro 2.6 for Windows as the interfacing language for the project. The original application was for vehicle tracking in the transportation industry (delivery, pick-up, parcel/package, etc.), which required some database handling. Microsoft s Access and Borland's Paradox were also considered. Budgetary constraints played a vital role in the decision to go to FoxPro.

FoxPro's support for dynamic data exchange (DDEs) allowed the authors to integrate the database component with the BMG MAIL Map program. BMG's GeoView did not support DDEs too well, and that for MAIL Map is more improved. Unfortunately, during initial runs at early stages of the system, the author's deemed it necessary to switch to a DOS-based application for most of the communications, primarily because FoxPro's user-generated screens and BMG's MAIL Map were using too much memory and were both taking too much time to redisplay in Windows. The next step was to develop the communications aspect as a DOS-based application written in Borland International's C++ for DOS version 3.0.

The same reasons were used in deciding to take out the mapping component from the Mobile Unit of the prototype. After initial runs with a FoxPro graphical interface and the BMG MAIL Map package, the authors decided to stick to a DOS-based communications program for the Mobile Unit. Similarly, the GPS receiver program was recompiled with Borland International's C++ compiler for DOS.

One important item to note, though, is that some companies providing goods or services in the wireless arena are charging ridiculously high prices. This will most likely change as competition becomes tougher. On the meantime, the authors realize that off-the-shelf components could be used to develop such systems. For example, a system similar to the prototype system developed by the authors was purchased by the city of Minnesota from a company called Guidestar [17]. The system tracks 80 of their 1000 city buses. There are also a few kiosks integrated with the system that commuters can use to determine more precise bus arrival and availability times The city paid $6.5M for the whole system. In comparison, the prototype developed by the authors has similar features at a fraction of the cost!

III. Applications In Education

A. Wireless Data Networks

Advances in wireless technologies have made wireless networks both practical and cost effective for the end user. Particularly in education, wireless networks can be beneficial. The geographic scope of radio packet networks can instantly set up a local area network at a remote school or add that school to a wide area network of virtually any geographical size. Wireless data networks can provide communication services to fixed sites where existing wiring within the building does not support networking. It also can be used to support building to building networking where the cost of wiring the different sites would be prohibitive. Radio packet modems allow wireless data networks to provide 2-way communication with mobile units independent of geographical location. In addition to fixed and mobile services provided by wireless radio packet networks, the technology can be used to quickly implement transient or portable data communication networks on a temporary basis. Consequently, wireless data communication networks using radio packet modem transmission can be used to both implement and supplement in-building and mobile connectivity over local and wide area networks.

B. Internet Access and Distance Learning

The ability to instantly add a school to a communication network facilitates distance learning. Information can be shared and distributed between all the nodes on the network. Thus, teachers and students have greater access to each other and to costly resources that can be accessed across the network. In addition to libraries, photos, records, digital images, and other collections that can be accessed by schools on the network, the wireless data communication networks allow students at distant schools to connect to and interact with students on field trips and at remote sites such as an archeological dig, etc. The wireless networks also will provide students and faculty at distant sites access to the Internet, which effectively allows the sharing of information and e-mail communication throughout the industrialized world. Estimates put the numbers of users of the Internet at currently more than 1 million and increasing almost exponentially [18].

C. Administrative Computing

The ability to set up transient data communication networks and to communicate with mobile units offer school admistractors at all levels access to instant real-time information. Transient data communication networks could be set up to provide communication and network access at conferences and special events at any site through the school system. School administrators would be able to both communicate with a moving school bus and to track its location, direction, and speed. In case of an accident or any emergency situation, the driver of a local school bus or the driver on a field trip of a vehicle located a thousand miles away could communicate with school administrators instantly. The ability to track a moving vehicle such as a school bus would also provide parents and students the ability from their homes to locate the proximity of the vehicle at any time.

IV. Other Applications And Future Directions

There have been quite a number of significant advances in wireless data and voice communications over the past few years. These have a direct impact on the office [5] and business [10] environments. One of the most interesting moves in the business environment is that towards the "virtual workplace". AT&T Global Information Solutions envisions this as an integration of notebooks (including mobile PCs and peripherals, PCMCIA and LAN cards), communications products, network services, application software, and support services. American Airlines is using wireless technology for customer service that provides real-time database access [10]. Soon to be available are "smart phones" [12], phones with PDA-like features (e.g. LCD screen and note-taking capability) that combine voice, organizer, and other capabilities.

Similar changes should be expected in the classroom as well. The classroom is evolving into a virtual classroom . We have witnessed students moving from the traditional notebook to the laptop or electronic notebook. Soon, we will see "smart" subnotebooks with wireless data communication capabilities in the classroom. These will be similar to the smart phones by Nokia and IBM [12], in that they will feature

* note-taking capabilities
* organizer/scheduler
* rolodex
* (wireless) Internet access
* (wireless) e-mail capabilities
* (wireless) faxing

The same piece of equipment could be used for taking down notes, for solving problems and assignments, for accessing in-campus information systems (be it searching for library materials or registering for a class in the coming semester), for sending e-mail to instructors (possibly for turning in assignments), and for many other functions.

Although the tracking ability using mobile satellite communications does not really fit in the classroom scenario, satellite communication will increase the range at which two-way wireless communication can be achieved. Integrating this with the "virtual classroom" will provide better communication between teachers and students, as well as greater access to resources such as national and university library collections of books, art work, photos, records and films. In fact, this is one of primary goals of NASA's Advanced Communications Technology Satellite (ACTS) program [14,15].

V. Summary And Conclusions

Incorporating wireless networks and satellite communications technologies with existing information systems within educational institutions will clearly increase efficiency and productivity as well as increase the educational opportunities for tomorrow's citizens. The capacity, quality, and cost of these modes of communication are expected to improve. And with wireless networks and satellite communications entering the office and business environments - soon, the evolving classroom - it is sure to affect many aspects of our lives.

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Universal Access and Faculty Training: Keys to the Information Highway for a Small University

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Overview

In order to function in the global information age, today's students must gain exposure to the rapidly advancing technology that is ushering in the future School systems everywhere have recognized the urgent need to be equipped with state-of-the-art technology and to increase emphasis on incorporating technology into the curriculum. However, programs to provide leadership and on-going training to most effectively use this technology are in short supply.

Imagine a 9th-grade language arts class in Atlanta, a 9th-grade English class in Paris, and a 9th grade English class in Moscow sharing thoughts about holidays in a story-writing contest. Imagine 10th graders from a dozen states across America comparing data about water samples they have collected in their locality. Imagine a 12th grader posing a complex question about business law and receiving a reply from five university professors. Think of these scenarios occurring within a 24-hour period for the price of a local phone call. If you are excited by these learning activities, then you are ready for the promise of computer-mediated communication (CMC) in the high school classroom. These and dozens of innovative, creative projects across the curriculum are taking place in a number of classes. For the price of a modem and the time to complete the paperwork for a free account in some states, teachers can achieve global connectivity for their students; and soon the power of fiber optics will upgrade these connections to interactive video mode.

Additionally, teachers can share ideas with their colleagues in other schools and stay in touch with fellow teachers they met at national conferences. Student teachers can network with their peers in other schools and access information at their college or university. The potential for professional support and collaboration in secondary education is extraordinary. Resource disparity between rich and poor schools can be alleviated to a large extent.

This, of course, is the visionary dream, and a dream that has come true in some schools and some school districts. The typical reality of telecommunications in the classroom, however, has often been a nightmare. A school that has one computer in the library, with a modem connected to a phone line, and teachers who give up after two or three unsuccessful attempts at network access will not be part of the dream. This is a typical example of the severe limitations that exist for realizing the potential of this technology. Two essential components of successful school-based CMC--connectivity and staff training--are often in short supply in the majority of middle- and high-school programs. This is especially true in schools attended by poor and disadvantaged students.

Federal Policy for Universal Access

The Clinton administration has formulated legislation to promote the advancement of a nationwide telecommunications and information infrastructure. The framework for this National Information Infrastructure (NII) initiative is a public/private partnership, wherein the federal government relies on the corporate sector to finance and build the infrastructure while the government provides incentives and ensures affordable access (Auletta, 1994).

The controversy surrounding this issue pits conservatives, who believe development decisions should be left to the marketplace which is smarter and more efficient than government, and liberals, who fear that a wholly commercial approach to information access would exclude those unable to afford it. The pro-government forces suggest the public library model as a standard for taxpayer subsidy of information, arguing that it is as much social as commercial (Auletta, 1994).

According to F.C.C. Chairman, Reed Hundt, 1995 will probably be the most important year in the history of American telecommunications (Auletta, 1995). The auction of wireless-spectrum licenses, the proposed telecommunications legislation, and the F.C.C.'s issuing of guidelines for high-definition television (HDTV) are three momentous events cited by Hundt.

Even with the political upheaval which placed the Republican leadership in the telecommunications driver's seat, certain guarantees proposed by the Clinton administration are still being considered essential. The new chairman of the Senate Commerce Committee, Larry Pressler (R-South Dakota), has circulated a draft blueprint of principles for new telecommunications legislation that requires government guarantees of "universal service." The proposal specifies the need for affordable access to advanced health care, education, and economic development. Although this language could have been drafted by activist democrats, according to Auletta (1995), a basic philosophical difference remains between "government as spectator and government as referee."

Another model is the widespread availability of basic telephone service at affordable rates, or "universal service," which has been the foundation of U.S. telecommunications policy for many years, and has helped provide opportunities for all people in the United States to communicate. The argument concludes that the full potential of the NII will not be realized unless all students who desire it have easy, affordable access to advanced communications and information services, regardless of disability, location, or parent's income.

Even if the federal government can assure universal access, the questions concerning implementation on the local level remain. How will the tough questions of "transparent" access be addressed? How will the connectivity problems be solved? Even if access to national educational services is subsidized, who will pay the hardware and software costs needed to connect to the national network? Who will provide the necessary secondary-teacher training?

Access or connectivity is the physical movement of information between computers over a communications channel. Since this channel is the major portion of the hardware involved in the data transfer, teacher awareness and understanding of networking is essential. Further, the complexity of hardware and software connectivity issues requires special expertise in the selection, installation, and maintenance of a network. Although educators involved in computer-mediated communication must rely on highly trained technicians to address the many esoteric connectivity issues, a basic knowledge of networking technology is essential for classroom teachers who want to expose students to the world of electronic information.

Investigation findings of hardware and software needs indicate that cost becomes a major factor. These costs increase even more when arrangements are made with commercial carriers, such as the telephone company. Dedicated phone lines are more expensive than regular connections. The opportunity for access to fiber optic cable is available in some cities, as well as some rural areas where the cable is being installed in anticipation of interactive cable TV. This type of service, which will allow for the best access, will be expensive.

With all this complexity and expense, the training issues become very challenging. Teachers must be trained on a working system in order to understand the full potential and, therefore, be motivated to persevere. Postsecondary educators are currently not preparing trainers to guide preservice and inservice secondary teachers, nor are they preparing teachers to administer complex networks. This knowledge cannot be gained from research alone; hands-on experience must be involved. This experience is not being provided; or if it is, it is a well-kept secret. A core curriculum in connectivity needs to be developed.

Local school districts need key players to provide the widespread coverage by implementing the "wired" school. This network includes academic and vocational classrooms, computer labs, faculty and administrative offices, and libraries. Access to the local network can be extended to anyone using a modem with a personal computer from home. Finally, a link is needed to the higher education facilities in the region, as well as online databases, and national and international research sites.

A Local Initiative

The American educational system is on the verge of a remarkable change. With the recent passage of the School-to-Work Opportunities Act and the Goals 2000: Education America Act, tech-prep educators will now have access to the necessary tools to prepare all students to be competitive in the workplace. Mississippi has begun to implement tech prep in phases throughout the state. A common strand in each tech-prep course is application of technology. As an integral component of Mississippi's tech prep implementation, and to ensure that students meet the objective of understanding and being able to effectively apply technology in the workplace, public school systems are resolving to design and establish state-of-the-art computer labs.

The Mississippi Delta has historically been identified as a region of wide-spread poverty in which resources are not fully developed to meet the challenges for the 21st Century. The recent inclusion of certain Delta areas as a federally designated empowerment zone will result in economic development that will generate an increased need for workers and educators with technological expertise.

In 1992, the Delta Area Association for the Improvement of Schools (DAAIS) conducted an Instructional Technology Study in the 31 public school systems which are located in Delta State University's (DSU) traditional service area. This study identified 177 buildings currently in use as schools. Building administrators plan implementation of instructional technology in the next few years and will need qualified personnel to support its use. Therefore, DSU's Division of Computer Information Systems/Office Administration (CIS/OAD) recognized a need to supplement their existing curricular offerings to include an instructional technology program that would prepare graduates to train current educators to use educational technology, and to directly support the curricular use of classroom educational technology. Additionally, graduates of such a program would have the necessary knowledge and expertise to plan and coordinate implementation and supervision of Tech-Prep labs.

Delta State University's CIS/OAD Division continually reviews its curriculum to ensure that it keeps pace with technological advances. Faculty conducting this review realized that the unique configuration of the CIS/OAD Division could allow the opportunities for collaborative, cross-discipline cooperation not ordinarily possible in traditional department/division structure. Therefore, they set out to develop a course of study which would provide school districts with personnel having the technical expertise outlined above.

Evolving an Instructional Technology Model

The focus of this paper will be to describe the process involved in envisioning its long-range approach to addressing the Delta's identified curricular needs. The process included: examination of community needs, assessment of current resources, curriculum development, impediment appraisal, and program evaluation issues. The final stage of this process was a proposed plan to develop a Master of Instructional Technology degree program which would enable students to gain expertise in selected areas of the emerging computer-based technologies.

Community Needs

The Delta Area Association for Improvement of Schools Instructional Technology Study (1992) recommends that on-going training in the use of hardware and software, as well as training for the integration of technology, be provided. Employment opportunities for graduates of an instructional technology program are strong, since the university's service area covers 31 public school systems with a total of 177 buildings.

Additionally, federal mandates to include technology education for K-12 and the generous state and federal funding for this type of education through the Tech Prep, School-to-Work, and Goals 2000: Educate America initiatives will generate a need for educators with expertise in the area of instructional technology. A pool of potential students for this proposed program exists, since teachers currently employed in the districts will need additional training to upgrade their knowledge and skill levels in order for them to assume the administrative and technical duties associated with today's highly technological instructional facilities. Projected enrollments were sufficient to anticipate full classes for at least five years.

Further, introduction of Internet to the Delta via DSU stimulated discussion among the Division of Computer Information Systems and Office Administration (CIS/OAD), the county library, and the local school district. From these talks, a pilot project to bring K-12 schools online and to provide training in effective Internet access and use was begun. A collaborative grant from the U. S. Department of Education was pursued to provide funding for this initiative.

Resource Assessment

Before undertaking such a project, the program designers thought it advisable to determine the resources currently available and additional resources which would be needed.

Available. Program designers determined whether courses for existing programs could be cross listed with the proposed program. Course offerings considered for the new degree included several which were already offered or planned at the graduate level, for example, Data Communications and Local Area Networks. Variations of technology resource planning, implementation, and management courses had been offered on an ad hoc basis in recent years. Moreover, several undergraduate courses included components which could be expanded into graduate-level offerings (e.g., Desktop Publishing included a multimedia component which could become Electronic Presentation).

Following the course overview, an evaluation of existing faculty resources was undertaken. Seven members of the CIS/OAD graduate faculty were involved in providing instruction in various areas of computer technology, including but not limited to those mentioned above.

Further, DSU's Office of Academic Computing had established, and coordinates, upgrades, and maintains, six instructional lab facilities. These labs provide a minimal basis for beginning an Instructional Technology program, but they more aptly demonstrate the Division's readiness and capability to implement the new technology necessary for the program. Examples of existing hardware included: one programming lab with a minicomputer server, one 30-station instructional lab, one 5-station (networked) desktop publishing/multimedia lab, and three general-purpose student-use/instructional labs. Available software included various application and programming packages.

Needed. In order to offer appropriate course work, such a degree program would require the addition of a full-time, doctoral-level faculty member holding a Ph.D. or Ed.D. in Instructional Technology. Since such programs are relatively new, a doctorally-qualified person from a related field who demonstrates extensive research or work-related experience in instructional technology might also be acceptable.

Further, extensive state-of-the-art hardware and software necessary to ensure students high-quality educational experiences would be needed for the new program. Tentative hardware requirements included one 16-station IBM-compatible instructional technology classroom and one instructional technology laboratory facility containing six high-end IBM-compatible and four high-end Macintosh stations. Tentative software requirements would include Authorware, Toolbook, Animator and Adobe

Photoshop for IBM hardware and Macromind Director, Sound Edit Pro, Fusion Recorder for Macintosh equipment, to name a few.

Curriculum Development

From research based on publication of Association of Educational Communications and Technology (1992?), the foci of the curricula at institutions offering Instructional Technology degree programs included the areas of Media Management, Telecommunications, Learning Theory, Instructional Design, Materials Production, Information Systems, and Librarianship. From this information, the designers determined that the areas of Information Systems, Telecommunications, Learning Theory, and Instructional Technology were most appropriate to complement existing and envisioned program offerings for their service area.

They then reviewed 50 listed university programs and constructed a matrix of course offerings within each program to determine areas of commonality. From this matrix review, they decided to include in the new program courses that covered such topics as telecommunications; multimedia; video and computer networking; planning, evaluation, and management of instructional technology; facility design; technology resource management; distance learning; fiber optics; and curriculum design. The plan was to develop these topics within the framework of an open-ended curriculum that would adapt to new technologies as they develop. Moreover, the Master of Science in Education Core requirements would provide the program with a strong pedagogical foundation.

Impediment Appraisal

Potential impediments to developing such a program are mainly internal and external turf issues, approval by state-level decision makers, and funding issues. For this program, stakeholders included: three university divisions/departments, two university schools, and the university as a whole; and two community agencies. Each stakeholder must be convinced of the value of the program to meet its own needs and interests. Further, even after all internal and external stakeholders come to terms, the project may be unacceptable to state-level decision makers.

A project of this scope requires funding in excess of that available through local, regional, and state sources. Designers must seek alternative federal and/or private funding sources. Perhaps the most difficult challenge is the collaborative effort necessary to achieve success in such a competitive funding market. Further, some areas of low socioeconomic development are excluded from seeking funding from sources which require the capability of the grantee to match funds awarded.

ProgramEvaluation

Evaluation is necessary to ensure a quality program of instruction. Programs are assessed by two types of evaluation--formative and summative.

Formative evaluation. In the developmental stage of a program, formative evaluation provides information to allow designers to revise and refine the program to meet specific needs, goals, and objectives. Activities involved in formative program evaluation may include advisory committee reviews, administrative/faculty reviews (including budget reviews), both student evaluations of the program and assessments of student performance within specific program courses, and instructor and peer reviews (Foran, Pucel, Fruehling, & Johnson, 1992). The formative evaluation activities selected for this program were advisory committee review and administrative/faculty review (including budget review).

Summative evaluation. Methods to determine whether the program has successfully met the goals set when it was begun must also be developed. After the program has been completed, the data are gathered to determine if intended results were achieved. Factors such as costs, image, lost opportunities, diagnostic information for improvement and graduate success should be considered (Foran, et al., 1992). The designers attempted to build in activities for data gathering and analysis to provide information pertinent for summative evaluation of this program. Research to locate/adapt an instrument to be used for summative evaluation is ongoing.

Summary

In today's highly volatile technological environment, how does a small university in an economically depressed area keep pace? This paper has detailed one university's effort to find the keys to the information highway and maintain a competitive technological stance.

Two essential components of successful school-based computer mediated communication--connectivity and staff training--are the focus of this discussion. First, access to the world-wide information network is discussed within the framework of government policy in regards to a nationwide telecommunications and information infrastructure. Second, an approach to developing a hands-on introductory training program for K-12 faculty is examined. A process to reach the implementation stage is presented.

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Designing And Integrating A Fiber Optic Network With An Existing Copper Network

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Purpose

Most colleges and universities have been developing computer networks for years, in fact, most were started well prior to being able to economically justify fiber media, agree on the type of fiber to be installed or have any flexibility in the installation of various fiber options. Early use of fiber was fraught with concern about the application of standards or the lack thereof and a fear that what was purchased now would be obsolete as the industry matured.

So.......we continued to install copper and as the industry gradually standardized and as the direction became focused, so did our view of the future. This view required high bandwidth capabilities that copper backbones were not capable of providing. And we found college administrators willing to participate in a discussion about this "infrastructure thing".

So.......many of us find ourselves with well-developed and highly connected copper networks that need upgrading.

I would suggest also that most of the folks in this room today are not flush with large budgets. It is really a pleasure to present these thoughts to you as I feel I am with a group of folks who have the same budget problems - no money at all! We have high level administrations who want world wide web home pages (because it meets a political need) and client-server solutions (because they know it will save mountains of money) and yet the well is dry when funding is requested for fiber infrastructure and associated equipment.

What can be done? My plan is to take you through the process that my college went through in moving from a copper to a fiber network. My thoughts include:

- describing the need in real terms
- building consensus for the project
- gaining support by college management
- justifying the need for consultant support - writing the RFP for the consultant
- working with the consultant and generating a final report - preparing an RFP for fiber installation and hubbing equipment - evaluating the responses to the RFP
- selecting the vendor(s)
- installation/integration
- possible synergy for the future

I also will present some personal views of how things can be done and where I think we should go as directors of computing services. Some of the ideas might be a little radical and controversial. Later on in the presentation, I'll ask for questions and comments and would really appreciate your critique.

Before I move into the meat of the presentation, I think that its appropriate for you to understand what my college is all about, from a general information viewpoint, what was our computing capability at the beginning of the process and what staffing did I have available. .sp

General College Information

Catonsville Community College was founded in 1956 and has grown to a institution with approximately 40,000 head-count students annually equating to about 10,500 FTE's. It is a comprehensive college with a significant commitment to the transfer student but with a very strong technical component. For example the Ford and GM ASEP training programs are on our campus; we have a large CIM and numerically controlled machine shop lab; we have an extremely large CAD teaching facility for Autocad, Cadkey, VersaCad and PC-Cadam and we operate a large JTPA program on campus.

Our campus occupies about 130 acres immediately west of Baltimore City and if you have even visited Baltimore's Harborplace, our campus looks down on the main harbor area from a large plateau about nine miles west of the harbor. The campus includes 21 buildings representing several architectural periods including an 18th century caretaker's house (now student activities) and an even earlier mansion house that has been fully restored and is on the National Register of Historic Places.

The annual budget for the college stands at $45 million with about $1 million allocated to Computer Services and computer purchases. There are 700 full-time employees and a total of about 3000 W2's issued annually including part-time employees, adjunct faculty and student workers.

Computer Services has reported to the Dean of Administration for the last three years after a stretch of about 10 years reporting to the Dean for Institutional Advancement. The Computer Services staff totals 23.

Community colleges in Maryland are funded by both the state government and the local counties resulting in rather autonomous institutions with minimal centralized state control i.e. plans are formulated, purchases are made and checks generated on the local campus. .sp

Computer Services Staffing

I have been at Catonsville for 14 years. One of my most prideful accomplishments is in developing a competent staff. They are experienced. My management staff consisting of managers of systems development, technical support, PC help center, data communications and networking and operations average 15 years each in the field.

In the data communications and networking area, I have a manager, a LAN administrator, 3 half-time communications specialists and a number of student workers. Also supporting this group is a UNIX analyst who is responsible for Netview, campus-wide LAN backups, Internet and MOSAIC development and special projects.

The remainder of the department consists of functions routine to data processing with the possible exception of a PC Help Desk that includes an automated trouble reporting system for PC hardware, software or data communications problems.

Back again to data comm, the staff over the last seven years is totally home grown. I have been fortunate in finding students who accepted the challenges of data comm and flourished. Many of them have gone on to much higher paying positions elsewhere but we have been fortunate to have them while we can. At this time, finally after years of requesting funding support, I can now offer living wages to these folks and we have stability in the staff - I'd stack them up against anybody's staff, anywhere.

A little farther on, I'll describe for you what our network looked like in the Summer of '93 when we began the upgrade process. No equipment including a large data PBX, the gear supporting nine remote sites, or our compressed video equipment has been installed by outside service providers. We have installed all of it ourselves including running 99 percent of campus cabling. All gear is self-maintained.

Combine the above with the natural drive and motivation of a young staff below the management level with a minimum of ego problems and an orientation to teaming in solving problems and moving ahead and you will hit upon one of the major reasons for our success with this project. In short, mention "fiber" to these folks and it was all I could do to hold them back!

Computing And Data Comm Capability At The Beginning Of The Project

In order to understand where we wanted to go, it is useful to understand where we have been. The following brief description of our computing and data communications capabilities in the Summer of 1993 sets the stage for our future direction.

- IBM 4381/T92, RS/6000, AS400 installed and networked to all workstations.
- Heavily committed to asynchronous (ASCII) data communications; three IBM 7171's are installed with 192 ports available.
- Links throughout campus to most of the 21 buildings and to most faculty and staff, the president (a heavy user), the deans, etc.
- Compressed video via T1 links to seven remote sites at other colleges scheduled and maintained by Catonsville.
- Student and financial data and an on-line library system available on the faculty/staff desk top for years.
- Six token ring LANs in use, each able to interconnect (after a fashion). Three Arcnet LANs installed with plans to upgrade them as funds become available. Token ring and Arcnet LANs connect to the IBM 4381 via NET3270. Total of 285 nodes are now connected to the college network via LANs at this time.
- Novell is the college standard for LAN communications.
- Netview/6000 being installed as the standard for network management.
- Infotron NX4600 data switch (character based) with 750 cross connects

- Infotron on-campus remote mode linked via fiber optic cable.
- Infotron remote node connected via T1 to Carroll Community College, Westminster, Maryland, with 100 connects.
- Coax installations include three IBM 3274's and one IBM 3174 for terminal support. (No pc's are attached via 3270 cards except for the two NET3270 LAN link gateways.)
- Many Sequel short haul multiplexors and Equinox T1 local multiplexors installed on campus.
- Many Astrocom coax multiplexors installed.
- Remote link to two other colleges via SNA at 19.2K.
- Remote link to two additional colleges at 9.6K.
- Linked to BITNET beginning approximately 1988.
- An NTI Meridian telephone pbx has been installed for about a year using only the copper wiring that existed prior to the install. Provides voice mail and data links for some terminals and PC's.
- Extensive campus-wide Email in use on the IBM 4381 and MUSIC/SP as the mail system platform with approximately 20,000 items/week.
- Remote links to five local high schools via 19.2 synchronous lines, each with 32 devices for student/faculty access.
- Remote dial-in service at 9600, 2400 and 1200.
- An AS400 installed with token ring and 16 async terminal connects.
- An RS6000 installed with token ring and 16 async terminal connects.
- Two ethernet LANs in MacIntosh labs not connected to the college network at this time.
- One Apple talk LAN in the College Press that is linked to the college network via individual serial connections from each MacIntosh on the LAN.

Did We Have A Problem?

More and more, it became obvious that the college had a problem, or better yet an opportunity. The pulse of the industry suggested exponential change. Multi-media was on everyone's mind. Connectivity was a necessity not only between users and the mainframe data store but also between individual users.

We dealt with the problems as best we could and built some solutions but they were not optimum. As we began to realize that computer services staff simply could not support many LAN servers located in various buildings throughout the campus, we hit on the collapsed backbone design as good for us. But how could we move in that direction by relying on thousands of feet of copper cable linking LAN servers to the computer center four buildings away.

It also became obvious that some of the cable that we had installed in conduits 10 years before was beginning to give us problems. In fact, on a day that registration was to begin in our gymnasium about

300 yards from the computer center, a key coax cable finally rusted away - literally. Charging into the breech, we alerted college management that the age of our connectivity infrastructure was such that they could expect many more occurrences in the future. But there was a way to solve the problem .... and what a way it was.

Developing Consensus For The Fiber Network Project

A candle hid under a bushel.................

Fortunately, Catonsville has a nurturing environment for implementing technology. Support comes from the president and the dean level of management but in a supportive, and in some ways, reactive way. For self-starters, we have the option of creating our own destiny. We are strictly a "bottom up" college. Rarely do directives come from on high that we must comply with. This environment fosters creativity and encourages risk but it places responsibility for success or failure on the entrepreneurs.

Because of this management philosophy, a well-developed committee structure has evolved that fosters cooperation among staff and faculty. To get something done at Catonsville, the committee structure needs to be stroked. We thus began a process of involving the various computer- related committees in the fiber network definition, proposal writing, critiquing and in general, talking up the project around campus.

The committee structure consisted of:

TEAM - Technology in Education and Management and the "daddy" of committees. Other established and ad-hoc committees report to this group.

ACADEMIC COMPUTING - The part of computing that deals with student needs.

MANAGEMENT INFORMATION SYSTEMS - The part of computing that deals with college administrative computing needs.

DATA COMMUNICATIONS AND NETWORKING GROUP - A sounding board for developing the networks needed to service all constituencies.

NETWORK ADMINISTRATORS RESOURCE GROUP - A support group of LAN administrators who are really local office folks and provide the first line of support in maintaining college LAN's.

COMPUTER RESOURCE GROUP - A support group of key PC users who meet regularly to provide guidance to the Computing Help Center in their role of conducting user training, offering software assistance and providing hardware repair.

THE PRESIDENT AND HIS STAFF - Meeting both with and without the president, this group needs to be informed about opportunities and directions and if in agreement, will support additional work on a project with the objective of later funding it.

THE TRI-COLLEGE COMPUTING COMMITTEE - Catonsville exists as one of three community colleges in our county. This committee coordinates computing development and with the active participation of two members from the Board of Trustees, smooths the way for ultimate approval of funding by the Board.

THE BOARD OF TRUSTEES AND THEIR FINANCE COMMITTEE - It goes without saying that the objective of a project proposal is to win approval to proceed from the Board.

>From this interchange of ideas at various levels throughout the college by the end of about a six-month period, we were able to create a list of needs that a fiber optic network and associated electronic componentry was designed to satisfy. By inference, the list pointed out those future needs that would not be met if the project was not approved. .sp

Future Campus Data Communications Needs As Initially Defined

1. To move to the next level of connectivity. The college had reached a plateau where the use of current copper/twisted pair/ coax technology would not meet future bandwidth needs.

2. To develop an adequate connectivity infrastructure, without which the college will not be able to move into and take advantage of the newer technologies.

3. To create an environment that can support client/server as campus computing evolves in the future. We need to be able to choose the type of computing platform that best fits the application being considered.

4. To connect any PC to any other PC and to any other computing resource in the network including the 4381, the RS6000 and the AS400. To facilitate this interconnection seamlessly with no degradation in response time or complexity for the user.

5. To free up many campus conduits that have been filled with coax and twisted pair cables by replacing them with a fiber optic configuration. Opening the conduits results in eliminating the need to dig additional trenches (an expe nsive proposition) when enhancing the telephone connectivity or tv/video service is required.

6. To create/move toward a network where connectivity and network software is maintainable from a central source with a minimum of staff. Expanding networks around the campus with no or minimal linkage to central services creates a maintenance headache when the support organization is under staffed.

7. To continue to emphasize standards and network consistency as we have already done. This helps to simplify maintenance, network extension, bridging and routing.

8. To continue developing a technical support staff that is well trained and has adequate numbers of people necessary to support the college community in the use of the new technologies.

9. To control and monitor the network via network management system software (SNMP, NETVIEW, etc). A method needed to be available to be aware of problems before the users do and to diagnose problems once they are determined.

10. To provide routing connectivity for an Internet link as an extension to BITNET and to provide interactive support for users connecting to devices remote to main campus.

11. To provide a network that can be extended to individual classrooms as necessary from centralized wiring centers in each building.

12. To extend full LAN connectivity to Macintosh users and to those Mac users now connected to Ethernet and Appletalk LAN.

13. To be able to link LANs at remote sites and to integrate users and lan maintenance in a seamless environment. LANs at the two remote sites need to be fully connected to services on main campus both for access and maintenance.

14. To create an infrastructure that will be able to support links to two sister colleges for SNA, TCP/IP and IPX protocols. Users across the tri-college network should be provided with full capability to access any resource on any campus.

15. Position the college with an adequate fiber media installation that could connect anything to it without limits as technology changed, i.e. we wanted to change the electronics not what was in the ground!

Project Cautions

Research into possible future scenarios determined that whatever approach we chose needed to consider several cautions. We listed a few to keep us honest.

1. Implement fiber optics technology. Bandwidth needed to be expanded by a significant factor. Multi-media and CD ROM access required a level of bandwidth not supportable on copper. Fiber was the only option. Fiber would be an enabler/a facilitator. 2. Be cautious if committing to some of the newer approaches such as

ATM. Standards and industry direction are not yet firm. However, there may be ways to hedge against possible obsolescence by installing a media layer that would service the new technologies.

3. Use extreme caution in justifying voice and video over fiber for the distances required by the campus. This approach may seem the most modem but may not be economically justified.

4. Question any FDDI deployment to the wiring closet and reject outright any FDDI to the desktop. Seriously consider FDDI as a possible collapsed backbone medium as it provides high bandwidth yet requires only a minimum commitment to the technology.

5. Use fiber to connect remote LANs to central servers as a way to meet the objective of item 4.

6. Question the continued use/standardization of token ring and whether 16 MB token ring is the best topology and speed for local LANs.

7. What is the best product for linking LAN's to mainframe resources? Is NET3270 still the best and most economical method of linking LAN's to the 4381?

8. Should the college continue with Novell as the lan operating system of choice?

9. Is ethernet twisted pair the best network media for connecting the CAD labs and engineering? Ethernet seems to be the choice in the CAD/engineering world.

We Knew Where We Wanted To Go But ....

>From the presentation so far you can probably tell that we were on the way toward an approach. We were comfortable with our ideas and the more we discussed them, the more they were becoming reality in our minds.

But still we thought that a sounding board for our ideas from someone outside the college community would help assure us that the direction was correct and the college could hope to reap significant benefits from our plan.

A consultant could provide us with:

- Advice on fiber optic technology that we did not possess
- Compare and contrast different approaches
- Question the collapsed backbone strategy
- Help establish a fiber topology and fiber counts
- Act as a sounding board for our ideas
- Help sell the plan to management and others on campus
- Provide suggestions for the hardware RFP
- Provide insight into different vendor hardware offerings

The idea was tried on the president's staff and they supported it but there was one caveat. Minimal funding was made available (surprise). Actually this played into our hands because the network was to be our creation. We were looking for support and a critique not a nuts and bolts plan. We expected to prepare all requests for quotation as in fact, the first RFP that was generated was for the selection of the consultant.

The RFP suggested a "short-term" project as the only option. Included was a list of current capabilities as well as our view of the future. The RFP asked for a number of specific deliverables including a topology plan, fiber counts and equipment options. Formal presentations were also to be made at individual meetings of the president and his staff, TEAM and the Network Planning Group.

A copy of the consultant RFP is included in ATTACHMENT A.

RFP's were forwarded to 16 potential consultants. Eleven responses were received and three were interviewed. The final cost was $20,000 for 20 days plus expenses. Included were the presentations and a report documenting findings and recommendations.

Preliminary Work Prior To The Consultant Visit

We realized that in order to keep consultant cost to an absolute minimum, significant preliminary work would need to be completed. For example, it would be a waste of money to pay a consultant to locate possible wiring closets when we knew the campus backwards and forwards. Using this concept as a guide, we scheduled a first meeting with the consultant immediately after the contract was awarded to detail exactly what we could do prior to the consultant's visit.

At this meeting we also planned a series of interviews with key faculty, staff and administrators. It was important for the consultant to connect with the campus community in such a way that would enable them to measure user needs and perceptions against those provided by computer services. A kickoff meeting was also planned to occur on the first day of presence on the campus by the consultants. At the meeting, the consultants would introduce themselves to most of the mid and upper level management staff and would describe the project, how they would go about gathering information and what they expected to deliver at the conclusion of their work. Most importantly, this presentation offered another opportunity to educate the college community about the project and create a sense of excitement and feel good about the college moving into this higher level of technology.

The initial meeting with the consultant also resulted in the do list of work to be completed before they came to campus. This was a major effort and could be compared to an in-depth self analysis such as prior to an evaluation. It could be argued that the most important part of the consultant effort was really what we found out about ourselves from the self analysis. We set about accomplishing the following:

* CONDUCT A MANHOLE AND CONDUIT SURVEY - The campus dates back to 1956 and has evolved one building at a time. The physical plant department, while being helpful, did not have near the level of detail that was needed. We began by walking the campus and opening each manhole and documenting the conduits entering and leaving the manhole. Conduit size was listed. The numbers and types of cable in each conduit was listed.

Building codes require that telephone and data conduits and manholes contain NO power. This simplified our study as we did not have to consider any manholes that contained power.

Each conduit was numbered in bright yellow paint and charted using a CAD program. Conduits were included and a topology was drawn. See ATTACHMENT B.

The purpose of the study was to develop a plan that would hopefully eliminate the digging of any new conduits or the placement of any new manholes. Such work would rapidly escalate the cost of fiber and should be minimized if at all possible. The study and topology map also helped to point the designer in the direction of a cabling topology that optimized the physical layout of conduits.

The study disclosed some good news and some bad news. Two conduits were found that connected major parts of campus that had not been used in years. In fact, the telephone cables that were in them were cut off at both ends! We contracted to pull out the old cables and presto, the consultant helped us visualize a ring around campus that provided a natural path for redundant links to each wiring closet.

Another find was a tunnel system that connected the buildings on the main quad. For some reason, this tunnel was not used by physical plant for power or telephone, relying instead on exterior conduits. Needless to say, we took it over and it saved many dollars in trenching and provided easy access to wiring closets in a number of the main buildings.

The bad news was that we determined that a number of conduits were completely filled with telephone, coax data cables and twisted pair data cables and control system cables (fire, energy management, TV, etc.). Fortunately, the entire network project required minimal construction: a 110' conduit to connect an existing duct bank to a tunnel beneath the main buildings; two 100' conduits to link the main technology building (the computer center) with the building immediately adjacent; and a 50' conduit to connect a building to an adjacent manhole.

Thanks to the level of effort accomplished to develop alternative paths and to work with what was available, only about $ 50,000 was expended for extra trenching and conduits. We were very pleased.

* INTEGRATE THE CAMPUS 10 YEAR MASTER PLAN - Perhaps it should go without saying, but obtain a copy of your master plan to be sure that any trenching you do need to do will not be right in the way of some projected construction. Future campus growth plans also serve as useful information in planning for extra fiber. Its cheaper to do it now. See ATTACHMENT C.

* DOCUMENT EXISTING LANS - If your campus is like ours, chances are that major offices, departments and lab facilities will not move beyond reason. So start with the existing LANs and you will have a good idea where major computing needs will be in the future. Design your fiber topology with this in mind. Take your existing connectivity needs and double them, then double that and you will have a fine plan.

* DETERMINE POSSIBLE WIRING CLOSET LOCATIONS - Using Category 5 unshielded twisted pair as the standard, we walked the buildings with a pass key and determined where wiring closets could be located that were always within about 300 feet of each workstation. It was our intent to home run each cable directly from the closet where hubbing equipment would be located to each workstation. This makes for the simplest design with minimum possible points of failure. Be ready to negotiate with area managers and building maintenance to obtain the space you need. See ATTACHMENT D.

* DEVELOP WIRING STANDARDS - We wanted to have the upper hand in dealing with fiber and copper wiring contractors. We contacted other major institutions and organizations in our area that had been installing networks and asked for their wiring standards. From these we assembled a set of standards that would fit for us. We defined cable types, connector types, cabinetry, plenum cabling, in-wall vrs. surface mount wiring and everything else we could think of. Then when it came to dealing with contractors we knew exactly what we wanted. See ATTACHMENT E.

Developing The Request For Quotation

As was stated earlier, we did not have the funds to afford a consultant to write the RFP. But when we really got down to it, we didn't want a consultant to do it. It was to be our network and if we couldn't define what we wanted, well .....

First let me state that during the time we were selling the project to the campus, preparing for the consultant, etc. (about a six-month period), we were attending every free seminar we could get to and were entertaining every hub and router vendor, installer and reseller on the campus that we could locate. We were building up our level of expertise so we could prepare the RFP and later evaluate the responses.

The RFP turned out to be 19 pages with five attachments. The document was broken down into five sections titled General Information and Network Description (including the vendor selection process), Fiber Cabling and Termination Equipment, Network Concentrators and Hubbing Equipment, Router Equipment and a Composite Cost Section.

Requests for Quotation were forwarded to 33 prospective suppliers - a list that we had accumulated over many months. Vendors included resellers, manufacturers and catalog suppliers of all sizes. Responses were received from 11 vendors. All major industry suppliers responded including Chipcom, Synoptics, Cabletron, Hughes, Lannett, 3COM, Cisco, Wellfleet and others.

Quotations ranged from $460,943 to $580,035. An important provision included in the RFP stated that we expected to negotiate a final contract price with our vendor of choice AFTER the vendor was chosen. This provided us with a level of flexibility that we needed so we could react to changes in college needs and in the industry between the time the RFP was prepared and Board of Trustee approval was granted - about three months. It also enabled us to have squirming room in selecting the best fit for the college. The final contract amount was $513,000.

In order to qualify for submitting a bid, vendors had to attend a pre- bidders conference where attendance was verified. After the meeting, vendors were split into groups and all campus buildings were walked.

Vendor Selection Process

Vendor selection and award of contract was based on a number of criteria including a point evaluation process. This process helped to insure that the college obtained the best equipment available for use now and in preparation for the future. Also of importance, was the objective of forming a business partnership with a vendor(s) who was capable of and interested in providing continued service to the college.

* SELECTION CRITERIA POINTS

* TECHNICAL QUALITY of the PROPOSED SOLUTION 40

Of interest was the vendor response to the specifications already developed; creative ideas in the proposal to refine and improve the specifications; hardware architecture; vendor plans for the future; how the response fits in with the college's stated directions.

* VENDOR QUALIFICATIONS 30

Vendor reputation; experience as an integrator or demonstrated ability to work with other vendors; time in business; references in the local geographical area; financial stability; key personnel to be involved; perceived desire to service the college.

* PRICE 20

Compared the firm fixed price of the various proposals. In the event technical proposals and vendor qualifications were similar, price may be a major factor. A contract would not be awarded solely on the lowest price.

* COMPLETENESS OF VENDOR RESPONSE 10

Content and quality of the vendor response to this RFP; adherence requested proposal format; understanding of needs and limits.

* TOTAL POINTS 100

Two vendors totaled in the mid-80's in points with the rest of the pack in the 70's. Negotiations occurred as we sought to find the strengths and weaknesses in the vendor approaches. Finally, one vendor stood above the rest and a proposal was sent to the Board of Trustees.

What Specific Criteria Was Used In The Final Selection

In the final analysis, vendor selection was based on a number of criteria that surfaced in discussions among the team members:

The desire for a single source of supply for the fiber installation, the hubbing equipment and the routing equipment was important to us. We wanted one organization to be held accountable for the entire project. They would then be responsible for marshalling their suppliers.

We looked for resellers with a strong local presence and commitment to our geographic area. We wanted a company with adequate financial backing to offer us payment options. Local references, and perhaps some in higher education networks would be a strong plus.

It became obvious during the negotiations that some companies above others offered a responsive sales force that could anticipate our questions and needs.

For the hubbing and routing equipment itself, we wanted a company with financial strength and past history that suggested they would play a major role in the future and perhaps even participate in defining it.

Equipment architecture became important. We wanted flexibility in equipment offerings where we could select chassis hubs or stackable hubs depending on the concentration of users at a particular location. We did not want a stackable choice to limit us in terms of network management or migration to newer technologies when available. We also wanted a chassis hub solution that could be installed in areas beyond the central computer center. Chassis hubs offer the highest level of flexibility and connectivity but they had to be affordable.

Hub density was a factor. We wanted to install chassis hubs that were sufficiently robust so that connecting more workstations in a given area could be accomplished incrementally without obsoleting equipment.

Since we had a historical commitment to and comfort level with token ring, we wanted to work with a company with the same level of commitment. We did not want to see token ring products always brought out last. We wanted to see a switchable token ring plan in place.

For the routing solution, we were looking for a scaleable plan that would provide sufficient bandwidth to incorporate all of our current and planned future rings in one chassis. Backplane speed had to be very robust. We also were interested in a solution that recognized the collapsed backbone philosophy as an ideal connectivity solution. Router options were also important as we expected to install a separate physical router as our Internet link, we had two remote sites with multiple rings currently installed now and we of course had the main computer center. The product line needed to be sufficiently broad to offer price competitive solutions to meet these three different scenarios.

The college had already made a commitment to Netview/6000. We wanted a hubbing and routing vendor that fully incorporated this product within their network management strategy. We also wanted a graphical display of the physical devices that would be able to integrate with Netview. Optimally, we hoped for a graphical product that would be identical for both the hubbing and routing devices.

And of course price. We wanted a vendor that was willing to fight for our business and offer price alternatives and concessions as necessary in order to win the project. During the negotiation we were looking for design modifications that would minimize cost but still meet technical needs. We were not willing, however, to buy second rate equipment just because it was the least expensive.

The final choice for the college was a solution offered by Bay Networks, the company resulting from the merger of Synoptics and Wellfleet. The local reseller and integrator was Data Systems Marketing, a $60 million company in the Baltimore suburban area.

Integration Plans

The installation of a fiber network for the college was not meant to be a revolution. The network design was thought to be an evolution from the current level of technology that would leverage the existing design and installation to provide increased support, network flexibility and future capability.

Since we have been building a collapsed backbone architecture for several years, we saw the fiber network as a means of connecting the workstation rings in campus buildings to central servers in a high speed network that would increase functionality and provide a new level of interconnectivity.

It was also our plan to build a network that would improve uptime and be manageable from a control standpoint - we wanted to know what was going wrong before it went wrong. This presumed using non-passive hubbing equipment and intelligent routing for all future purchases.

Prioritizing equipment purchases enabled us to select areas of the college that had a high immediate need. Hubbing equipment and routing support was purchased for these first. Since our major opportunity was to interconnect LANs, we did not plan to replace any existing LAN cabling or passive multi-station access units at first. We acquired sufficient equipment to connect the existing category 5 and Type I LANs to the hubs. For several new areas, we did acquire sufficient hubbing gear to home-run these installations directly to the hubs (our standard for all future connectivity schemes).

This enabled us to bring up the network with a rather small initial investment but let us take advantage of much of what was anticipated for the future.

We are now at the point of installing the hubbing equipment in the closets and connecting to centralized routing. Hopefully, all will go according to plan and we will meet out goals.

Enhancing The View Of The Future

As the project has evolved, so have our expectations. Industry developments have also suggested some exciting future uses of the new network that would not have been possible before. Our list is still growing but for now, it includes:

- College-wide access to the production duplicators for faculty and staff so that documents can be transmitted via the network and held in a queue in the copy center for duplication.

- Access from any student lab to all student software existing anywhere even when some buildings or labs are closed.

- A robust Mosiac access to the World Wide Web.

- A network with bandwidth to handle imaging. Under consideration is an option to outsource imaging and link the off-campus supplier to user offices via the network.

- Using the network as an enabler for maintaining a software and hardware inventory, a software distribution system and a means of autom^ting server and workstation backups.

- Establishing a college-wide directory of files with standards in place on all machines.

- A new awareness that client-server computing depends first on a high bandwidth network.

- A potential for a PC administrative application to be accessible from any location with no degradation of response.

- Centralizing dial-out activity and FAX service for all PC users.

AND IN CONCLUSION ....

Thank you for your attention and I have time for any questions you may want to ask.

Mooving to a Virtual Curriculum

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I taught three writing classes this past fall–freshman, sophomore, and senior–at the University of Missouri - Kansas City. But all three classes spent much or most of the semester on the virtual campus of–although not in the classrooms of–Diversity University Moo. The moo in that name stands for "multi-user object oriented." DU Moo is an Internet accessible, computer-based, virtual-reality program in which students and teachers may engage in on-line, computer-mediated discussions and co-operatively compose interactive textual constructions. It is both less complicated and more wonderful than it sounds.

The 110 class wrote one paper on Internet exploration (find three things to explore and describe them), wrote another on their favorite Internet destination (describe how a new user could get the most from it; LambdaMoo getting the most attention here), and for their third papers had a choice: apply for a RL (Internet-ese for "real-life) job (ie: research a potential employer, write a cover letter, write a resume) or build your own virtual space at DU Moo.

The 225 class wrote three papers on textual reality–one based on words shaping their personal experience, one on the worlds made of words on the Internet, and one comparing either of those to the realities shaped by words in Leslie Silko's novel, *Ceremony*. Additionally, they collaborated, in groups and as a class, in the virtual painting of a text-only mural for DU Moo's Minority Studies Hall.

The 403 class, "Writing in a Cultural Context," had only two projects: the first, a "real-life," essay-shaped object describing any aspect of virtual reality; the second, a virtual construction imitating any object they chose from "real life." I particularly enjoyed the football stadium built by the Chiefs cheerleader who was in that class; although both of the Malaysian students in the class came up with interesting virtual constructs: a Malay Visitors' Center (iconographic artifacts) and Nora's Cafe (authentic cuisine). But, even so, this class was, I suspect, the one which got the least out of its exploration of cyberspace. In addition to whatever shortcomings (and techno-pedagogical ambitions) I might have brought to that class (and its syllabus), it suffered, I think, from a serious case of Short Timer Blues on the part of its student members.

This course was offered solely to provide graduating seniors in the University's business school–aka: the (H. & R.) Bloch School of Business and Public Administration–a low-impact method of fulfilling the university's requirement for a "writing-intensive" course beyond sophomore composition. As such, it was scheduled in the Bloch building and in a regular, which is to say, "computer-less," classroom. It attracted, predictably enough, eight business-administration majors in their last, or next-to-last semesters at umkc: two Malays, one Nigerian, and five (for lack of a better term) "traditional" students–nice kids each and every one: charming, deferential to authority, open enough to any new classroom innovation which promised to reduce the number of books they needed to buy for the semester (see the syllabus included in the appendices to this paper), but Short Timers, never-the-less. Their interest in "writing," in or out of any given "cultural context" was, so far as I was able to determine, nil, pretty much across the board, although they ranged from "willing" to "eager" to acquire some new computer skills. What they mostly wanted out of my class, however, was (to get) Out Of The University.

The class met three days a week: Mondays, Wednesdays, and Fridays at 9:00 a.m. To acquire at least some computer access, we "liberated," to borrow some terminology from my own long-departed undergraduate days, a couple of different computer labs on the campus for two of those class sessions each week. On Wednesdays we'd "sit in" at the Language Resource Center, with the kind permission of its director M. Jeanne Yanes; and we would connect via brand new Macintosh Centris (since renamed, "Quatra") 610s. On Fridays we would meet, with the cooperation of coordinator Shelia Honig, in the English Department's computer mediated composition classroom, where we would connect via vintage Macintosh LC iis.

On Mondays, that semester, there was no Internet access to be had anywhere on campus. That was the routinely scheduled "downtime" for maintenance of the university's erstwhile vax1 mainframe computer, our Internet server at that time. So we went ahead and met in the regularly scheduled classroom, thus providing the instructor an opportunity to strut around in front of the class and nurture his ego. I get kind of a kick out of marking up a traditional "black board," truth be told.

Floating from building to building through the week provided the class with about an hour and a half of in-class computer access each week. That's better than nothing, but the time was divided between two computing platforms which, although they were both Macintosh, were just different enough to complicate the students' lives. And these were students who, although they were sporting enough to meet in a different classroom each day of the week, were also altogether unwilling to log onto the Internet outside of class hours. Whether because I spent too much time guiding them through the intricacies of our multi-platform environment, or too little time stressing the need to take electronic texts as seriously as they took the printed texts they read and wrote for other classes; whether my assignments were too ambitious, or my deadlines too ambiguous; whether the Short Timer Blues were just too compelling, or Business Majors just don't *do* Humanities, I honestly do not know. But these students would not–and did not–work on this class outside of class, except during the last week of the semester, of course, when my class suddenly became the most important thing in their lives and the most rewarding experience they had ever encountered, and so on and so forth. You've heard it all before.

I never-the-less include, as appendices, examples of some of their projects. They didn't do too badly, given their minimal investments in these electronic enterprises. I think they might have done better–especially in terms of revision, editing, and final proofreading–if we had had more computer access on a single computing platform, and if they had been more at ease with word processing generally and Moo programming in particular in the first place. Having a better, or perhaps more sympathetic, teacher might also have helped, but hey, my other two classes did alright with the *same* teacher, so I'm not going to beat myself up too badly over this.

The most polished virtual product of the semester, by contrast, was the mural created by my 225, "Composition II," class. It received lots of group attention and in-class revision time. You can see it for yourself by telnetting to *MOO.DU.ORG port 8888* , @go(-ing to) cultural (studies); then exiting west (w) to Minority Studies Hall. Be sure to "taste mural" and touch it, too. Here's how it took shape.

It was not on my syllabus. I was wandering around DU Moo one day, visiting with my friend and colleague there, Jeanne, the archwizardess, and we happened to wander into DU's Minority Studies Hall. The room description said there was a mural there which portrayed people of all races working together in harmony to build a peaceful world, or words to that effect.

I typed, "l [for (L)ook] mural."

And I received the response, "I see no mural here."

Jeanne explained that the mural was just part of the room description. I decided the hall deserved something more elaborate–perhaps a separate detail that would bear closer scrutiny; and so, with Jeanne's permission, I offered the virtual painting of such a thing to all three of my classes as an "extra credit project." I was really excited by the possibilities, but the only class which seemed to share that enthusiasm was my 225 class–perhaps because it was studying *Ceremony*, a novel with a culturally inclusive theme by a Native American storyteller (and one of my two or three all-time favorite books, I might add), perhaps because I had just handed back a stack of essays with comments indicating that much, much revision was in order across the board. We may never know.

In any case, we began the project with a class discussion of how the mural might convey the sense of people of all races working together etcetera etcetera. I had visions of workers and peasants in coveralls and kerchiefs wielding hammers and sickles in the best socialist realist tradition, something like what might have been at Rockefeller Center. They suggested a picnic. I grumbled. They suggested children playing games together, and people fishing from a bridge. I grumbled some more. They explained that the bridge would serve a metaphorical purpose. Not unlike a bridge in Silko's novel, they reminded me, it could act as a visual connecting structure for diverse cultures. I had to admit I liked their idea better.

I discussed several generic programmable moo "objects" we could use as a virtual canvas for the mural. "We could use the generic talking object," I said. "It could talk back to people who asked it questions that contained certain key words, kind of like my desk." The desk in my DU Moo office talks to people who visit me there. My students were unmoved. They wanted a more traditional mural, as virtual murals go. "Murals," I was politely informed, "don't talk back." We settled on the "generic detailable object" available for programming in DU's Technology Hall.

I solicited a list of activities to be portrayed in the mural from the class as a whole and recorded their suggestions on the "white board." When four or five activities had been listed, and class time was about over, I asked them to each choose one of those activities to consider between then and the next class period. When the class next met, I divided them into groups according to the activity they had chosen to consider in the interim: bridge-building, picnic preparing, water sports, land games. Then I left it pretty much to them to divide the work among themselves within each of those groups. We devoted portions of the next couple or three class periods to meeting in those groups, until each group had produced a collection of "detail" texts describing the various components of its broader activity. Each of those details was then discussed and revised and edited by the class as a whole before being entered in the moo by the more computer-clueful of students in the class.

The result was, I think, pretty slick, as virtual murals go. Certainly, it is the best, if also the only, virtual mural I've ever seen. It has lots of details, and details within details. I like showing it off. But I realize that my product, as a composition instructor, is not text, or even "student text," and still less "students." It is, on my best days, in my best semesters, writers: that is, thoughtful communicators–people who think critically and share their thoughts carefully. I hope the process we used to produce the mural gave my students some practice in critical thinking and careful communication. I *know* they got a huge charge out of "publishing" a fairly high-profile "artistic" creation in a literally international medium. This was highly motivated text generation and revision.

But I also suspect that the "Composition I" students in my 110 class, without necessarily having much to "show" for it, as a group, learned the most. And I think that's because I told them the least. (See Tari Lin Fanderclai. "MUDs in Education: New Environments, New Pedagogics." *Computer-Mediated Communication Magazine.* Vol. Two, No. One. January 1995. Page 8. Posted at: http://sunsite.unc.edu/cmc/mag/1995/jan/fanderclai.html)

"These are your character names and passwords," I wrote them, in e-mail sent to their various student accounts one evening. "Here's the address," I told them the next day, writing DU Moo's telnet address on the white board. "I want you to describe yourselves in this moo space and build homes for yourselves there. To learn how to do that, you'll have to solicit help from other users in the moo. Have a nice day."

One student, in particular, showed just how much such a *laissez faire* approach can yield. Her "Koda's Skywatch," and the virtual objects within it (especially her pet bat) are incredible. But for me the more remarkable thing is that she spent whole nights (as in dusk to dawn) meeting people from all over the world in order to:

learn how to program her space and objects,
write and enter both their apparent descriptions and descriptions for their verbs,
enter those descriptions,
seek out audiences (again from around the world),
share her text, and then
revise it in response to their (text-rendered) responses.

The creativity Robin Wilkinson honed in that space--as a student who had very little to say in class and one whose full repertoire of prior computer experience consisted of operating a cash register in a restaurant–is, to me, as a teacher of college-level composition, literally awesome.

Conclusions

I have no doubts about the viability of moo environments for composition instruction. They provide teachers a powerful new medium for class discussion and text production and publication. To make the best use of this medium, classes need: **regular access**, on a consistent platform to a robust moo environment (I recommend DU Moo at Telnet *MOO.DU.ORG port 8888*); **savvy teachers**, familiar enough with moo programming to point students in the right direction (ie. the "help" menus) and comfortable enough with the creative process to let them travel that way largely unescorted; **willing students**, motivated to invest their own time and energies in learning the intricacies of an evolving, interactive medium.

Appendix A

English 403-WI/VOA / Writing in a Cultural Context / Fall 1994
MWF 9:00 -- 9:50 a.m. / 13 BSBPA*
Instructor: John LaRoe
Office: 223 Cockefair Hall / Hours: 10:00 -- 11:00 p.m., Mondays.

Required Texts & Materials:
You are not required to buy any textbook for this class, but there is much that you will be expected to read and otherwise engage (see below). Depending upon the level of access we obtain to a CD-rom reader or readers, you may be encouraged to acquire the CD-rom based Myst product published by Brøderbund. You are required to have an account on UMKC Vax1, a 9x12 manilla folder, and at least one 3.5" floppy high-density, double-sided computer diskette. I recommend you also acquire a writing guide (such as Bedford Handbook for Writers) and a guide to the Internet (such as The Internet Complete Reference). Browse the bookstores, find guides that strive to be comprehensive and with which you are comfortable.

Work Load:
You will be reading a lot of material which you will be locating on the Internet. You will post short (minimum 200 words in length) weekly commentaries on your reading and class discussions to a dedicated locally hosted UseNet Newsgroup.
One major essay (hard copy, minimum ten pages in length) will be composed and submitted in a series of drafts: Rough Draft (19 September), Revised Draft (26 September), Response Draft (10 October), Final Draft (17 October).
One virtual essay (multi-user interactive, minimum ten objects / details) will be constructed over the course of the semester; opened to the class for initial peer responses no later than 18 November and submitted for a grade no later than the last Friday on which the class meets.**

Other Important Stuff:
Grades on the two essays will determine 60 percent of the grade earned in

this class. The Newsgroup commentaries will determine another 20 percent. Class participation will determine the remaining 20 percent. It is difficult to imagine that students using all three of the "skips" permitted by the attendance policy described below will earn better than a "C" in class participation. You will be advised at mid-term to drop or stick with the class. If you are advised to drop, you should do so.
Class attendance is required. If you miss more than three classes, your grade will be lowered; if you miss more than six, you will be asked to drop the course. There are no excused absences other than those dictated by university policy.
PLAGIARISM: If I suspect and then prove plagiarism on your part, you will receive an "F" for the course and your dean will be notified. This is department policy.
TARDINESS: To cite a mentor of mine, Mickey Dyer, "It is unwise to annoy your instructor."

# # #

* The class may, depending upon enrollment and room availability, meet at other sites on the Volker Campus to obtain access to computing resources.
** The instructor may, at his discretion, approve an alternative multi-media interactive virtual construction.

Appendix B

main hold
The main hold of the Pequod is dark and damp. This seems to be where LaRoe's students store their works in progress.

Exits include: [hatch] to Pequod's main deck, [revolving_door] to Diversity University's Corner Pharmacy, [Sliding_Wooden_Door] to Malay Visitors' Center, [Airport_Road] to The Docks, [tunnel] to D.U.'s Stadium, [automatic_door] to Diversity University Food Center, [sliding_glass_door] to Neil's_Gym, [red_door] to Noraz Cafe

tunnel
D.U.'s Stadium
Walking onto the huge football field, you immediately see a huge sign that says, "WELCOME TO D.U. STADIUM." Thousands of fans screaming all around you. As you walk onto the field, you look around and see football players, lots of media, the D.U. mascot, and the cheerleaders. The weather is great and the excitement is high for a great game about to begin.
Exits include: [tunnel] to main hold

You see goal posts and uniform here.
l d.u. mascot
You see a big bulldog named "The D.U. Dog." He is about six feet tall and grey. D.U. Dog wears a red collar with little silver buttons on it around his neck and wears red baggy shorts with a red and white shirt. His name is printed in big letters on the back of his shirt. As the game begins, you see D.U. Dog doing his own groovy steps in the end zone. Everyone is cheering and laughing with him. As you are watching him groove, he comes running over to you and shakes his belly at you. You laugh and go on your merry way.
l players
You see lots of players on both sides of the field. On one side, they are in red and white. On the other side, they are in blue and white. You notice immediately how big these men are. Some of them are as big as 6'8", weighing 300+ lbs. You immediately feel incredibly small and could run into a hole. You watch the players run onto the field. They are yelling and seem to be very fired up.
l media
You see tons of people lined up and down both sides of the field. They either have cameras or video cameras in their hands. There are so many of them that you have a hard time even seeing the plays that are occurring on the field. Cords are following these people everywhere and you are trying to cheer on the fans without tripping. This is not so easy. Among these media people, is one you recognize every week. The Jumbo-Tron Man. You can see him for a better description.
l jumbo-tron man
You see a tall skinny man decked out in D.U. colors. He has a big video camera on his shoulders with a cord that follows him. He gets real close to you and yells "You're on!" You look up at the big T.V. screen and see your face on the Jumbo-Tron. You smile real big and yell "Go D.U.!" The Jumbo-Tron Man yells "OK," and you are off the screen.
l cheerleaders
You look around the field and see 36 girls all in red shiny sequined uniforms. They have sparkling red poms in their hands that are constantly being used. They are cheering and dancing throughout the entire game. You are curious about those red poms and wish that you could see one. There just happens to be a set on the ground in a corner. If you want to see them, look poms.
l uniform

It is generic, thus the description is generic as well.
Type "help clothing" for more info.
take uniform
You take uniform.
wear uniform
LaRoe slides into a teeny-weeny red sparkling sequined outfit
remove uniform
You remove uniform.
drop uniform
You drop uniform.

tunnel
main hold
The main hold of the Pequod is dark and damp. This seems to be where
LaRoe's students store their works in progress.

Exits include: [hatch] to Pequod's main deck, [revolving_door] to Diversity University's Corner Pharmacy, [Sliding_Wooden_Door] to Malay Visitors' Center, [Airport_Road] to The Docks, [tunnel] to D.U.'s Stadium, [automatic_door] to Diversity University Food Center, [sliding_glass_door] to Neil's_Gym, [red_door] to Noraz Cafe

red_door
Noraz Cafe
The walls are painted in light red. You see several *dining tables,
all covered with dark red table-clothes. At the left corner, close
to the wall, you see *food counter. Checking counter is located
near the entrance. The room is divided into smoking and non-smoking
section, which separated by a few distance away. Varities of food
are diplayed at the food counter. Some of them you might not find
familiar. But they sure looks delicious.*Melati is here to serve you.
Exits include: [pequod] to main hold
You see melati here.
l melati
A woman wearing M'sian trad Batik silk dress.She looks friendly & eager to serve u.
"Hi melati
You say, "Hi melati"
melati says, "[to LaRoe] Hello there! Welcome to Noraz Cafe."

l menu

==

%%NORAZ CAFE%%

Breakfast special
Curry-Puff
Egg-Sandwich
Lunch Special
Fried Rice
Chicken Rice
Fried Noodles
Dinner Special
Chicken or Beef Satay
Oily Rice
Beverages
Coke or Diet Coke
Hot Tea, Iced Tea
Hot Coffee, Iced Coffee

==

l food counter
You see several kinds of food displayed at the food counter. Most of them you might not find familiar, but do not panic. Malaysian foods are made from good stuff only. And they not only smell good, but also taste very delicious. You can see *Fried Rice, *Chicken Rice, *Fried Noodles, *Chicken or Beef Satay, and *Oily Rice.

l fried rice
Shrimp, chicken, and beef are cut into small pieces, fry with onion, red hot chili sauce and some vegetables, mix with cooked rice.
l chicken rice
Rice which cooked with chicken soup, serve together with fried chicken, chili sauce, soy sauce and also chicken soup.
l fried noodles
Shrimp, chicken, and beef are cut into small pieces, fry with onion, red hot chili sauce and some vegetables, mix with spaghetti or noodles.
l oily rice
The rice are quite oily, that's why it is called oily rice. It is serve together with chicken curry. Also, cucumber which is peeled and cut into 3"x 0.5" pieces, mixed with onions, and vinegar.

l coke
You see a glass of Coke with lots of ice in it.
l diet coke
You see a glass of Diet Coke with lots of ice in it.
l chicken
Rice which cooked with chicken soup, serve together with fried chicken, chili sauce, soy sauce and also chicken soup.
l egg-sandiwich
A typical egg-sandwich with lots of sliced tomatoes, onions, and lettuce. It looks awfully delicious.
l curry-puff
A D-curve pastry or puff stuffed with diced-potatoes curry.
l iced coffee
You see a glass of deliciously looking iced coffee.
l hot coffee
You see a cup of hot coffee.

Portions of this paper were published previously as "What I Did *After* Summer Vacation" in the March 1995 issue of *ACW Connections*, the newsletter of the Alliance for Computers and Writing, posted in ACW's World Wide Web pages at http://prairie_island.ttu.edu/acw/acw.html.

Connecting Classrooms to the Web: An Introduction to HTML

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You and your students can now "point & click" your ways around the world.

The WorldWideWeb (www, or simply "the Web") acts as a multi-media Internet, navigable via Web browsers in much the same way that the Internet Proper can be navigated via "gopher" clients and servers . Web browsers (including Mosaic, NetScape, Cello, WinWeb and other locally hosted clients) "read" files treated in html (HyperText Mark-up Language) and display interactive "pages" to their users. You click here, it displays a new page; click here, a picture appears; click over here, you're watching a movie clip; click on this other spot on the page, you're hearing music. Click, click, click, click. Bunch of fun. And it *can be* educational. It doesn't matter to the Web browser whether the files it displays are saved to a local hard drive or stored on a remote machine to be accessed via a Web server–across the street or around the globe. Click!

Teachers with computer-mediated classrooms (or labs) can use html and Web browsers to create multi-media presentations for their classes. All they need is the browser, at least 8 meg of ram and some space on a network-accessible hard drive. Click! Teachers fortunate enough to have computer-aided classrooms (or labs) with Internet access can take it a step further and create customized gateways that will lead their students directly to the Internet resources most relevant to the subject(s) at hand. Click! And teacher and student scholars who have system administrators who are willing to support a local Web server and to provide disk space on a machine accessible to the Internet can take Web use still another step. They can add to and embellish those resources, publishing pages of their own for use by other teachers and students around the world. Click!

It is a relatively painless procedure.

Mostly, it requires of you the creation of text (as in "text-only" or ascii) files. All the other files with which you'll be working–the .gif files for your grahics, the .jpg files you'll use for high-resolution pictures, the .wav files you'll need for any sounds you want to use, the .mpg files you'll use for moving pictures–all those files will be either "found art" that you'll collect or files that you'll create yourself (or with the help of computer-clueful friend or associate) using machines and software that will ask little of you other than that you name the file. Indeed, the primary challenge presented to you by these "multi-media" files will be keeping track of their names, if your experience is anything like mine.

But, getting back to those pesky text files, that's what you'll use to create your html documents. They'll contain coding–embedded html commands. That's the "language" you'll be using to "mark up" your "test" and make it "hyper" (that is, interactive) and, well, pretty (which is to say, italicized where you want it to be italicized, in larger type where you want larger type, illustrate it with graphics, etc.) This coding may look strange to you, at first, until you get used to its (really pretty straightforward) inner logic. But your computer and all the software on your computer and everyone else's computer–*other than whatever Web browsing software looks at it*–will see (and treat) these files as "text-only" or text files. You should treat them as text (*not* binary) data, too, whenever up- or downloading these files, when using ftp etc. The convention, on the Web and amongst the computer-clueful in general, is to give these files ".htm" extensions on pc (or dos) platforms (and ".html" in unix or vms environments).

There are several html authoring programs available that you can use to embed this coding in your documents. Each offers certain conveniences. But you don't really need one of those to get started. All you *really* need to produce html documents is a text editor. You can use Windows' "Notebook" or any dos text editor. You can even use "Word" or "WordPerfect"–provided you remember to save the file as "test-only" or ascii.

The most common html codes (or "tags") for making your text pretty include the following:

<u>Begin</u> <u>End</u> <u>What It Does</u>

<html> </html> These are not really necessary to make your html document "work right," but it's considered "good form" to use them to indicate the beginnings and ends of such documents.

<title> </title> Whatever text appears between these tags will operate as your title. That is, it will appear in the "title bar" of the "window" the reader's Web browser occupies on the screen.

<h1> </h1> Whatever text appears between these tags will appear as a Size 1 heading, however the reader's Web browser treats that. Type specifications, by category, are resident in the readers' Web browsers. You control the category, with tags like these. But they control how those categories are treated typographically. Most browsers recognize smaller headings, designated h2, h3, h4, h5, h6.

</p> Ends (or "breaks") a paragraph. It also inserts a blank line and begins the next paragraph. There is a <p> tag which begins paragraphs, but it is not necessary or commonly used.

 Forces a line break. It operates, in other words, sort of like a "hard" carriage return. Web browsers generally "word wrap" lines of text according to whatever size window their users are operating, unless they encounter </p> or
 or some other excuse to "end" whatever line they are reading.

<u> </u> Underlines the text between the tags so that <u>this</u> appears like <u>this</u> when read by a Web browser.

  Bold faces the text between the tags so that this appears like **this** when read by a Web browser.

<i> <i/> Italicizes the text between the tags so that <i>this</i> appears like *this* when read by a Web browser.

Do not permit your tags to overlap. Encapsulate your coding instead. That is, if you want part of a **message to be in bold and *part of it to be italic too*,** that needs to be encoded: message to be in bold and <i>part of it to be italic too</i> and ***not*** message to be in bold and <i>part of it to be italic too</i>.

To make all this an interactive, mutli-media experience for your readers you'll need to use a couple of additional tags to "link" your document to other documents on the Web and to decorate your document with graphics (called "in-line images" by the computer clueful). That's what will put the "hyper" in your hypertext. The most common html codes (or "tags") for "hyper"-activating your document include:

Begin End What It Does

  Whatever text occurs between these tags will be highlighted (usually in blue) by your readers' Web browsers. "Clicking" on that text will connect the user to whatever "url" you specify between the quotation marks (where I've inserted a question mark).

<img align=x src="filename" alt="text"> Inserts an in-line image in your Web document, when the following substitutions are made. Where I've put an "x," you insert the word **top**, **middle**, or **bottom**, depending upon where you want the next piece of text in your document to "align" itself *viz a viz* the graphic. The name of the graphic file replaces "filename." And you may offer an alternative "text" substitute for the graphic for users operating non-graphic browsers (like Lynx).

To get a little fancy, you can combine these two commands (putting **<img align=x src="filename" alt="text">** between **** and ****, where the text would ordinarily go) to create graphics that operate as "buttons" that link your document to other resources on the Web. But gettting fancy is, by no means, required in your first venture into Web construction. You can save that for your second or third venture, after you've done a little experimenting, tested the results, and visited the on-line Web tutorials you'll find listed in Appendix B of this paper.

In the meantime, there is a good deal to be said for keeping things simple in this new interactive medium; and very little of that has been said, thus far. The best of what has been said so far, along these lines, I'd like to cite. I heard it at a conference this Spring in Columbia, Missouri. The subject was Web aesthetics and the speaker was Scott Fritz, manager of User Services for the Missouri Research and Education Network. He suggested the folloiwng:

Limit the wordiness of your documents. Several small documents are probably better than one large one.

Limit the size of graphics and offer alternative views for those without grahical interfaces. Thumbnail graphics [2,000 to 3,000 bytes] provide a small view so that people might explore graphics of interest and not enlarge those they do not wish to see.

Too much written material or too much grahpical information can both be difficult to look at, and be difficult for those who print the material out.

When linking to a purely grahical piece of information indicate the approximate size of the graphic.

Always try to give the viewer an indication of where they are.

Always try to provide some simple navigtional buttons (not all browsers incorporate the common ones, so you may want to have a "backout" button, or a link to the central home page of your server).

Try to make the text which indicates your links be informative of the links (do not use "click here" as the link text). This could help [bibliographic] indexing processes. (Fritz)

Appendices include sample text from a Web document of my own construction and some http and ftp sites of interest to Web builders.

Appendix A: Sample Web Document

```
<html>

<title> Jumpin's Jive Pad </title>

<h1> Jumpin' Johnny's Jive Pad </h1><p>

<img align=bottom src="jumpbutt.gif">This Jive Pad belongs to Jumpin' Johnny LaRoe, pictured here. "Ta da!"<p>

<H4><i>It has <b>Whole New Worlds</b> to explore ... </i></H4>

You could visit a <a href="http://www.atom.co.jp/GALLERY/index.html"><b>Virtual Gallery</b></a> of contemporary art in Japan, f'r'instance, or travel to <a href="http://www.eunet.es/spain/images-dali/"><b>Spain</b></a> to view (or even download) a collection of works by Salvador Dali. And there's always <a href="http://sunsite.unc.edu/louvre/"><b>Le Louvre</b></a>, of course -- <i>dans le pays du Coneheads</i>.<p>

You also may wish to explore the campus of <A HREF="du_moo_1.html"><b>Diversity University MOO</b></A>, where Jumpin and his friends do some of their best eduMOOcational work; or wander the streets of <a href="http://www.awa.com/"><b>Downtown Anywhere</b></a> or the outskirts of <a href="http://sensemedia.net/sprawl/"><b>The Sprawl</b></a> -- Jumpin's favorite page away from home. But please understand ...<p>

<H4><I>you're also welcome to stick around.</I></H4></dl>

There are things to see here, too, ... in Jumpin's <A HREF="gallery.html">personal art collection</A> ... and things to read, as well, in his <A HREF="library.html">private library</A>.

</html>
```

Appendix B: HTTP & FTP Sites

A Beginner's Guide to html (from ncsa)

http://www.ncsa.uiuc.edu/demoweb/html-primer.html

Clarkson University's html Tutorial

http:// fire.clarkson.edu/html/htut.html

Indiana University's Primer to Web Writing

http://www-slis.lib.indiana.edu/internet/programmer-page.html

ncsa Guide to Documents for Writing Good html

http://union.ncsa.uiuc.edu:80/HyperNews/get/www/html.guides.html

The Bad Style Page (examples of things worth avoiding)

http://www.earth.com/bad-style

A Good Collection of Web Materials (including html editors)

ftp://ftp.more.net/pub/nic/windows
or
ftp://ftp.more.net/pub/nic/mac
or
ftp://ftp.more.net/pub/nic/unix
or
ftp://ftp.more.net/pub/nic/os2
or
ftp://ftp.more.net/pub/nic/lan
or
ftp://ftp.more.net/pub/nic/dos

Other Handy Web Stuff via MOREnet

http://www.more.net/common/resources/web_resources/internet.htm

Work Cited

Fritz, Scott. "Weaving the Web: Design Issues for Web Builders." Presentation. MOREnet Spring Conference. Columbia, Mo.: Missouri Research and Education Network, 1995.

COMPUTERS ACROSS THE CURRICULUM: Teaching A Computer Literacy Course for Multi-disciplinary Use in a Network Environment - Content and Pedagogy

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Abstract

Kent State University Regional Campuses has conducted surveys of their applied business associate degree graduates in Office Management, Accounting, Business Management, and their employers. The response to these survey's consistently indicated the need for computer literacy appropriate to the employment situation. In addition, instructors of traditional liberal arts subjects are requiring students to access and use computerized databases. The recognition that the technology has forged an interdependency between disciplines impacts no only the curricula of specific disciplines, but also the traditional perspective and content of an introductory course in computers as taught by computer faculty.

Introduction

Our society is on the brink of a remarkable transformation. As the force behind this social evolution, the information technologies enable "tabletop" access to humanity's accumulated body of knowledge. Computer "expertise" is no longer the domain of a select few practitioners who perform rites of processing in cryptic languages, for a child can lead the way.

The recognition of the public ownership of information through the use of computer- integrated technologies has lead to a new economic paradigm inclusive of government, business/industry, secondary education, and higher education. Institutions of higher education play the pivotal role in the success of this consortium for "virtually every significant advance in knowledge and new technology originates with college-educated people . . . the leaders in almost every walk of life are college-educated" (Riley Report, 1993). In addition, current and future employment opportunities will have high information content, demanding higher order thinking skills in order to make effective and efficient decisions formerly reserved for a chain-of-command. Therefore, higher education is facing the challenge of adapting to the needs of the marketplace and addressing the cultural diversity of a high-tech knowledge based society.

The Challenge

The social ideological landscape upon which institutions of higher education are built is rapidly changing. This evolving terrain is inclusive of: budgetary constraints, having to more with less;

accountability, this includes performance measures supported by documentation prepared for oversight agencies or organizations, responsibility to business and industry who rely on the higher education system for an educated workforce, and the promise of knowledge the students who have entrusted their future to the system; and technological intervention into the classroom and office - changing the way in which education is delivered.

This trinity is not mutually exclusive. However, the information technologies are the power tools in transformation of higher education as a system. The challenge that we face as educators is not to be threatened by the change, rather there must be a willingness and desire to take advantage of the situation; to lead - not follow - the reformation.

Third Wave Preparedness

How prepared is higher education? A recent survey by the American Electronics Association's National Information Infrastructure Task Force found "that just 59 per cent of the teachers surveyed said they had access to multimedia computers, 29 per cent had networked computers, and 20 per cent had an Internet connection" (Chronicle of Higher Education 3/31/95, pg. A19). As alarming as these figures are, they only address accessibility, not use. In addition, there is a technological gap both inter and intra institutional which has produced a new class of have's and have not's.

The Have's

Skimming over the journals or surfing the Internet quickly reveals who has caught the wave. Both commercial vendors and institutions of higher education are utilizing the Internet to alter the way in which knowledge in transmitted. The Gopher and WWW sites are an electronic windows of insight into an institutions understanding of the application of the technology. Some of these can be accessed on the Web at:

http://www.portal.com/~webacad/
http:/www.iftech.com/
http:/www.iftech.com/iti/othertut.htm
http://www.yahoo.com/education/courses

Therefore, extant in the ether are examples of the technology being merely used an overlay of the traditional, to the creating of a new template of communicating, teaching, and learning.

A holistic prototype of internet innovation is BEV. The Blacksburg Electronic Village is a Gopher and WWW (http://crusher.bev.net/), site which is a cooperative project of Virginia Tech, Bell Atlantic of Virginia, and the Town of Blacksburg, Virginia. As an existing illustration of how the new paradigm can succeed, BEV has the capability to involve all of their citizens in the information revolution. However, for the citizens of Blacksburg, or any community, to utilize this resource to its potential, education should precede access.

Kent State University Regional Campuses

The Kent State University Regional Campus System is comprised of seven regional campuses located in six northeastern Ohio counties. These commuter campuses serve both the traditional and non-traditional student, and offer a wide array of associate degree programs, transfer and parallel courses, limited upper division, and graduate coursework. Under the administrative leadership of Dr. Gordon W. Keller, Vice Provost for Regional Campuses, the system has moved to the brink of becoming a full-fledged member of the Internet community.

Each campus in the system has a unique repertoire of hardware and software specific to their needs. The Trumbull Campus computing manifest is dynamic, currently consisting of four dedicated file servers running Novell and UNIX. These LAN's support nearly 300 workstations for administrative and academic needs. It is anticipated that by the fall of 1995, the Trumbull Campus will become a WWW site..

The Computer Curriculum

The Internet capability, coupled with the fact that various non-computing disciplines are using various facets of the system for instructional support, forewarns a fundamental change in classroom pedagogy and student performance expectation. This shift directly impacts upon the computer faculty, program goals, mission, and associated curriculum.

Because of the overwhelming variety and the rapid revision of software(s), computer faculty can develop expertise only in limited subject areas. This presents computer faculty with a conundrum. Not only must they focus on software specialization within their degree programs, but also broaden their perspective to include computer application within the curricula of other disciplines. Computer-related technologies have forged an interdependency between disciplines and computer literate faculty must take an active part in the formulation and presentation of coursework in support of other degree programs.

Computers Across The Curriculum

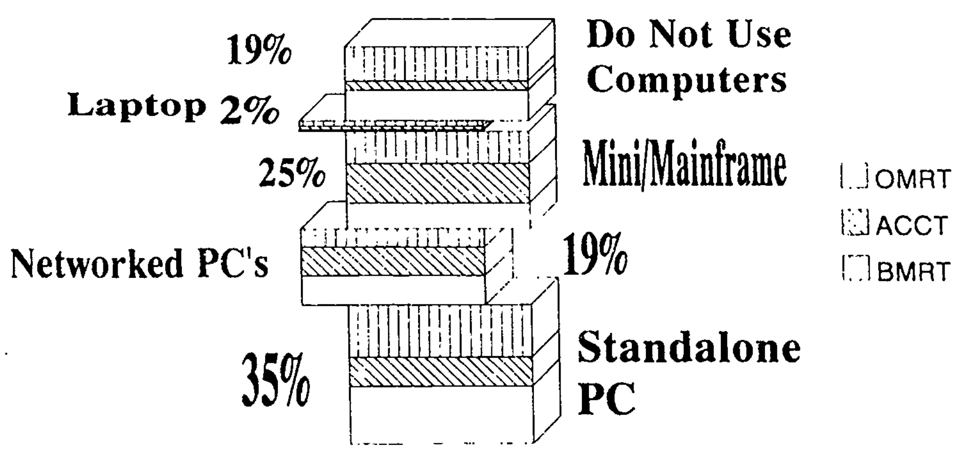
At the Trumbull Campus, English faculty are requiring term papers be composed using word processors. At present, the majority of students taking the freshman course have no computer skills and the English faculty are taking time away from their course content to provide computer instruction. Although admirable, the knowledge conveyed to the students regarding what a computer is confined to the individual instructor's (mis)understanding. Currently, WordStar and three different versions of WordPerfect are taught to students in English classes. In some instances, the instructor insists that the student uses the software which is familiar to the instructor regardless of the students personal knowledge.

Other disciplines also require computer skills. A Geography instructor requires that research for term papers be conducted using the telecommunication links to the electronic library databases. Again, time is taken away from the course content in order to train students in a single use of the Internet revolution. Nursing, Psychology, and Philosophy students have available computer-based study aids. The Office Management curriculum does not require an introductory course in computers, but does require a spreadsheet course which is taught exclusively by their faculty. Banking and Business Management coursework include spreadsheet components which require the instructor to first teach the basics before utilization and comprehension can be effective.

The occurrence of these and other examples of computer usage in the classroom make it abundantly clear that a computer literacy course must become part of the general requirements for all degree programs. While this has not yet occurred, the computer faculty, both individually and collectively, are moving towards a restructuring of the traditional introduction to computer course. The composition of this course(s) is guided, in part, by the surveys of the regional campuses graduates and their employers which were individually conducted by the Accounting, Business Management, and Office Management programs.

The compilation of computer-related data provided by these independent surveys demonstrates a pattern of consistency regarding both the hardware and software utilized. Figure 1., shows the hardware employed by the graduate respondents in their current position. As noted, eighty one percent (81%) of the graduate respondents from these three program utilize a computer in their employment situation. Fifty four percent (54%) of this usage is in a PC environment.

Proportions of Hardware Types Used by Accounting, Business Management, and Office Management Graduate Respondents

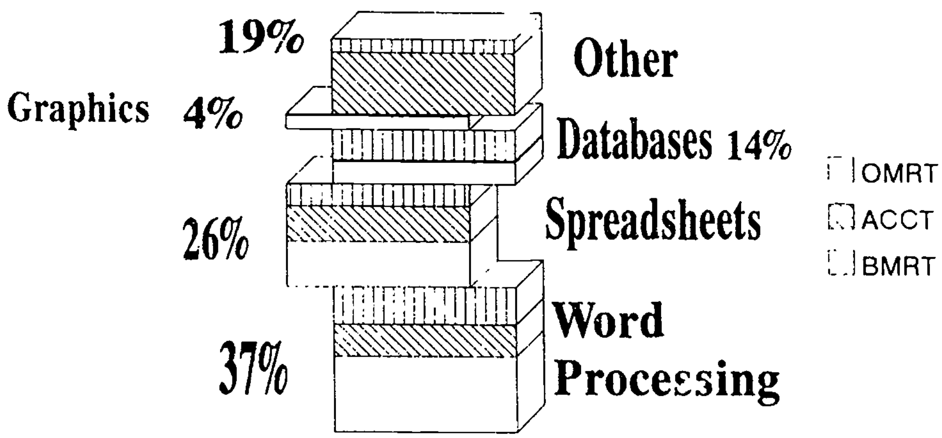


Total Responses (N=219)

Figure 1.

Figure 2., represents the proportion of software applications utilized by the graduate respondents. Overall, the big three of general software application are dominate representing seventy seven percent (77%) of computer usage.

Proportions of Applications Used by Accounting, Business Management, and Office Management Graduate Respondents



Total Responses (N=231)

Figure 2.

A cautionary note must be added, these surveys represent respondents who variously graduated between 1986 - 1992. Queries regarding Internet use were not considered when the survey tools were constructed. The rapid change in the computer industry may also reflect an increase in the number of PC's and laptop's in use.

Taking into consideration the above usages and needs, the overall objective of a computer literacy course is student success. Students need to both enjoy and understand a computer system through a combination of theory and application.

Computer Literacy: Content And Pedagogy

The prediction of a computer on every desktop and in every home made over a decade ago seems finally to be upon us. Now computer faculty are faced with students who not only drive a better car than they do, but also own a better computer. Facetiousness aside, currently over fifty percent (50%) of the students in a introductory course have no experience using a computer. Of those that do, knowledge is limited being a user of a packaged program. Only a few have knowledge of a computer system, which generally has been gained by trial-and-error or by trying to decipher manuals. Therefore, this first computer course should be conducted as if the student has no previous knowledge or experience on a computer system.

At present, the introductory course is 3 semester credit hours. Internally the course is designated as 2 hours of lecture, and 1 hour of lab (3.5 teaching load) representing one and a half real time class hours twice a week. The regional campuses computer technology agree in general that the following topics should comprise the generalized computer literacy course:

hardware/software terminology and general concepts
operating systems (DOS and Windows)
networking and communications concepts
e-mail, internet, world wide web
word processing (windows based)
computer ethics
issues regarding buying a PC

Textbook selections are individualized, with some faculty opting for none. I use O'Leary & O'Leary's Computer Essentials: Annual Edition, available from McGraw-Hill (ISBN: 0-07- 048984-X or 1-800-338-3987). I choose this text because it is relatively inexpensive, easy to understand, and compliments the course content and my teaching style.

From my perspective, within the first several classes, an instructor should accomplish two parallel concepts. First, I have found that students do not know or really understand the process of problem-solving. Humans have had the same intellectual capacity for over 50,000 years and the concept of a computer is not new. Other than the traditional example of the abacus, there are the Mesolithic cave-paintings and tally stones, monumental calculators like Stonehenge, the Mayan calendar round, and a wooden Stonehenge-like structure excavated at Cahokia, an archaeological site in the Mississippian floodplain near Alton, Illinois. All of these are cognitive tools created utilizing state-of-the-art technology. A modern computer is a cognitive tool created by humans in their own image using the state-of-the-art technology. Focus of lecture is not on the computer, but on the process (semantics) of human problem- solving.

Second, that computers do not think. They only appear to think because they reflect the human cognitive process (a magicians ruse). The full implication of WYSIWYG (what you see is what you get) should be ingrained ASAP (not a computer abbreviation or acronym).

A problem-solving exercise that I have found useful in linking these concepts together is GUM. I tell the class that they will solve a problem where the result is chewing gum. I then take an unopened pack of stick gum from my pocket and tell them to instruct me in how to chew the gum. I write their instructions on the board in a pseudocode, forcing the students to specify consistent operators and operands (an instruction such as "pick up the gum" is too vague). It generally takes thirty to forty minutes to open and chew the gum. Within this time it is hoped students will comprehend the syntactic and semantic complexity of what they at first considered a simple task. I point out the pattern of repetitive operations, the progressive result of properly sequenced operations, and the value of various logic structures such as a Do Until (the flavor is gone).

While these concepts are being explained, the purely mechanical operation of a computer system can be performed. Ideally, lecture and lab are taught in an electronic classroom with networked PC's. The instructor's station is interfaced with a projection unit. With this configuration available the instructor can lecture in the traditional manner, lecture and demonstrate (show and tell), while having the class mimic examples on their own PC, or conduct lab where the students are working independently.

Location of keys and mouse dexterity are points of tremendous frustration. Confidence in the mechanical operation of the computer system can be achieved through non- threatening exercises. I have found that letting the students play games readily instills these skills.

Evaluation of student performance is evenly divided between written exams and lab projects. This split provides the opportunity for students to experience and excel using an alternative learning style. Using this technique, overall class performance has increased.

The lab projects are designed to be fun. The first project is for the student to produce a drawing using the Paintbrush utility in Windows. Again, situated in a non- threatening environment, the student refines manual dexterity skills, begins to understand the semantic connection between sequential action and cumulative results, and learns the commonality of menu screens as they relate to working within a Windows environment.

Another project teaches the use of word processing in both a DOS and Windows environment. I use two versions of WordPerfect to: 1) show the difference between versions in terms of a software upgrade, and 2) demonstrate the transferability of data to a higher version, but not down again. In addition, once the students have a word processing skill, they are required to import other projects into the WP environment (ASCII files, .BMP, .CGM, etc).

The largest single topic time block is spent on connectivity. Over the course of a fifteen week semester, fully one third may be devoted to the many facets of Internet communication. Major areas demonstrated and then reenforced through projects include: e- mail, links to library databases, BC Gopher, NCSA Mosaic, and NetScape.

Exercises in the use of e-mail include sending mail to me, and in collaboration with my colleagues at other regional campuses, transmitting to students in their classes. Exercises in the use of library databases require that students provide me with a hardcopy of resources located at the Kent library (KentLink), a library elsewhere in Ohio (OhioLink), and one from an out-of-state library (WorldCat). Internet exercises include accessing the MERIT software library and downloading files for both DOS and Windows. I have them copy .zip files, unpack and execute their finds (usually games). Guides to the internet are also popular items for a download.

Since abbreviations and acronyms abound throughout the Internet and within the computer industry in general, I supply each student with a copy of BABEL, a glossary of computer terms complied by Irving Kind. Although under copyright, specified reproduction is allowed. A copy of this useful reference can be found at:

http://www.access.digex.net/~ikind/babel95a.html

If times permits, I also show what other Window browsers are available that are not resident on our system (WinTapestry has a demo). These can be accessed through City Net Express:

http://www.city.net/checkup.cgi

http://www.city.net/

There is more covered in the course in terms of lecture than space (or perhaps interest) allows here. There is also more to be covered than the time allotted for a single course can permit. Therefore, it is the conclusion of the regional campuses computer faculty that a sequence of two courses are necessary in order meet the computer needs of other disciplines.

Discussions of the content for this second course center on the following topics:

Spreadsheets (windows based)
Database software (windows based)
Multi-media
Advanced Internet surfing (research project)

Introduction (brief) to programming concepts with a visual programming tool Integration of data within software suites in Windows via OLE or current standard

As a group, we are open to any and all suggestions regarding these crucial courses. Please e-mail your thoughts to me at the above e-mail address or to Dr. Larry D. Jones, Interim Director, School of Technology, Kent State University (jonesl@aldebaren.win.net).

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Information Technology Curricula: Business and Interdisciplinary Perspectives

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Abstract

For the past twenty-five years, much discussion, concern, and controversy have surrounded programs of study designed to prepare students for computer and systems-related careers. Model curricula have been published by professional organizations to serve as guides for higher education. Students at many institutions have tried desperately to understand the difference between computer science and information systems. Recently, the rapidly changing nature of the computing field has further complicated matters. This session will present a newly-revised information systems curriculum as well as an interdisciplinary curriculum which couples information systems and computer science. Opportunity for open discussion and idea sharing will be provided.

Partnerships

Over the past several years, there have been dramatic changes in the way we teach and our students learn. Much has occurred with technology, computers, video projection equipment, and multimedia to alter the traditional learning environment. We now hear much about distance learning via fiber optic network, satellite and video conferencing, and interactive cases on CD-ROM. New paradigms for teaching and learning are emerging, and a great deal of emphasis is being placed on cooperative learning, a learning methodology which actively engages the student in the learning process. Students learn by participating, not by reading, listening, and note-taking. Faculty teams are replacing individual faculty stars. In leading edge schools, it has been said that the role of the faculty member is changing from teacher/ instructor to facilitator/mentor/coach. Schools that continue to ignore the market mandate to modify programs risk losing their brightest faculty and students to their competition.

Business schools in particular have faced unusual challenges since 1989. Nationally, enrollment has plunged in our business schools by up to 35%. Competition for students has become intense at both the undergraduate and graduate levels. Many have opined that if the downward enrollment trend continues, only the strongest business schools will survive. The feeling among many is that educational programs in business must respond to the needs of their customers --- businesses and students in this case. Business schools must strive to understand businesses better, pursue alliances with them, and adopt some of their responses to challenging economic conditions, such as leveraging information technology, flattening the management hierarchy, and developing a more global perspective (Lorange, Executive

Education, p.36). Academics are being encouraged to find a new balance between teaching and research. Traditionally, academics have turned away from the business world, because it is too scientific. The reward system in academe has primarily rewarded publication on narrow topics in hard to read journals. Academics in business schools are encouraged to underpin their teaching with real-life examples and maintain relevance. Businesses must partner with academe if they wish to keep the pipeline filled with superior management talent (Lorange, p. 39).

According to a study conducted by Mckinsey & Co. for the University of Texas at Austin, six major competencies emerged as significant and warrant consideration during curriculum revision (Lorange, p.39):

1. Cooperation. Working together.
2. Vision. To be a pathfinder able to see niches and possibilities.
3. Global perspective. Itfs an open world with no borders.
4. Educability. Learn from our own work and avoid old ways of thinking.
5. Flexibility. Mobilize for change.
6. Resilience. There are no problems or mistakes, just possibilities and opportunities

The accrediting agency for business schools in the United States, the American Assembly of Collegiate Schools of Business (AACSB), dedicated the 1995 Annual Meeting in Minneapolis to the theme of Partnerships. Creating strategic alliances is rapidly becoming one of the most effective means for satisfying customer needs, because in most cases, expertise can be more readily acquired than cultivated (Jacobs, AACSB Program Chair). Ultimately educational programs and educational institutions must arrive at the conclusion that they cannot provide all of the resources necessary to remain competitive in a rapidly-changing environment.

Partnering efforts do not have to be between far-away universities or far-away businesses. At our School of Business Administration at Duquesne University, we have ventured into a number of far-away partnerships with businesses as well as other educational institutions. For instance, we have done student exchange agreements with universities in France, Belgium, Japan, and Colombia in an effort to globalize our offerings. We have done study trips to Japan, Germany, Italy, and Nicaragua. Perhaps our most significant and rewarding partnerships are those that we have forged on our own campus, however. We have had, for some time, a three/three program with our School of Law --- three years in the undergraduate business school and three years in law school. We have also had, for some time, two joint degree programs at the masters level --- MBA/Masters in Nursing and MBA/Masters in Pharmacy.

Within the past year, we have partnered our MIS program with our School of Health Sciences to offer a dual or joint degree in Business/Health Information Sciences. Just as ltechnology is a hot buzzwordî at the moment so are technology and information systems as applied to health care. This partner program was intended to better utilize both faculty and computer resources on our campus. Students enrolled in either Business or Health Information Sciences will be the real winners as a result of this program.

Dual Degree---MIS & Computer Science

Curriculum development for information systems (IS) began in the early 1970s. IS curricula have reflected many dynamic changes caused by the rapid development of information technology over the past several years. IS curricula have also recognized the need for both an organizational and technical emphasis. Standing alone, neither IS nor Computer Science programs have been able to deliver everything needed.

Organizations such as the Association for Computing Machinery (ACM), Data Processing Management Association (DPMA) and the Academy for Information Systems (AIS) have played a key role in helping to define curriculum for the computer and systems-related professions. In the winter of 1994-95, Longenecker, et.al. reporting in the Journal of Information Systems Education provided a collaborative curriculum framework devised by a joint task force from the above three organizations. The area and sub-area competencies are summarized by the following general curriculum guidelines:

IS 1995 Curriculum Area And Sub-area Designations

A. Fundamentals of Computer Information Systems
- A.1 IS Literacy
- A.2 End-User Computing

B. IS Theory and Practice
- B.1 Systems and Quality
- B.2 Decision Making
- B.3 IS Planning
- B.4 IT and Organizational Systems

C. Information Technology
- C.1 Computer Hardware
- C.2 System Software
- C.3 Telecommunications
- C.4 Programming
- C.5 Algorithmic Design

D. Systems Development
- D.1 Software Development
- D.2 Database
- D.3 Systems Analysis and Information System Design
- D.4 Teams and Interpersonal Relations
- D.5 Project Management

E. IS Deployment and Management
- E.1 Support Services
- E.2 Systems Integration
- E.3 Management of the IS Function
- E.4 Information Resource Management

In the same article, Longenecker et.al. also summarized the descriptive characteristics of graduates as a result of the work of the Joint Task Force. These characteristics are presented as follows:

Characteristics of IS 1995 Graduates

Communications

IS graduates must communicate in a variety of settings using oral, written and multimedia techniques.

Problem Solving

A fundamental activity of the IS professional is problem solving. IS professionals must be able to choose from a variety of different problem solving methodologies to analytically formulate a solution.

An IS graduate must think creatively in solving problems.

An IS graduate must be able to work on project teams and use group methods to define and solve problems.

Organization and System Theory

IS professionals must be grounded in the principles of system theory.

An Information System is intimately and inextricably linked with the organization in which it is embedded and which it serves. The information system must be congruent with, and supportive of the strategy, principles, goals and objectives of the organization. Therefore, the IS professional must have sufficient background to understand the functioning of organizations.

IS professionals must understand and be able to function in the multinational and global context of todayfs information dependent organizations.

Information Technology (Database, Modeling, is Development)

IS professionals must understand modeling, measurement, and simulation approaches and methods.

Graduates must function competently at an entry level position. In that respect they must be able to describe and develop Information Systems both personally and in groups which are characterized by the following:

IS provides the info/infra structure - a system of data and information flow and responsibility within the organization.

IS provides direct support for the operational activities of the organization.

IS provides a means of meeting the internal and external reporting requirements of the organization.

IS provides measurements necessary for establishing quality and improvement.

IS provides a historical record of the activities of the organization.

IS provides a strategic weapon to be used to gain competitive advantage.

IS provides the link to external information.

IS provides for more timely development and marketing of products and services.

Information Technology (Computer Hardware, Communications, Operating Systems)

As IS becomes more quantitative and develops additional analytic methods, the IS professional must develop sufficient understanding of relevant software and hardware engineering concepts, and the underlying principles on which the methods are based.

An IS professional must have the ability to apply and work readily with (specify, acquire, configure, install, and operate) central networked and telecommunicating distributed systems; the IS professional must integrate hardware, software and communicating systems into effective organizational solutions.

An IS graduate must adjust rapidly to specific hardware, software and communications environments.

Perhaps one of the more difficult partnerships to forge on our campus has been that between our School of Business Administration and our College of Liberal Arts. Perhaps it is the fact that our faculty think differently, act differently, and place relative importance on different things? In any event, the Computer Science Department and the MIS faculty from the School of Business Administration agreed to venture into a dual degree option which would allow the student to tailor a program of studies from the wide range of courses available from the two curricula.

With the previous information as a framework and with specific requests from students and employers, the MIS faculty and the Computer Science faculty at Duquesne University have decided that the best overall program for the ambitious student can be provided through a partnership. The program requires 144 credits and awards a dual degree. By taking 18 credits per semester for his/her entire collegiate career, a student can complete this program without additional tuition expense as the University flat rate tuition structure permits up to 18 credits per semester. Although specific courses are listed in the outline below, course substitutions tailored to the studentťs interests are permitted. The outline of the program is as follows:

University Core - 24 Credits
101 Thinking and Writing Across the Curriculum
102 Imaginative Literature and Critical Writing
109 College Algebra
132 Basic Philosophical Questions
151 Shaping of the Modern World
161 The Arts and the Human Experience
--- Core Theology
--- Core Science

College Core - 27 Credits
--- Language (12 credits)
111 Calculus for Non-Science Students
--- History/Literature (6 credits)
--- Philosophy/Theology (6 credits)

School of Business Core - 36 Credits
182-183 Information Systems I & II
281-284 Quantitative Analysis I & II
214-215 Financial & Managerial Accounting
251 Business Law
331 Finance
361 Management
367 TQM & Operations
371 Marketing
499 Strategic Management

Overlap Courses - 12 Credits
221 Principles of Econ I (University Core & SOB Core)
222 Principles of Econ II (College Core & SOB Core)
368 Ethics/Communication (SOB Core & SOB Core, replacing Communications)
--- Selected social science course (College Core & SOB Core, replacing Econ 223

Computer Science - 24 Credits
100 Elements of Computer Science
120 Problem Solving with Computers
150 Computer Programming I
210 Computer Programming II
220 Computer Organization and Assembly Language
250 Programming Languages: C
300 Data Structures
325 Operating Systems and Computer Architecture
350 Computers and Humanity
480 Senior Project

MIS Major - 21 Credits
382 Object-Oriented COBOL
383 Powerbuilder/Lotus Notes
385 Client Server Computer Systems
481 Systems Analysis and Design
482 Database Management
483 MIS Project
484 Networks and Telecommunications
Total 144 Credits

As previously stated, students completing this program will receive dual degrees from the School of Business and College of Liberal Arts. Students electing this program stand to benefit in four ways:

1. They receive a broad-based liberal arts education, an invaluable background which many in the corporate community insist must be enhanced.

2. They receive a general business background which will help them to function in todayfs dynamic organizational environment.
3. They receive an intensive dose of business applications and systems education from their MIS coursework.
4. They receive technical competency beyond MIS from their Computer Science coursework.

Summary

From the information presented, it should become apparent that the School of Business Administration at Duquesne University is very much in favor of educational partnerships. Partnerships allow for resource sharing; they allow programs to jointly offer something that is not possible on a stand-alone basis. Students are given an opportunity to tailor a program that meets their needs. Faculty collaboration is also a direct benefit of this partnering approach. In the case of the program presented, the student will actually earn a dual degree, albeit at a price. The student must be dedicated, focused, and hardworking to complete the program. Finally, from a business school perspective, it provides an additional option, an option which may serve to enhance competitive position and provide that option which certain ìcustomersî may be seeking.

Hopefully, this presentation will generate ideas for other collaborative programs and partnerships. Student choices and student educational preparation can be enhanced tremendously by curricular innovation and change.

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Conducting Political Science Research using Multimedia

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Abstract

Political scientists have long been interested in how people make voting decisions. A great deal of research into this topic has been conducted with the aim of building quantitative models that are able to accurately predict vote choices. But most of that research has been carried out using surveys, which capture the decision making process at only a single point in time. Because elections are dynamic, occurring over a period of time, and always changing, surveys may not be the best way to understand the decision process. Thus, some political scientists have chosen to develop election simulations, which attempt to model the election campaign, so that the information acquisition and decision process can be traced over time.

This paper describes one such simulation that we have developed at Rutgers, using Multimedia Toolbook. Toolbook has features which allow us to present an information flow mimicking the flow of a campaign, using both text and video. Subjects are presented with textual information that flows across the screen, representing the passage of time. They may choose from a number of "headlines" in order to learn more about candidates. In addition, campaign commercial videos appear on the screen from time to time. This methodology allows us to present a realistic campaign, using the computer to track all of the information chosen examined by subjects. In so doing, we create a "script" of the decision process. Using the data collected, we are building a more complete information-processing based model of voting. In addition, we are using Toolbook to present an on-line questionnaire prior to the experiment, with which we collect political attitude and demographic information. ! By using the on-line questionnaire, we eliminate the need to do data entry of paper questionnaire.

Introduction

This paper represents an update and extension of work presented at a prior ASCUE conference in 1992. (Redlawsk, 1992.) At that time Richard Lau and I had completed a conversion of a presidential election simulation which had been originally developed on an Apple Macinotsh system. The reason for the conversion and the choice of Toolbook 1.5 from Asymetrix Corporation were detailed in the earlier paper. Since 1992, we have made numerous changes to the original system, and have moved from Toolbook 1.5 to Multimedia Toolbook 3.0, which was released last summer. In doing so, we have been able to move from a simple text-based presentation of information to our subjects, to a system which includes text, pictures, and videos, better mimicking the range of information sources to which voters are exposed during a "real-world" presidential campaign. These changes would not have been possible without the advances in computer technology that have become available over the past three years. This paper discusses the nature of our project, including the psychological and political science theories which directed us towards simulation and away from traditional political science research methods. It particularly focuses on a project that I am overseeing, attempting to understand how voters process information that they receive during election campaigns. I will then describe the system as it is now designed, and discuss plans for future enhancements.

Theory

For many years the holy grail of voting behavior study has been the goal of predicting election outcomes. Beginning with the studies by researchers at Columbia University in the 1940's, (see Lazarsfeld, Berelson and Gaudet, 1948; Berelson, Lazarsfeld and McPhee, 1954, for examples) through an ongoing research agenda at Michigan (Campbell, Converse, Miller and Stokes, 1960, is the classic work in this area) and its followers, and on to the present day, political scientists have surveyed the public, and crunched the numbers resulting from those surveys in order to develop voting models with good predictive power. There is no question that much of this has been successful; our ability to predict vote results based on a range of factors is on the order of 90% accurate. But, while developing our standard models of the vote, researchers have developed a view of the typical voter as uninformed and relatively uninterested. We have become convinced that, because voters cannot ea! sily articulate the reasons for their vote, and because they often seem unable to place candidates on the various issue scales, that the public is just not paying a lot of attention.

During election campaigns voters are exposed to large amounts of information about candidates. In some cases voters can choose whether to pay attention, while in other cases the information is so ubiquitous that voters can hardly avoid it. But in all cases, the flow of information is dynamic -- one day information on a candidate's position on an issue is readily available; the next day it can hardly be found. Yet, nearly all of the studies that form the basis of our view of voters have relied on survey research as the methodology of choice, despite the fact that surveys can capture only one moment in time. Even panel studies only give us a snapshot of a few moments in an ongoing, dynamic campaign. So, we are forced to rely on respondent's memories of what they have seen and which campaign information affected them. The election's dynamic nature is missing. One important result of this mismatch is that while we can make good predictions of the vote choice, we cannot do nearly as good a job describing how voters come to their choice. To understand this point, we have to recognize that all standard models of voter choice conform to what is called a "memory-based model." That is, they implicitly (Columbia, Michigan) or explicitly (Kelly & Mirer, 1974) require the voter to maintain information about the campaign in memory and then to access and use that information "at the moment of decision" in order to evaluate candidates and make a choice. Kelley & Mirer probably provide the clearest example -- they propose that as voters encounter campaign information it is stored in memory. When the time comes to vote, the memories for each candidate are recalled and the likes and dislikes that they represent are added up. The candidate who emerges with the highest affective "score" is then chosen. If there is a tie, party affiliation b! ecomes the tie-breaker.

The underlying problem with this model is simple -- people just don't and can't process information this way. Cognitive psychologists since Simon (1955; 1956; 1957) have long recognized that humans are limited information processors. We have a serious bottleneck, called short-term memory, which limits how much stimulation we can absorb at any one time. Further, it takes cognitive effort to move things into long term memory and then to retrieve them again when needed. So, while political scientists have been developing models which require a significant investment of cognitive energy, psychologists have been showing us that people are, to use Taylor's (1991) term, cognitive misers. Recently, Lodge and colleagues Lodge, McGraw and Stroh, 1989) have proposed a new way of looking at how people process political information. They have begun to apply a model developed by psychologists Hastie and Park (1986) which recognizes the limits of human cognition. This on-line model, as it is known, proposes that people are constantly evaluating social information as they perceive it; that is, they maintain a kind of "on-line tally" which is used to keep track of current feelings towards a social object. Where memory-based processing reserves the evaluation phase for sometime after the information is received, the on-line model argues that evaluation is constantly occurring. More importantly, for our purposes, On-line processing does not require that any of the information originally received, be retained in memory. Whether remembered or not, the information is included in the constantly updated on-line counter. The on-line model suggests that as campaign information is attended to by the voter, a pre-existing affective tally about the candidate is recalled from memory. This tally, which contains a running score for each candidate, is then updated based on the voter's reaction to the new information. The updated tally is then restored to long term memory, and the information which was used to update it can be safely discarded. When the time comes to vote, one need only retrieve the tally for the candidates, compare each, and vote for the one with the more positive value. There is no need to search memory for information learned about the candidates; in fact, little of the information which informed the tally can be expected to remain in memory. Lodge and his colleagues, recognizing that voting is ultimately an evaluation task, argue that the on-line model is a better descriptor of how people process campaign information. They have run numerous experiments which have consistently shown that people do appear to use an on-line tally, rather than some type of memory process when evaluating political figures. They have routinely shown that there is no connection between the contents of memory and the evaluations their subjects report.

Implications of Current Views of Voters

Why do I think this matters? That is, since political scientists agree that existing models of the vote do an very good job of predicting vote choice, why we be concerned about how people process the information which leads to their decision? As long as we know the inputs and the outcomes, why should we be concerned with the "black-box" where inputs turn into outcomes? I have already alluded to one of the reasons why I think it is important earlier -- existing research paints a pretty negative picture of the voter as citizen. Unable to give a good account of his or her vote, and unable to tell us much in detail about politics and elections, we find voters to be almost derelict in carrying out their civic duty. Existing ways of looking at voter decision making makes us wonder how voters could ever manage to pick the candidate who is "right" for them. Even recent explanations for voter accuracy, such as Popkin's (1991) low information rationality, take as given that vote choices are made with very little real information. Of course, if it were only political scientists who take a dim view of voters, this might not matter much at all. But, our view of voters has become the conventional political wisdom -- issues don't matter, and flash is everything. The pictures we paint affect how politicians view voters and how they then respond to them. However, if the on-line model is an accurate description of how voters process information, then voters may well be taking large amounts of information into account in their evaluations of candidates -- large amounts that they cannot then regurgitate to the survey researcher. Why not? Because by processing it on-line and making evaluations on the fly, voters have no need to keep the details in memory, once it is included in the on-line tally. Taking this to its logical conclusion there is no reason for memory to play any role whatsoever in voter decision making, and Kelly & Mirer are simply wrong. If this is the case, then anything voters tell us after the decision has been made represents rationalizations, rather than memories. Recent work (Rahn, Krosnick, and Breuning, 1994) has come to a similar conclusion. They find strong evidence that our standard open-ended National Election Study1 questions elicit responses which simply do not connect with the actual vote choice. They argue that our traditional survey based methods of getting at vote choice cannot be counted upon to measure what we have thought they were measuring. This methodological problem, then, represents a second reason why it is important to understand how voters reach their decisions. The standard approach to determining the reasons for a voters choice is to ask a series of open-ended questions requiring respondents to list their likes and dislikes about the candidates. This questioning takes place after the election, after the decision has been made. Voters are expected to recall from memory reasons why they supported or opposed a candidate. But, if Lodge, and Rahn, and the psychologists who tell us that we make most evaluations on-line are correct, these recollections do not necessarily represent the reasons that really went into the voter's decision. If this is the case, how can political scientists be expected to ever truly understand why voters do what they do? The answer, I believe, lies in a technique called process tracing.

Process Tracing Analysis

Process tracing originated in marketing research's efforts to understand decisions like buying a car, or choosing an apartment. The design called for tracing each step that the decision maker applied to the task. By following subjects as they actually made a decision, researchers could study each step in the decision-making process as it happened. The ability to follow what is normally a private process, provided significant new insights into how people deal with complex decision environments. The tracing has been done either by asking subjects to "think-aloud" as they carried out the task, or, in some research, by attaching equipment to the subject which records eye movements as different items are examined. A third method consists of using an "information board" on which items of interest are arrayed in one dimension and the attributes of each item are arrayed in the other dimension. While these boards have had a long and fruitful history in the study of decision making, they have rarely been applied to the decision we are talking about today -- the vote. In fact, the only example of which I am aware is research by Herstein (1981) in which he used a traditional information board to trace evaluation of two candidates on a number of different attributes. Perhaps the most fascinating finding Herstein reported, was that political party did not matter much -- it was accessed by his voters to a much lesser extent than other information, and was chosen far later into the campaign than one might expect. But, despite these odd findings, which I believe to be methodological artifacts, the information board appeared to be a useful technique. Process tracing has proven itself as a good way to understand complex decision making. And, from a political science point of view, voter choice during a political campaign is certainly a complex decision. Herstein's problems stemmed from trying to study what is a dynamic election process with a static technique. What I have done is to take the traditional static information board, and modify it into a dynamic, ever changing design, which better mimics the flow of information during a political campaign. Political information comes and goes, certain types of information are available at different times during a campaign. To try to model this dynamic process on a static board has as many problems as using surveys to snapshot the dynamic nature of the campaign. Thus, a way to present something like an information board, but which mimics the dynamic nature of the political campaign, needed to be devised. Richard Lau and I have designed and implemented such an approach, using Multimedia Toolbook 3.0 running on Windows-based computers. Using our system, we can present a mock presidential election campaign to voters, with the computer recording what information was viewed, ho! w much time was spent on various kinds of campaign information, and the order in which information was searched. Using the data generated in this manner, along with a questionnaire following the campaign, we have the ability to examine the "black-box" that political scientists have generally ignored. We have called this simulation system Ballot Box.

The Ballot Box Application

From the perspective of the person using our simulation, the system appears relatively simple. After reading a set of instructions, subjects "register" to vote in either a Democratic or Republican presidential primary election. The primary election then begins, and subjects see information for a number of candidates, some of whom are from their party, while others are from the opposite political party. This information is presented in the form of short descriptive statements which appear in the middle of the screen, six at a time. These statements take the form of "Rodgers position on Haiti", or "Gallup Poll Results Released" where they provide a label that might represent a newspaper headline. To learn about the information represented by the label, a subject using the computer mouse to click on the label of interest. A new screen then appears which shows a paragraph of detailed information about the candidate. When finished reading, the subject returns to the initi! al screen to see more information labels.

The critical difference between our approach and traditional static information boards is that the labels on the screen keep changing. New labels appear at the top of the screen about every 4 seconds, and scroll down the screen for about 20 more seconds, and then disappear at the bottom. Subjects cannot know whether labels which disappear will ever be shown again -- information not accessed when it first appears may or may not appear again, much as information in a real campaign comes and goes. As the primary campaign progresses, voters are expected to learn everything they believe they need to know to make their vote choice.2 In the original version of Ballot Box, technological and financial limitations meant that all information presented to subjects was in text format and everything was read on the screen. Of course, while this mimics a newspaper reasonably well, voters get much of their campaign knowledge through television and pictures. Thus, as the technology available to us has improved, we have made significant changes to our system. First, we were able to scan in and present still pictures of each of our candidates. These pictures were digitized and presented as bitmaps using Toolbook's ability to show both graphic images and text. Then, with the release of Multimedia Toolbook 3.0 and its greatly enhanced capacity to handle digital video, last summer we enhanced the system again to include video campaign ads, as well as our standard text-based information. Thus, the system has truly become a multimedia system, incorporating text, still pictures, video, and audio into a single simulation.

As subjects go through the primary campaign, choosing information of interest, they are interrupted from time to time by the campaign videos, which overlay the label boxes, and temporarily disable the ability to examine text-based information. Thus, subjects have little choice but to watch the videos. When an ad finishes, the label screen reappears. After a preset period of time, the primary election ends, and subjects must vote for their preferred candidate. At that point, the general election begins, featuring one candidate from each party. Subjects may or may not see the candidate they chose in the primary end up in the general election -- in other words, sometimes they vote for "winners," other times for "losers." The general election is basically the same as the primary, with video, text, and pictures available. At the end of the general election, subjects make a choice between the two candidates and then end the simulation. Finally, some information is collec! ted via a pencil and paper questionnaire.

The System and Programming Environment for Ballot Box

While the presentation to the user of the system is reasonably straightforward, and appears relatively simple, the programming environment is actually quite complex. The original system was designed using Apple Hypercard, and ran on Macintosh machines. In 1991, we began converting it to Toolbook 1.5, for two basic reasons. First, we wanted to make full use of color, and color Macintosh's were relatively rare. Second, Rutgers political science had standardized on Intel-based machines. Conversion was relatively straightforward, and we began running experiments with it in 1992. As the technology improved, and available PC's became more powerful, we took advantage of new capabilities and the system grew more complex. With the arrival of Toolbook 3.0, both power and complexity increased again. In 1995, we are running the Ballot Box system under Toolbook 3.0a, in a Windows for Workgroups 3.11 environment. We acquired two IBM Thinkpad 750Cs portable computers in order to take the experiment into the field, rather than requiring subjects to come to our offices. These computers have 80486 DX33 processors, 8 Mb RAM, and 340Mb hard drives. The Thinkpads come standard with sound chips, eliminating the need for any kind of external sound device in order to play the videos. While they also possess good quality screens, we needed to present the simulation on relatively large screens, to make using the system easier for subjects. So along with the portable computers, we added two 15 inch external monitors by NEC. Each portable computer was configured in exactly the same way, so that there would be no variations in the way the system ran on either machine. The machines were also equipped with docking stations and ethernet adapters so that when returned to the office, ! all data on them could be accessed across our office Windows for Workgroups based network.

Because of the addition of video to our system, we needed to acquire a system powerful enough to produce and edit videos. We chose an 80486 DX2/66 machine initially, which has since been replaced with a Pentium-90 machine. This video production system has 32Mb RAM, nearly 2 gigabytes of fast hard disk space. It has been equipped with an Intel Smart Video Recorder card for video capture, along with a Soundblaster 16ASP card for audio capture and playback. We are using Adobe Premiere 4.0 to capture segments from videotape and create our own digital campaign ads. Voice overs are then added to the video and a complete 20-25 second campaign ad is produced and compressed. Even with compression, though, the campaign ads take up to 3Mb of disk space for each ad. Working with Toolbook means learning object-oriented programming (OOP). For programmers used to the more traditional languages like COBOL or BASIC, OOP based languages can be very confusing. Toolbook functions under a hierarchical structure. Messages are sent from the level at which they occur on up the structure until a script is found to handle that message. Clicking a button sends a BUTTON UP message to the script for that button. If there is no BUTTON UP handler defined for the button, the PAGE that the button is on will get the message. If it has no BUTTON UP handler, the message will be sent up to the BACKGROUND level, and so on, until a handler is found or an error generated. Every object that is defined on a screen can have a script associated with it. If there is a script, that script will define the events that occur when the user selects that object. If there is no script, the object is generally simply a graphic or a field into which data can be typed. ! It is the interaction of the scripts, and the messages that get sent through the hierarchy that define how the application operates.

Scripts are programmed in Toolbook using a language called Openscript. Openscript is very English-like in its syntax and use. It may remind programmers of BASIC in its simplicity. However, that simplicity masks a great deal of very powerful function. Openscript has a wide range of pre-defined functions which, when built into a script, allow for the complete control of every object on the screen. As will be seen in the examples below, Openscript is structured, and programming in it is a good test of the ability to master structured programming techniques. This structure is critical to Openscript, as there is no GOTO construct. Everything must be managed through looping structures, calling structures and through the hierarchy of objects. Perhaps one of the biggest culture-shocks for traditional programmers who face an OOP language is that there is no one place in which you can see the complete flow of the program, since the program does not have any kind of typical top to bottom flow. Instead, objects are identified and grouped together as needed. Scripts are defined for each object only once, and then re-used at an appropriate place in the application's hierarchy. Consequently, trying to see the big picture of an application can be difficult. Added to this is the fact that Toolbook does not have any way to print out all of the scripts associated with an application in one pass. Also, the data associated with an application is stored in a special format, within fields that are themselves objects. So, while it is very easy to manipulate the data from within a particular application, creating large amounts of text is better done outside of the application with a word processor. The text can then be imp! orted into the application and placed into appropriate fields.

The strength of Openscript and Toolbook is the ease with which it handles graphical objects and video. Candidate pictures in Ballot Box are bitmaps, which are stored on disk outside of the Ballot Box application. When a subject access a picture, the Openscript programming merely reads the bitmap in and places it on a predefined "stage" on the screen. This works very quickly, and provides incredible flexibility. For example, if we wish to vary the pictures of our candidates, while holding constant all other information, this is easily coded. Multimedia objects, such as videos, are handled in a similar way. Toolbook contains a number of functions which open, play, rewind, and close digital video and digital audio. Coding these objects is simply a matter of placing a pointer to the disk file and reading it.

Future Directions

We have now used our simulation to run six sets of experiments, though we have so far analyzed data from only three of them. (See Lau and Redlawsk, 1992; Lau and Redlawsk, forthcoming; Redlawsk and Lau, 1995 for reports of the data analyses.) Our studies have included manipulation where we have varied the number of candidates in the primary election -- so that some subjects got two candidates in their party and others got four -- as well as varying whether or not the preferred primary candidate becomes the general election candidate; that is, whether the candidate for whom the subject voted in the primary win the nomination. We have also varied the number and content of the campaign videos that are shown, as well as changed the gender of candidates. In our next study, to go into the field this month, we are varying the attractiveness of the candidates, to assess how personal factors influence the way people process political information. From the standpoint of our system, we have some plans for change. The campaign videos were currently use are very rough -- their quality is not as good as we would like. In addition, because we chose to use Microsoft's Video for Windows, and our portables do not have local bus graphics, we have been limited to running the videos in very small windows. Our plans include upgrading our equipment so that the videos can run in at least a 240 X 320 window. Further, as video capture technology improves, we expect to be able to get better images in our videos. The recent upgrade of our video production machine gives us a platform to improve this critical are of our application. Finally, the Ballot Box program is not unlike many programs that have been developed and changed over time. It contains code that is no longer used, as well as inefficient structures that need to be streamlined. Most importantly, for our purposes, we hope to simplify the system so that any researcher interested in similar questions would be able to use the program without the necessity of recoding large amounts of the system. For the kinds of questions were are asking in our research program, Rick Lau and I needed to have a methodology that is radically different from that employed by most political scientists most of the time. Thus, we borrowed the information board concept from psychology and consumer behavior studies. We then changed its very nature by making our system dynamic, where we could match the flow of campaign information over time, in order to understand how information affects the voting decisions that people make. We see this technology as continuing to support our research, as we find additional ways to apply it over time.

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Video and Computer Technologies for Extended-Campus Programming

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1. Overview of University of Kentucky Extended-Campus Programming

Along with other major state universities, the University of Kentucky (UK) has a long history of providing courses and programs at off-campus sites. Because instruction was typically deliverd to the sites in person by the instructors, most of the courses were offered within reasonable commuting distance in central Kentucky.

In recent years the public's expectation has come to encompass a statewide graduate program and research mission for the University of Kentucky that provides much greater access to graduate and professional programs. In responding to this expectation the University is fulfilling the mission designated by the Kentucky Council on Higher Education and the philosophy guiding the development of land grant universities. The statewide outreach has been facilitated by recent advances in distance education technology which removes much of the travel burden from the instructors and from students.

A survey funded by the Kentucky Council on Higher Education and conducted by the UK Graduate School in 1989 revealed a high level of interest across the state in Ed.D. programs in Educational Administration and Higher Education. In response to the program needs revealed by the survey, funding for technology, instruction, and support services was made available by the president's office. The Departments of Administration and Supervision and Educational Policy Studies and Evaluation in the College of Education were asked to provide those Ed.D. specializations to extended-campus sites.

Four sites have been designated as Extended Campus Graduate Program Sites-- Ashland, Owensboro, and Paducah Community Colleges and the University of Kentucky-Northern Kentucky University Graduate Center. The three community college sites have been connected by T-1 data lines to carry the instruction by interactive compressed video. The advantage of this technology is that it provides two-way audio and video, thereby facilitating greater interaction among students and instructor than is the case for instruction via satellite. However, courses offered via satellite serve students at dozens of sites both in

All satellite and compressed video sites are staffed by part-time technical coordinators who oversee the classroom on-site facilities and operate the local technology. The four graduate program sites are staffed by part-time (full at NKU), doctoral-level site directors who oversee all site activities, maintain close contact with students, and serve as liaisons to the program faculties at the Lexington campus. All staff members at the sites are coordinated jointly by University Extension and the Graduate School.

Currently nine colleges provide programs and/or courses to extended-campus sites:

- Agriculture
- Arts and Sciences
- Allied Health
- Education
- Engineering
- Human Environmental Sciences
- Communications and Information Studies
- Social Work
- Nursing

UK now has an extended-campus graduate enrollment of more than 400, of which more than 80 are doctoral students.

Several sectors and units cooperate to provide support services to extended- -campus students. The colleges in the academic sectors provide the programs and courses; Information Systems installs and maintains the technologies; University Extension provides logistical support (e.g., student registration); the Graduate School provides coordination of extended-campus program planning and implementation and liaison with the regional universities; and the community colleges provide facilities for housing the video classrooms as well as local library support.

A major strength of the UK extended-campus initiative is the quality of library support provided to students and faculty by the Extension Librarian. The Extension Librarian responds to students' requests for special searches and provides copies of articles, monographs, and books.

Each of the four graduate program sites is equipped to provide students with computer connections directly to the UK mainframe, allowing them to communicate by e-mail with instructors and perform searches of the library card catalog and databases.

The extended-campus Ed.D. programs have also provided an avenue for expanding the Joint Doctoral programming with the regional universities. This arrangement allows the students to take some of their doctoral coursework conveniently at the cooperating institutions, and two of the five advisory committee members may be from that institution. A majority of the 80+ extended- campus Ed.D. students have chosen the joint doctoral route.

The technology-based extended-campus initiative by the University can be described as one of the most significant efforts to bring its programs to people in all parts of the state. This is truly a modern-day expression of the traditional land grant mission of the University of Kentucky.

2. Compressed video

The current University of Kentucky distance learning initiative began in 1974. The University was selected as the network Operations Center for the Appalachian Community Service Network (ACSN). ACSN, a project supported by the Appalachian Regional Commission, was a one-way video, two-way audio, distance learning network delivered through NASA's ATS-6 communications satellite. ACSN moved from the University in 1978 to become a for-profit organization and is still in existence today as The Learning Channel.

The University continues to deliver distance education by satellite through membership in the National University Teleconferencing Network (NUTN), the National Technological University (NTU), the Agricultural Satellite Network (Ag*SAT), and Kentucky Educational Television's StarChannels.

The television system in the United States is based on analog technology and relies on the broadcast and cable television networks to transmit signals into our homes and classrooms. Since the analog television system is expensive and does not always provide connectivity to the specific classrooms that we are trying to reach, we determined that we needed a different kind of network. The University installed a two-way interactive compressed video network in 1991. The University of Kentucky Interactive Television (UKITV) Network is based on a digital video system. Digital compressed video systems were becoming a cost effective means of providing faculty and students with a fully interactive two-way video, two-way audio, network in the late nineteen eighties.

The compressed video system relies on standard video components such as cameras, VCR's, and microphones to capture the lecture and the students' interaction. The system differs from traditional analog video in that the standard television signal is sent to a coder/decoder (commonly called a CODEC). The University of Kentucky CODEC is actually an IBM compatible personal computer that is running specialized compression algorithm software.

The CODEC converts the analog video signal to a digital signal. When analog video is converted to digital the resulting signal requires 35 megabits per second (mbs) of bandwidth to transmit the signal. Bandwidth refers to the amount of information that can be transmitted in this case on a per second basis. Due to the high cost of the telephone services that are capable of handling 35 mbs we use compression algorithms to reduce the signal so that it can be transmitted over less expensive telephone lines.

The UK system compresses the video signal from 35 megabits per second to 384 kilobits per second, a ratio of over 90:1. This compression scheme removes information from the video signal such as some color, some resolution or sharpness, and most important the video becomes somewhat jerky. We are improving the video by installing accelertor boards in the CODEC's. These boards provide very smooth video as well as improving resolution and color.

We have installed the same equipment in every compressed video classroom on the network. Faculty are encouraged to teach from the remote sites at least two times during each semester. When they visit the remote sites they are quite comfortable since they find themselves in familiar surroundings.

There are nine rooms on the University of Kentucky Interactive Video Network: Network:

Lexington Campus
Medical Center Campus (Lexington)
Kentucky Educational Television)
Ashland Community College
Hazard Community College
Owensboro Community College (2 rooms)
Paducah Community College
Paducah Information Age Park

Connections are also provided to Kentucky State Government offices in Frankfort and to other universities across the Commonwealth of Kentucky. The UKITV Network is connected to the SPRINT VIDEO GROUP providing access to interactive video facilities across the nation and around the world. The UKITV network is also connected to and is a part of the Kentucky TeleLinking Network.

The Kentucky TeleLinking Network (KTLN) is a consortium of the Commonwealth's publicly supported universities and community colleges, the Council on Higher Education, the Kentucky Department of Information Systems, the Kentucky Department of Education, Kentucky Educational Television, and numerous other state and local agencies.

KTLN is currently implementing a United States Department of Education Star Schools project. Kentucky is the only state to be awarded a Star Schools statewide grant this fiscal year.

KTLN uses interconnected digital video switches at eight university hub sites to connect distance learning classrooms throughout the Commonwealth. KTLN is best characterized as a "network of networks" linking individual systems into a statewide web which allows the sharing of resources among a diverse partnership. KTLN is the newest "on-ramp" to Kentucky's Information Highway. It is designed to address the needs of the Commonwealth by providing access to government, to global databases, and to new markets.

The funding from the KTLN Star Schools project will allow the University of Kentucky to place distance learning classrooms at Prestonsburg Community College, Elizabethtown Community College, and on the Covington Campus of Northern Kentucky University.

The KTLN Star Schools project is not limited to public institutions. As a part of the project the University of Kentucky will install an interactive video classroom on the campus of Saint Catherine's College in Washington County as well as the Scott County High School campus in Georgetown, Kentucky. The total Star Schools project will fund 46 new distance learning classrooms in universities and in over 20 high schools across the Commonwealth oı Kentucky.

The University of Kentucky is also developing a Telemedicine Network in eastern Kentucky. The objectives are to investigate the feasibility, costs, appropriateness, and acceptability of telemedicine consultations for improving access to health services for rural residents and reducing the isolation of rural practitioners. Specialty services that will be provided over the network include radiology, cardiology, dermatology, mental health and/or substance abuse, obstetrics and gynecology, orthopedics, subspecialties of pediatrics, and resuscitation of trauma patients.

The Telemedicine Network utilizes the same video compression hardware as the UKITV Network and the KTLN. The Telemedicine Network will be connected to and fully compatible with these distance learning networks.

The distance learning and telemedicine initiatives have been a big factor in driving the development and expansion of the digital telephone infrastructure in Kentucky. The Commonwealth of Kentucky awarded a contract for the "Kentucky Information Highway" on December 23, 1994. The winner of the "Kentucky Information Highway" bid was the Local Exchange Carrier Telephone Group (LECTG). LECTG is made up of South Central Bell, Cincinnati Bell, GTE, and 17 local phone companies in Kentucky. The goal of the Kentucky Information Highway is to provide state and local government and state supported institutions with a cost effective digital telephone infrastructure. Development of the network is already underway. This network of T-1 lines (T-1 service to all of Kentucky's 120 counties) will support the bandwidth requirements of distance learning, telemedicine, as well as data and voice networking throughout the state. The contract specifies that the cost of T-1 service in the state will be $665 per line per month and the rate is not "distance sensitive" which means that a line from one end of Kentucky to the other will cost the same as a line from Lexington to one of the University Community Colleges. This standardized rate will save users money and it will make budgeting for expansion projects much easier.

The University of Kentucky is in the process of connecting all of its 14 Community College Campuses to Lexington through T-1 lines. While the initial motivation for installing T-1's was to transmit instructional compressed video, we have found that the cost savings from utilizing the T-1's for voice and data transmission now justify the installation to campuses that do not currently have interactive video classroom. These T-1 lines provide high quality, high speed connections for long distance telephone service and more importantly for access to the centralized databases on the Lexington Campus such as the UK Library NOTIS system and ERIC, MEDLINE, Expanded Academic Index, IAC National Newspaper Index, Company Profiles, and the Center for Research Libraries. Most importantly, these high bandwidth connections provide connections to the Internet.

The University is beginning a new initiative to increase off-campus Internet access for all students, faculty, staff, and friends of the University. UK awarded a bid to MCI, Inc., in April 1995, to provide Internet access in Lexington and in each community college community at a nominal cost. The award specifies that MCI will install a bank of modems on each campus and provide access services to students, faculty, and staff at a rate of $12.00 per month. Other members of the community can subscribe at a rate of $17.00 per month. This service will be another addition to the growing list of information resources in our communities.

3. Computer Utilization

Owensboro is a small community in rural western Kentucky. In 1991, Owensboro Community College, a two-year, associate degree-granting institution, responding to the local business community's need for instruction by distance learning, designed and implemented the National Distance Learning Center (NDLC), a free on-line database of distance learning programs and products accessible by computer modem or by Internet.

Owensboro Community College's experience with providing on-line learning services allowed the college to leverage its successes into new services for the Owensboro and Daviess County communities. The college began to offer on an experimental basis a gateway to some Internet servces by subscription. The gateway also provided local e-mail and database information.

This Internet gateway quickly became more popular than was expected. In a few few weeks, the college registered more than 300 users. Today, the gateway processes more than 700 dial-ins each day.

As impressive as the numbers are, more impressive is the impact it has had on the community. In March, 1994 the NDLC sponsored an e-mail-a-thon which brought young people from around the community and world together for live conversation by Internet e-mail. In June the college was the site for a reception given by mothers of children with multiple disabilities who have learned to use the technology as an electronic support group.

By the summer of 1993, two years after the opening of the NDLC, representatives from the three colleges in Owensboro, city and county governments, public schools and private business came together for the purpose of designing and deploying a community-wide high speed data network that would interconnect all educational institutions, government, medicine, and other organizations into a single network. The purpose of the Community Networking Cooperative was to provide e-mail and data and to allow sharing of computing resources.

The Community Networking Cooperative has succeeded in securing some pieces of the network. For example, during the most recent renewal of the city franchise, the cable company agreed to provide free to the city a system-wide data network on their fiber backbone. The CNC, through support from NDLC and the College, also established the first free-net in the Commonwealth of Kentucky. This data network, to be fully implemented by this summer, will provide community e-mail and data servces to all citizens by dial up modem.

Soon the mayor of Owensboro will announce the creation of an Information Technology Commission. Under the direction of the Chamber of Commerce, this commission will convene CEO's to bring a high level of attention to the issues of information technology with industry recruitment as its highest priority.

As the level of technology consciousness and application developed within the community of Owensboro and Daviess County, Kentucky, the community turned to the community college to provide leadership. The mission of Kentucky community colleges creates a special relationship between college and community with the result that the colleges are highly responsive to community needs.

There are direct applications to education as well. The college is studying and experimenting with ways to deliver training to the learner by data networking. The community-wide network, when fully implemented , will provide the learner with access to multimedia, voice, video and data, and learner-programmed instruction. Virtually any desktop computer in the Owensboro community will have the capability to connect with the Kentucky TeleLinking Network (KTLN), a statewide network of interactive classrooms. The KTLN represents a partnership among all Kentucky universities, state government, and public schools. Through developing technologies and partnerships, Owensboro Community College is in a position to lead the state in providing cost effective, learner-programmed and directed education to the citizens of its hometown.

4. Library Applications

The University Libraries are the focal point for information services to the University Community and continue to focus on providing information in electronic formats. The library system continues to examine and acquire those resources that provide the most efficient delivery of that information, working toward a unified, user-friendly access gateway for all users. The goal is to provide electronic information resources in a reserach university library with emphasis on "just-in-time" rather than "just-in-case" acquisition of materials.

To accomplish these goals ground was broken for the W.T. Young Library on November 6, 1994. When complete in the Spring of 1997 this $58 million facility will provide state-of-the-art information resources. The entire building will be wired with fiber optics. The 350,000 square foot facility will have a seating capacity of over 4000 and will provide either wired or wireless network connectivity for every patron as well as every faculty and staff member in the building. Computer labs with high speed workstations will be provided to patrons and will be available 24 hours a day. A centralized media retrieval system will provide users in classrooms and at workstations with immediate access to a wide variety of multimudia resources including CD ROM, laserdisk, video and audio tape and emerging technologies. This system will provide the model for extending these services to the entire campus, to the community college campuses, and statewide.

5. Adaptations for the Small College

What advantage do these initiatives at a large state university offer to small colleges? They offer models that can serve as a starting point for projects on your campus. All of the initiatives in this paper utilize off-the-shelf hardware and software and can be implemented at your institution.

Saint Catherine's College is preparing to take advantage of the interacitve video network mentioned above. Spalding University in Louisville is also interested in installing a compressed video classroom so they can become a full partner in a new statewide initiative to train place bound students as nurse practitioners and nurse midwives. Small colleges such as Georgetown College are connected to the University's NOTIS library. When a patron on the university campus accesses NOTIS they choose the Georgetown NOTIS database and a patron on the Georgetown campus can choose the UK database.

[Graphics will be included at the time of the presentation.]

Macintosh Computer Classroom and Laboratory Security: preventing unwanted changes to the system.

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Abstract:

Because of the graphical interface and "openness" of the operating system, Macintosh computers are susceptible to undesirable changes by the user. The changes take the form of software added to the computer, software removed from the computer, or changes to the control panels. The basis of these user changes is usually out of ignorance but often comes from maliciousness. Personnel responsible for administrating classrooms and laboratories must spend time reconfiguring the systems. This presentation will discuss the pros and cons of some of the software packages that offer protection for the Macintosh system.

Body:

There are two basic forms of software security packages for Macintosh. One type of package provides protection by masking the interface a user would see on an unprotected system. The most common example of this is the program "At Ease" by Apple Computer Inc. In these programs, the administrator decides what applications will be available to users. Users can not get to the portion of the operating system that would allow them to make unwanted changes. While this approach is very functional, it removes the user from the standard operating system. Many faculty members and teachers who teach computer technology related courses prefer to maintain the normal Macintosh operating system but have added protection.

The second basic form of security package protects the system while maintaining the standard operating system. There are a number of packages available to do this and each has its own, specialized approach to protection. This session will review three products that offer desktop security but maintain the Macintosh interface (see below). The topics will cover installation, security provided, and implications for computer classroom administrators and instructors.

"FoolProof" by SmartStuff Software.
PO Box 82284, Portland, OR 97282
Tel: 503-775-2821
FoolProof has four Control settings sections.

1. Desktop Control.
    - Prevent dragging and renaming of files and folders. This disables copying or moving individual files or applications.
    - Disable desktop altering menu items (New Folder, Duplicate, Make Alias, Clean up, etc). Also disables Sharing setup and Get Info.
    - Lock the document in the Get Info dialog box so that users can not change a stationery document
    - Specify a designated folder for saving on the hard disk.
2. File Saving
    - Direct all file saving to floppy disks, network volumes, or specialized folders designated by the administrator.
    - Dialog boxes are used to tell the user where saving is permitted.
3. Program Control
    - Prevent users from opening control panels.
    - Prevent users from opening the Chooser.
    - Prevent users from starting applications from floppy disks.
4. Preferences
    - Prevent users from changing a hard drive by restarting from a disk or holding down the shift key.
    - Has a keyboard override capability.
    - Disable the snap shot capability (command-shift-3).
    - Lock hard disk on shutdown and restart.

Comments: These is considered a weaknesses.

- Users can relocate, resize, and change the view of a window. These changes remain in effect when the next user comes to the computer.
- When control panels are locked, all of them are locked. The administrator cannot decide to allow access to selected control panels.
- A user can save a file on the desktop of a floppy disk. The user is then unable to delete or move the file.

Costs:

Single User - $39.00, 10 pack - $179.00, 30 pack - 349.00, Building License $589.00, District Licenses available.

Other services for extra cost:

- File Security: Protects confidential documents and applications, encryption available.
- Screen Saver.
- Toner Saver: limits the amount of toner used on draft copies.

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"Mac Control" by BDW Software
1410 Rocky Lane, St. Paul, MN 55122
Tel: 800-726-5462 Fax 612-452-4902

Mac Control uses a special folder called the Control Folder. Setup and administrative changes occur from files in this folder. The contents can be seen only by the manager who has access via a password. Mac Control also creates four special folders called Public, Shared, General, Special. A variety of users (for example students, advanced students, teacher assistants, teacher, administrator) can be assigned by the administrator depending on user needs. These users can each have their own accessibility to the special folders and the hard drive. A series of user definition windows allow the administrator to determine the control settings.

- May or may not work on floppy/server/personal/general/ or any folder.
- May or may not see contents of special folders.
- May or may not use Command Shift 1/2/3
- May or may not lock or unlock files
- May or may not duplicate applications
- May or may not launch applications from floppies
- May or may not modify any finder window display.
- May or may not use specified DA's or Apple Menu Items (Chooser, Control Panels, and two other of administrator's choice) o Make certain applications available for use during only certain hours of the day. This is specified from a list of all applications available on the hard drive.
- Make the mouse automatically move to the default button of a dialog box.
- Disable the System 7 Application Menu.
- Lock the hard disk on shutdown and restart.
- Restricting the number of copies to Print.

Comments:

A new version was released at the time of this writing.

Costs: Single User - $59.00, 5 pack - $129.00, 10 pack - $229.00, Building License $399.00, 5 buildings $1199.00, 15 buildings $3299.00.

Other services for extra cost:

- A junior version with the most common control features for less cost than the full version.
- Mac Control Pro. Includes the full version of Mac control and limited versions of the two products listed below. o Remote Control: Allows an administrator to control functions from a single machine, i.e. updating settings, install new software, override the keyboard and mouse during instructional settings. o Digital Ditto: Can copy selected files and folders from a source Mac to multiple destination Macs.

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"MacPrefect" by Hi Resolution Inc.
The Tannery Complex, 12 Federal Street, Suite 46, Newburyport, MA 01950. Tel: 800-455-0888 Fax: 508-463-9619 Applelink:hi.res.us.

MacPrefect has nine settings tools.

1. Folder Control: Maintains folder structure, maintains file and folder names, prevents files from being saved in unauthorized locations, stops users from throwing away files and applications.
2. Copy Control: Prohibits copying of certain file types, e.g. application files and control panels.
3. Folder Sweep: A folder can be created to allow users to save information. Files can be removed after they have been there for a certain period of time or after the folder reaches an administrator specified amount of memory.
4. Control Panels: The administrator can selectively restrict access to control panels.
5. Launch Control: Prohibits launching of unauthorized software.
6. MacShifty: Disables the shift key startup feature that would turn off extensions.
7. Disk Name Control: Disable the ability to change the name of the hard drive.
8. Screenshot Lock: Disable the snap shot capability (command-shift-3)
9. DiskPrefect: Locks the hard disk if the user starts up from a different system.

Comments: Some dragging is allowed at lower levels within the hierarchy. If there are many layers of folders, some files in lower layers can be moved to other folders.

Costs:

1-4 $49/copy; 5-24 $39/copy; 25-49 $30/copy; 50-99 $27/copy; 100-199 $24/copy.

Other services for extra cost:

- MacVisa: Allows student logon to be sure that the right users are on the right machines using the right software and peripherals.

Cooperative Efforts to Integrate Computer Technology into Teacher Education Curricula

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Introduction

The College at Old Westbury is part of the State University of New York (SUNY). Founded in 1948, SUNY comprises 64 geographically dispersed campuses, of which four are university centers and 13 four-year colleges of arts and science. The other 47 colleges are colleges of technology and health science centers, as well as community colleges. SUNY Old Westbury is a small four-year college of arts and science with 4000 students and about 200 faculty. The College, founded in 1965, is located on a 600-acre site on Long Island, twenty five miles east of New York City.

SUNY College at Old Westbury is called the "College of the 21st Century", because its students, faculty, administration and staff reflect demographics predicted for the 21st century. Students range in age from 18 to 76, of which 58% are female. About 27% are African-American; 10% Hispanic-American; 6% Asian-American; 55% Caucasian; and 2% international students from 41 countries.

Responsibility for educational computing on campus is concentrated in the Educational Technology Center (E.T.C.) which now includes labs for languages, business and management, American studies, multimedia for social studies, computer science, natural sciences, and teacher education. There is also a small faculty lab. E.T.C. was founded in 1985 with funding from a Title III federal grant. This grant provided financial support for three years, after which the Center became fully supported by the College. For equipment and software, E.T.C. relies on SCAP funds. SCAP which stands for Students Computing Access Program is funded annually by the SUNY Central Administration. The program provides financial support to individual colleges within the system to acquire computer equipment and software, at the rate of about $18.00 per student per year.

Recognizing the value of educational technology in the instructional process, the College in 1991 restructured E.T.C.to combine the Academic Computing and Audiovisual Media departments. Prior to 1991, the Center's major objective was to provide adequate computing facilities to the college community. After the restructuring, the focus was expanded to include total support to faculty efforts to integrate educational technology into the curriculum.

Several Teacher Education faculty expressed an interest in using the new technology and they had both a rough plan and a vision for technology development in their program. As a result, in late 1991, E.T.C. and Teacher Education joined hands to achieve the goal of implementation of educational technology into the curriculum. But why educational technology?

Educational Technology

In the last two decades, new technologies have advanced very rapidly and transformed in many ways the manner by which things are done in our daily life. This transformation has also affected education where computer, video, and telecommunications technologies have merged to create a powerful tool that can be successfully used in teaching and learning. As Knapper (1988) points out, "education has traditionally made quite extensive use of the products and processes of technology, from the chalkboard to the computer." It had been estimated that by the 1980's, 99 percent of all public schools in the United States used some form of educational technology (Robertson, 1994). In 1984 the ratio of computers in schools to students was 1:125. By 1991, it was 1:20. In addition, about 46 percent of school children now have a computer at home. (Maddux, Johnson and Harlow, 1993)

We, as educators, have an obligation to prepare all our graduates "... to live in, work in, compete in, and thrive materially, vocationally, and personally in the new milieu..." (Stowe, 1992). However, the vast majority of educators, at all levels of education, have not been fully prepared to meet the challenge of integrating new technologies into instruction. It is crucial that we address the question of how teachers are prepared to use technology to help students enter and compete in this new world and, in particular, how well faculty involved in teacher education programs equip their students, the teachers_to_be, to participate in the information age professionally and personally.

A number of studies have been conducted on the implementation of technology in teacher education. These studies have concluded that the use of educational technology has the potential to improve instruction and effectiveness, and save time. (American Association of Colleges for Teachers, 1987; Association for Educational Communication and Technology, 1981; Bosworth & Welsh, 1993; Byrum & Cashman, 1993; Reyes, Torp, & Voelker, 1993; Robinson,1993; Woodrow, 1993). However, the potential for improving teaching and learning will not be achieved unless teacher education instructors are well trained in the use of educational technology. (Centre for Educational Research and Innovation, 1992)

This paper discusses the cooperative efforts of E.T.C. and the Teacher Education Program at the College at Old Westbury over a period of five years to encourage faculty to integrate educational technology into the teacher education curriculum, and, in turn, to train pre_service teachers how to use this technology successfully in the classroom.

A Cooperative Effort to Build Computer Literacy

In the fall of 1989, the Teacher Education Program at the State University of New York, College at Old Westbury, felt itself to be way behind in entering the computer age. About 60 percent of faculty had computers at home on which they did word processing of their syllabi and exams. Special education instructors invited speakers to their classes once a semester to demonstrate software used in special education classrooms. (The speakers brought their own hardware and software.) The rest of the faculty considered themselves computer illiterate (interestingly, these were all men).

The Teacher Education Program had one elective computer course "The Microcomputer in the Elementary Classroom," taught by an adjunct instructor (the computer coordinator for a nearby school district), and no computer laboratory. In a given year, less than 10 percent of the teacher education enrollment of about 450 pre-service teachers could complete the course. The instructor of the microcomputer course taught students a bit of programming in BASIC and for several class periods brought in two of his own Apple IIGS computers to demonstrate educational software that he borrowed from his school district. Thus the 16 students in the class had four to six hours of class time devoted to "hands-on" work with computers.

Faculty in the Teacher Education Program discussed this sorry situation and emerged with a plan, not as deliberate a plan as they would have liked, and more clear in hindsight than it was at the time, but a plan nevertheless. First of all, the Teacher Education faculty's preferred goal was to integrate technology across the teacher education curriculum and not to rely on specialized courses. They realized instinctively what Dell and Disdier (1994) concluded three years later. In a search of the literature on technology in teacher education, these researchers became convinced that in order for technology training to be effective, certain characteristics had to be present:

1. Educational technology training needs to be integrated into the entire teacher preparation curriculum, not taught in isolation, so that effective technology integration is modeled for pre_service students...;

2. The training must link technology with the instructional process and the curriculum. It must emphasize that technology is not an end in itself but rather, it is a means to an end_-which is the enhancement of teaching and learning...;

3. The training needs to be hands_on...; and

4. The training needs to be in_depth... Teachers need to be comfortable enough with computers..." (Dell & Disdier, 1994).

The Teacher Education Program's integrative approach was consistent with its emphasis on interdisciplinary instruction and equity of opportunity for all students. For years, it had required courses for pre-service teachers in multicultural education and interdisciplinary teaching strategies. The program supported the mission of the College which was to serve students who have been traditionally bypassed by higher education.

Secondly, they assessed their faculty. Things didn't look too good. In 1990, teacher education instructors were coping with a doubling of enrollment in the program due in large part to publicity regarding growing job opportunities for teachers. With large teaching and advisement responsibilities,they had little time or energy to take on the task of learning about technology.

Luckily, a faculty member eligible for a sabbatical during the coming academic year, offered to center her sabbatical plans around computers in education with the express purpose of returning to campus to share knowledge with colleagues and help establish a teacher education computer laboratory. This sabbatical plan was discussed and approved. While not stated explicitly at the time, this faculty member was to become the Program's technology leader (TL).

While the TL was away, the Chair of the Teacher Education Program successfully applied for SCAP funds to purchase 16 Mac LC computers with hard drives and Apple IIE cards (These cards enabled the Macs to run Apple software; the majority of educational software available was still designed for the Apple computer.). There were two arguments in their favor. After the Business and Management Department,the Teacher Education Program had the largest percentage of majors at the college and the Chair emphasized that they didn't seem to be getting their fair share of computer resources. A recent New York State Education Department re-registration review of the College had recommended that the College provide the Teacher Education Program with a "dedicated computer laboratory."

At this time, directorship of the Educational Technology Center (ETC) changed hands. The Center had been managed by staff with mostly technical expertise. One result was a Center that had been operating mostly for the benefit of computer science majors. Much of the SCAP funding was being spent on sophisticated equipment that the College was often unable to maintain properly. Less emphasis was being given to the needs of the student body at large which had such mundane needs as computers on which to word process their class assignments and papers. With the new director, the mission of ETC was clarified. It became more supportive of the needs of all academic programs In fact, the new director of ETC made this mission a condition of his accepting the position. This change of emphasis was an important development for the Teacher Education Program.

Upon return from sabbatical the TL volunteered to serve on the Academic Computing Committee, an advisory committee that sets policies and procedures for the operation of the academic computer labs and recommends how SCAP funds will be used. The TL was also designated computer coordinator for the Teacher Education Program, an unofficial title that provided no release time or compensation. It was simply an attempt on the part of the Teacher Education Program to make its fledgling efforts in the technology area less scattered and fragmented.

The TL drew up a list of recommended software for the Teacher Education Program, the Mac LCs arrived, and the lab was set up. The original order had included five and one-quarter inch disk drives for each computer (to run the Apple software--most of which was only available on this size disk). At the last minute, the drives had been cut out of the order to pay for anti-virus programs and security devices. And still no money was available for software. This was disappointing enough but then the Program was informed that, while they had priority for time in the lab, their 16 Macs were to be shared with the whole college. There turned out to be serious problems with this arrangement as some students mischievously tampered with the hard disks or accidently erased programs. Others, understandably, did not want to stop working when teacher education classes arrived. These difficulties were enough to completely discourage all but the most determined teacher education faculty.

We began to work on the problem of software. Arguing that the instructor of the microcomputer course had none with which to teach his course, the Teacher Education Program and the Director of E.T.C. convinced the Academic Vice President to approve a site license for LogoWriter. They were able to borrow Microsoft Works from one of the science programs where it was not being used. The TL began to develop a Logo unit on problem solving and informal geometry for her mathematics methods courses. After almost three years, we felt we were finally on the way.

In July 1992, a full academic year after the Mac LCs had been purchased, an order for about $4,000 of education software (about half of our original list) was finally approved. The programs arrived at the very end of August, too late to preview for fall classes.

Before we could even begin using the software, the Director of ETC convinced the TL to help write a modest proposal for a conference on computers in teacher education. Funds were available through a SUNY-wide organization called Faculty Access to Computer Technology (SUNY FACT). The goal of this very modestly-funded organization was to promote faculty use of computers across the curriculum and small grants were available for activities such as workshops and conferences.

As newcomers to technology, the only possible approach we could take was to design a conference that would inspire and teach us as much as the participants. When we sat down to brainstorm about the conference, several questions came up. What should be our priorities for training pre-service teachers? What do the schools want us to do to prepare our beginning teachers? What were other SUNY campuses doing to prepare their preservice teachers and engage their faculty with technology? With a $4000 grant from SUNY FACT, we invited teachers and administrators from nearby school districts to discuss what beginning teachers should know about technology in education. We invited teacher education colleagues from other campuses to tell us what they were doing. We shared the little we were doing. The conference was very successful and one result was that some of our teacher education faculty were inspired to begin to integrate technology into their coursework. For example, two reading instructors who were team teaching their bilingual and monolingual reading courses included a project where the bilingual and monolingual students used the computer to communicate with one another.

It took another year, and two events, before the Mac Lab was finally "dedicated" to the Teacher Education Program. SCAP funds provided a second Mac lab of 20-plus computers for use by other academic programs (particularly Journalism) as well as the larger student body, and the Middle States Association of colleges and schools repeated the State Education Department's recommendation for a dedicated lab for teacher education students.

Once the lab became our own, we thought we were settled but we weren't quite. One semester later, we moved from E.T.C. to the library. E.T.C. staff tries hard not to forget our lab but we have had to fight off efforts by the library director to open our lab to the entire library population (with no arrangements for supervision of students). The latest development is that we have just received a videodisc player (and one video disc). It needs only to be set up and we will begin learning how to use it.

Teacher Education Faculty Development

There have been several informal ways that the Teacher Education Program has encouraged faculty to become computer literate and to integrate computers or other technology into their courses. For one thing, we have already agreed to consider progress toward computer literacy and integration of technology into coursework as an important part of professional development. Secondly, the TL set an example by integrating computer technology into her courses. This example encouraged some faculty to begin thinking about their own. The TL has offered to show interested faculty the lab and to demonstrate software related to their instructional area. She has accompanied classes to the lab on their first visits.

Special education faculty who teach methods courses have been particularly motivated. This is because special education programs in schools have often been in the forefront in regard to the use of technology in learning.

The interest of three relatively new faculty members has come from several directions: their desire to participate in educational reform and change; the inspiration that they received from participating in our first computer conference; and their work with school districts.

Some faculty have made the transition from no knowledge to self-use; others from self-use to asking students to hand in assignments done on the computer. Others are ready to make a move to simple requirements or to full integration in their courses. According to research, the step from personal use to use in the instructional setting is one of the most difficult.(Wetzel, 1993, p. 349; Roberts and Ferris, 1994, p. 216) And it is common at some institutions for full implementation to be achieved by only one member out of an entire teacher education faculty. (Roberts and Ferris, 1994, p. 218)

Continuing Forward

The Teacher Education Program, in continuing cooperation with E.T.C. has not stopped pressing for change. Many things contribute to our momentum. The TL does many independent studies with students The independent study students not only help to provide a bit more access to the lab, they demonstrate software in other methods classes and assist beginning students with simple problems. A goal is to develop a core of TL leaders among students.

Our 1993 conference was successful in motivating several faculty. It also provided the start of an informal network with instructors from other colleges and school districts. One of the presenters at the conference is now the adjunct instructor for our microcomputer course and is helping to keep us moving along with the latest technology. The TL and the Director of ETC wrote another successful proposal for a computer conference, to be held in fall 1995. To engage our Teacher Education faculty, including the non-computer-users, we chose a theme, Equity and Excellence in Access to Computer Technology, that is consistent with the mission of our college and the Program. We plan to include a larger number of teacher education students in the planning and participation stages of this conference and hope this will create excitement and show them the relevance of computer literacy to the outside world.

Conclusion

Several factors were critical in our five-year cooperative effort. The first was to identify a TL who was willing to use professional development time and energy to become more knowledgeable, and who was committed to sharing that knowledge. There is considerable research that shows the importance of technology leaders and the factors that contribute to their success. (Kearsley and Lynch, 1994; Ferris and Roberts, 1994)

It was also important for the TL to support college-wide technology development by volunteering to serve on college-wide technology committees and maintaining cooperative relationships with other faculty who are TLs for their departments. A department's development can best flourish in the context of excitement over technology development for the whole campus. This participation also helped to ensure that the needs of the Teacher Education Program were kept in the forefront of college-wide deliberations regarding resources for technology.

A second critical factor was the support of program faculty and the college administration for the TL's sabbatical plans. Research shows the importance of such support. (Ferris and Roberts, 1994) A third was using the clout--even if only on paper--of outside groups such as the New York State Education Department and Middle States. Other colleges have used state mandates for changes in teacher certification programs as opportunities to include requirements for inclusion of technology in education coursework. (Roberts and Ferris, 1994) The Teacher Education Program at Old Westbury is also using the design of a new graduate program as an opportunity to enhance the technology component of the undergraduate and graduate curricula.

A fourth factor in our modest success was change in the Educational Technology Center itself. At a critical time, the Center's mission was clarified to support computer use and literacy development for the largest number of students. An important goal was to develop a systematic way to fairly distribute funds to support technology development. The new ETC director has been working to ensure that the needs of all campus programs are balanced. This is not easy to do and requires constant vigilance.

The Teacher Education Program and E.T.C. worked together patiently. Research indicates that awareness that change in a school is slow is one of the critical factors in successfully creating and maintaining technology leaders among the faculty. (Ferris and Roberts, 1994, p. 11) Ours has been a successful cooperation that is continuing. We find that sharing reflections on our journey, as we are doing with you today, is an important part of our planning for the future.

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Netware-specific network security

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Abstract

Computer network security is becoming an increasingly important problemin a society that is becoming more and more dependent on informationsystems and computer technology. As Novell NetWare is the currentleader in market share among network operating systems software, thistalk will focus on practical and cost-effective NetWare-specificapproaches to information systems and computer security. This will bedone with a series of specific and practical real world experiences inthe area of information systems and computer security specific examplesthat, at the same time, illustrate general and fundamental informationsystems and computer security concepts.

Introduction

Computer networks are increasingly used to share informaticn andresources in order to reduce the costs associated with the duplicationand sharing of such information and resources. And computer securityhas become important in direct relationship to this increase in the useof information systems and computer technology.

The area of information systems and computer security forms an everexpanding body of knowledge. A short paper can only touch the surfaceof this knowledge (see, for example, Forcht, 1994; Stallings, 1995;Kaufman, et al, 1995). So, instead of a general overview of networksecurity, this paper should be considered a continuation of the paperpresented last year (Snyder, 1994b) and will consist of a series ofspecific examples with which the author has personal experience andthat, at the same time, illustrate some fundamental and generalprinciples of network security. And, as Novell NetWare is the currentleader in market share among network operating systems software,practical and cost-effective NetWare-specific approaches to informationsystems and computer security will be featured (for general anddetailed information on NetWare 3.x, see, for example, Heywood, et al,1994).

Where appropriate, a command-line approach, as opposed to a full-screenapproach, to network commands will be used since the execution of acollection of command-line commands can be automated by placing thecommands in a batch file and executing the batch file.

And, since the goal is cost-effective and practical network security,only readily available and low cost solutions will be addressed.

Background

The purpose of a network is to share resources, typically files,printers, and information in general. But, in order to balance sharingwith security, user accounts, identified with a user identification, oruserid, are created with password access in order to limit sharing. Forconvenience, users can be made members of groups so that entire groupsof users can be given certain rights by giving those rights to thegroup, although NetWare is not designed to make group managementparticuarly easy (Snyder, 1994c). A NetWare network (3.x will beassumed in this paper) is a client-server network in that the fileserver is used to share files (and information) while clientworkstations access the (centralized) file servervia some networktopology (usually ethernet or token ring). In practice, a file serveris a high powered workstation with Novell NetWare software installed.A printer server is another type of server, but, in practice, if thefile server is not being fully utilized, the print server (and otherservers, such as SQL, modem, fax, etc.) can be installed on theworkstation comprising the file server. A local area network (LAN) mayconsist of a large number of interconnected file servers, often calleda wide area network (WAN). The entire process is sufficientlycomplicated, ever changing, and important enough that a full-timenetwork administrator and assistants are often hired to maintain thenetwork.

Passwords

A password is used to authenticate that the user is who the user claimsto be. There should be a one-to-one correspondence between users(people) and userids (user accounts). If not, consider the commonaccount STUDENT (with no password). If STUDENT has email access, thenSTUDENT can send a nasty message to the president. Who is responsible?Anyone could have used that account. On the other hand, suppose thatuser LAYNE leaves his workstation unattended. A student uses theopportunity to use the workstation to send a nasty message to thepresident. Who is responsible? In this case, the person assigned toLAYNE is responsible. This is a simple example that illustrates theimportance of password protection and the example can be used to warnusers about giving their passwords to other individuals. User mustunderstand that account access is associated with responsibility forthe actions done by that account.

For this and other reasons, password protection is an importantcornerstone of network security. Given the proper password(s), a personcan get access to anything on the network (for which it is possible toget access; even the SUPERVISOR cannot access password information inNetWare without physically disassembling the file server and dissectingthe hard drive).

For example, user RSNYDER can login to file server HORNETS with the command

login.exe HORNETS/RSNYDER

whereupon the login.exe program requests a password to authenticate theuser as RSNYDER. If the person types the proper password, the networkassumes that the person is, indeed, the person assigned to the RSNYDERaccount.

But, and here is the rub, the password must move from the clientworkstation to the file server over a wire. What if someone has accessto the wire and watches the messages go back and forth? So longpassword protection. Hardware (and software) are available for suchtasks, and the price is coming down. Think of it this way. A bridge canbe used to connects two network (of similar or dissimilar topologies).Messages from one network that are destined for the other network arepassed through the bridge. In this sense, bridges are one way ofreducing traffic in a congested network (that is, split the network inhalf and connect the networks with a bridge). Although hardware bridgescan be purchased, a NetWare software bridge can be created from aworkstation by adding two network adapter cards to the workstation,connecting each of the adapter cards to one of the two networks to beconnected with the bridge, and installing the software to take messagesfrom either side and place it on the other, as required. (Note: NetWaresoftware bridges are somewhat limited if certain non-Novell protocolsor software are to be used, e.g., TCP/IP, PC Support). In action, thebridge software takes messages from the adapter card, as required, intothe CPU (and memory), and then to the other adapter card, from the CPU(and memory). There is nothing to stop someone, given the propersoftware and/or programming techniques, from looking at the messages asthey are being transferred.

Luckily, the NetWare login.exe program (NetWare 3.x and after) has abuilt-in encryption feature that uses the RSA algorithm that works, insimplified form, as follows.

- The login.exe program on the client workstation requests a public key from the file server.
- The file server generates a public and private key. The private key is kept at the file server. The public key is sent to theworkstation. Anyone listening (watching the wire) could obtain thepublic key.
- The client workstation gets the password from the user and encrypts it with the public key. The encrypted password is sent tothe file server. Anyone listening (watching the wire) could obtainthe encrypted password, but decrypting the message would requirethe private key, which is very difficult to determine given onlythe public key. (This is the trapdoor part of the algorithm).
- The file server decrypts the encrypted password with the private key. If the decrypted password matches the password stored at thefile server (and to which even the SUPERVISOR does not haveaccess), then the user is assumed to be valid, and login succeeds.

This scenario ignores the problem of "spoofing" where a clientworkstation attempts to look like a file server and fool the clientinto revealing information (such as a critical password) to a fake fileserver.

So, no problem. Just encrypt the passwords. But, NetWare allows thenetwork supervisor to issue the following command

Set Unencrypted Passwords On

This command would typically be placed in the autoexec.ncf file on thefile server (autoexec.ncf is similar to the autoexec.bat file in DOS inthat the autoexec.ncf file contains commands that are automaticallyexecuted when the file server is booted). But why?

In one particular case, the author, as Director of Academic Computingand academic network supervisor, received a request from the Registrarto install a direct connect print box (and, as is common practice, wasnot contacted before purchasing the box). It turns out that certainhardware devices do not have built-in support for NetWare encryptedpasswords. In this case, the print box could be set up in RPRINTER orPSERVER mode. In RPRINTER mode, the printer acts as a remote printer,requiring one user license on the network (a 100 user license becomes,in effect, a 99 user license). In PSERVER mode, the printer acts as aprint server, not requiring a user license on the network. RPRINTERmode does not require that encrypted passwords be turned off, butPSERVER mode does. For these reasons, the author chose to set up theprinter in RPRINTER mode. On the other hand, the administrative networksupervisor (and again, as is common practice, there was littlecommunication between the administrative network supervisor and theacademic network supervisor) chose to set up the printer in thePresident's office, using the same type of print box, in PSERVER mode.Well, when the administrative network supervisor left the university(for reasons that were never revealed), the author was called in tocheck the state of the administrative network. The userlist.exe programrevealed that a print server was active and the name of the printserver indicated that it was in the President's office. Immediatelywalking down the hall and looking at the box, the author asked the VicePresident for Business Affairs why they were not using the encryptedpassword feature on the network, since anyone watching messages on thewire would be able to determine passwords and gain access to importantinformation. The Vice President was somewhat indignant that I wouldsuggest such a possibility and the Directory of AdministrativeComputing expressed doubt as to whether the (former) administrativenetwork supervisor would have allowed it. So, we walked back down thehall to the file sever console which was, as usual, running monitor.nlmbut not locked (always leave the file server console runningmonitor.nlm lock the console whenever the file server is leftunattended, especially if remote file server console access isenabled). With a few keystrokes I brought up the autoexec.ncf file (editing the autoexec.ncf file is one of the options on the monitor.nlmmenu) and, there and behold, was the statement

Set Unencrypted Passwords On

at the end of the file. And this is a statement that must be put intothe autoexec.ncf. It just does not get there by itself. To the best ofthe author's knowledge, the print box is still run as a PSERVER, but,on the other hand, the author is no longer asked to check the state ofthe administrative network.

The moral of the story is twofold. First, the specific lesson is thatpassword access can be compromised by turning encrypted passwords off.Second, the general lesson is that subtle influences and circumstancescan undermine the security of the network, which needs constantevaluation in order to determine possible weaknesses.

Bindery

NetWare 3.x stores all of its information about users, groups,printers, and such in a data structure called a bindery. Think of thebindery as a database. Calls can be made to the bindery (using theappropriate NetWare API, application programmers interface, or SDK,software development kit). NetWare 4.x uses a somewhat moresophisticated data structure called NDS, NetWare Directory Services,that is supposed to provide bindery emulation for those file serversand applications that require it. We will limit discussion to theNetWare 3.x bindery. Information such as file and directory rights arestored in the network file system. The bindery and file system worktogether to define user rights.

A fundamental assumption of security is that any potential adversaryhas access to all public and published information. In the case of anetwork file server, what exactly is public information. Well, in termsof a file server, public information consists of any accessibleinformation in the bindery and file system. File system rights arefairly well understood by most network supervisors (read, read-write,shareable, etc., rights for users and/or groups). Bindery informationis not as well understood by network supervisors and users in general.But there is a considerable amount of network information available tomost users from the bindery.

The author has written a program that uses NetWare API calls to dumpall user accessible information in the bindery to a tree data structurethat can be printed or used for future comparison. The author intendsto implement a tree merge routine to allow comparison of the bindery atvarious points in time (the current program allows the binderyinformation to be collected before the comparison program is done).This serves a number of purposes.

- The author can see exactly what is public knowledge (from an attacker point of view) and take appropriate action.
- The author can track changes in the network over time. Since the author has written a number of software programs that are used onthe network for classroom purposes, it is important to find outabout changes sooner rather than later.

The author wrote a similar type of program, in BLISS, in 1982 to trackwhat was happening on a DEC-10 used in a Research & Development Center.Within weeks, the author knew more about what was happening as far asusers and computer usage, than the computer staff who had been therefor years. The same thing happens on a NetWare network. Within weeks,one begins to have a better picture of the network than even thenetwork staff (the author is now teaching full time and no longerDirector of Academic Computing, so things can happen without theauthor's knowledge). For example, the author can say to the networkadministrator, "I happened to notice that EVERYONE now has access tothe MALTHUS (PostScript laser printer) when before, just BUSSCH (thebusiness school) had access." (it's sometimes best not to reveal yoursource of information; it just makes the network administratornervous). To make matters worse, some institutions have policies wherea record must be kept of the users, groups, etc., that are on thenetwork. And this record is usually kept manually. But this informationis already available from the bindery. And getting it from the binderyis much less error prone than maintaining it by hand (Snyder, 1994a).In essence, maintaining a series of snapshots of the bindery allows amuch better picture of what is happening. And, as mentioned before,this is critical in being able to react to subtle influences andcircumstances can undermine the security of the network.

Since the bindery is critical to the network, it is important to backup the bindery (the bindery files in NetWare 3.x are stored in theSYS:SYSTEM directory as net$obj.sys, net$prop.sys, and net$val.sys).This can be done as follows.

- Insure that there are no other users on the network.
- Login as SUPERVISOR.
- Disable login (from fconsole.exe or from the file server console).

- Run bindfix.exe, supplied with NetWare, as SUPERVISOR from a client workstation. While fixing the bindery, the bindery is alsocompacted. Note any error messages and take appropriate action.The old bindery files are stored as net$obj.old, net$prop.old, andnet$val.old.

- If there were no problems, run bindfix.exe again. This essentially makes the old bindery files the updated bindery files.

- Enable login.

- Copy the files net$obj.old, net$prop.old, and net$val.old to the client workstation so that they are not lost should the fileserver irrevocably crash.

At a later time, the command bindrest.exe, supplied with NetWare, canbe run as SUPERVISOR from a client workstation in order to restore thebindery.

And there is always the problem that a GUEST, or other user, can stuffthe bindery by creating large amounts of bindery entries such that theperformance of the file server is compromised.

Trade Secrets

It may, on occasion, be sufficiently secure to just keep certaininformation secret. In the case of the academic file server, theRegistrar had a program called transman (transcript management) thatwas used to manage transcripts. As a practical consideration, all userson the network had access to the same menu system. In a submenu, theRegistrar could run the transman program. Now, even though users neededsufficient rights to actually run the program, the appearance on themenu system might alarm certain administrative persons. A compromisewas to rename the menu option from transman to the less obvioustechnical manual. The few people in the Registrar using the program hadlittle trouble adapting and there was less cause for alarm. (Of course,funds for a more sophisticated menu system would have allowed theproblem to be solved in another manner).

Just remember, trade secrets do not work if the trade secret is publicknowledge. That is, if the knowledge is discernible from the bindery bya normal user (or GUEST), as would be the knowledge that the MALTHUSPostScript laser printer was available to EVERYONE. Yes, printer accesscan be a security problem, especially if confidential information issent to a network printer. Just imagine a printer that "spoofs" theprinter that prints paychecks (or other confidential correspondence) bypretending to be that printer (and no one notices the difference).

Login Script

When a user uses the login.exe (or other similar) program to login to afile server, the system login script, stored as the text fileSYS:PUBLIC/net$log.dat, is run. One purpose of the login script is toset up initial drive mappings, set default printer queues, etc., thatare specific to that network. Usually maintained by the networkadministrator, some network administrators depend on this login scriptfor some form of security, such as running certain programs at start-up(e.g., anti-virus software) or for auditing purposes. Of course, thiscan be misused. The current login script at the author's universityruns the anti-virus software if the user is STUDENT (intended for thehard drives in the lab). Naturally, the case of a STUDENT login to ateachers workstation and causing the virus software to run may havedisastrous side effects, not in finding viruses, but in possiblycorrupting the hard drive or crashing the workstation of the teacher.But a client can create their own login script as, for example, thetext file C:\my$log.dat and bypass the system login script with thefollowing command.

login.exe /S C:\my$log.dat HORNETS/RSNYDER

So, do not depend on the system login script for security purposes.

Another weakness (or feature) is that users can automate passwordentry. Why would someone want to automate password entry? To avoidtyping the password, of course. Automating password entry in NetWare isas easy as creating a file called C:\rsnyder.pwd that contains theplain text of the password and using the following command thatredirects the input from the file C:\rsnyder.pwd instead of from thekeyboard.

login.exe /S C:\my$log.dat HORNETS/RSNYDER < C:\rsnyder.pwd

The problem here is that anyone with physical access to the workstationhard drive can determine the network password for RSNYDER.

In terms of avoiding typing, the author is no exception. In the courseof network software development, it may be necessary to logout andlogin to the network many times during the course of a day. And, usingthe OS/2 Warp operating system with Microsoft Windows and DOS, it iseasy to open many (private) network sessions concurrently. One partialsolution to the automated password entry problem, and the one used bythe author, is to dynamically create the password file on a memorydrive the first time after the computer is turned on that the passwordis needed (this is done via a batch file). (Note: There goes my tradesecret since the scheme is now public knowledge). Thereafter, thepassword need not be typed to login to the network. But, when the powerto the workstation is turned off, the memory drive, and the passwordfile, disappear. For security purposes, however, physical access to theworkstation is restricted by always locking the office door wheneverthe workstation is left unattended and the workstation is powered downat the end of each working day.

The system login script can also be avoided by attaching, as opposed tologin, to the file server. Many network file servers maintain a GUESTaccount whose primary purpose is to allow users to attach to a networkfile server in order to user a given printer or other resource. TheGUEST account is created, with no password, when NetWare is installed.Some network supervisors may not even know of the existence of theGUEST account. One can attach to a file server with a GUEST accountwith the following command.

Attach Admin/guest

Again, no login script is executed, so that all drive mappings must bemade by the user. But a GUEST may have browsing rights to a substantialamount of information. In particular, GUEST can access the bindery as alogged in (or attached) object and can obtain a good deal ofinformation about the infrastructure of the file server (via binderyand other calls). The author can just imagine the chagrin of theadministrative network supervisor the night that the author's entirenetworking class attached to the administrative file server as GUESTand browsed through the information available to GUEST (note: twoemployee's of administrative computing were taking the course, so itwas for demonstrative, and not devious, purposes).

One might consider either removing the GUEST account, if it is notneeded, or, at least, restricting GUEST access to certain resources byremoving the GUEST account from the group EVERYONE (which conveys asubstantial amount of read access on the file server). But, the GUESTaccount issue does need to be addressed.

Loopholes

The security.exe program, provided with NetWare, can be used by theSUPERVISOR to attempt to find potential security loopholes such asinsecure passwords (that is, the user used the userid as a password),no passwords, supervisor equivalences, root directory privileges, nologin script, and excessive rights in a certain directory. Since theprogram generates a lot of output, a suggested way to run the programis from the (secure) SUPERVISOR client workstation as follows.

security.exe > C:\SECURITY\95-04-18.dat

This command redirects the output of the security.exe program to thefile called 95-04-18.dat in subdirectory C:\SECURITY. The date is usedfor the filename so that a record can be kept of the security messages.Note: This program generates a lot of output and spurious messages. Onemight want a program to filter the output of security.exe into a moremanageable form.

In the case of the administrative file server, running the security.exeprogram revealed that less than half of the about ninety user accountshad passwords (supposedly new user accounts were being created,manually, and had not been given passwords). Repeat. All user accountsshould have passwords assigned to them. Use automated (and tradesecret) means for the initial password generation and require the userto change the initial password).

Conclusions

This paper has attempted to use a series of specific examples toillustrate general security concepts. There has been so much that hasnot been covered, but the purpose of the paper is to highlight somepractical real world experiences in the area of information systems andcomputer security that can be addressed with low cost solutions.Hopefully this objective has, in some measure, been accomplished.

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Designing Effective PC-Based Multimedia Presentations

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Abstract

This tutorial/discussion will focus on the components of effective multimedia presentations. Each of the elements--tools, preparation, documentation, and delivery will be discussed. Differences between computer-based and computer-aided presentations will be highlighted. Effective selection and use of layout, color, sound, and graphics will be included. Other elements, including a discuss on of room layout, lighting, equipment, and backup, will be examined and recommendations made. The presentation will use examples of both good and bad techniques as described in the presentation to involve the audience in evaluation processes.

Preparation

The first step to designing any good presentation is, of course, clearly defining onefs objective. Once this has been articulated, building the content becomes focused. Additionally, understanding the audience, their background(s), and their expectations will enhance the probability of success for the presenter.

Building the presentation using multimedia resources requires a clarification of the specific role and a determination of the relationship between the presenter and the tools and techniques employed in the delivery. On a continuum from technology driven where the medium actually delivers, (e.g., showing a film), to technology aided where the presenter actually delivers and uses simple tools as aids, (e.g., overheads), this paper reflects the middle ground.

Differences between computer-based and computer-aided presentations relate to the interaction by the audience with the medium versus with the presenter. Computer- based design would primarily rely upon the medium to provide delivery of the intended message. Computer-based training is probably the consummate example of dependence upon the media for delivery. In such case, the presenter is the media. Moving toward a more traditional delivery method implies a human being as the key variable in the delivery and the use of computer-based tools to enhance the message. The key focus of this paper will be the interactive use of computer-based multimedia on a microcomputer with a purposeful balance between the presenterfs role and that of the media.

One of the most advantageous benefits of developing computer-based presentations is the ability to change any element or item in the show at any time, even minutes before it is given to the audience. This flexibility allows reuse of effective slides and information with minimal cost and rework. Laptops and portable projectors can be effective tools for local or remote sites. Run-time versions of software are generally available with most packages. These allow for transporting only a floppy containing the presentation (and backup disk, of course) that runs on any compatible machine without having to have the specific software installed. However, the disadvantage of this is that without the software one cannot make changes to the slides.

Tools

Available tools include primarily hardware, software, and projection systems. No attempt will be made in this paper to describe all such items that change rapidly and can be used in multiple combinations. However, specific guidelines will help the presenter achieve success regardless of the selected tools. If given the option to select the combination of tools, practicing with them is the only sure-fire way to be sure that the presenter and the tools will be a comfortable and effective team.

If there existed a cardinal rule for microcomputer-based media use, it would be that the user/developer should be seen as an expert in its use by the audience. This includes the PC, MAC, laptop, or whatever size and type of hardware used, as well as the software and projection systems IN COMBINATION. To facilitate this, the presenter should be the one to develop the presentation rather than assign it to assistants or others. The flexibility of tools as well as the individual idiosyncrasies of specific combinations of these three elements must be thoroughly tested before one can be assured of successful interactions. Many presentations have been artfully developed separately and when attached to the projection device, suddenly the colors are different, text is obliterated, and icons or screen sections disappear. Being able to rectify problems with as much poise as one would use to pick up a dropped item from the floor, confirms for the audience that the presenter is in control and has something to offer.

When one has the option to select a presentation software, there are many excellent packages commercially available. Each possesses specific attributes and characteristics for different types of presentation needs. For example, some have excellent linking capabilities for moving around and through the presentation and rearranging the order 'on-the-fly," while others have to be restarted from the beginning. Some have excellent development tools with automatic charting and graphing capabilities, for example, but may have limited text formatting features.

Generally, packages which are the least difficult to learn, have the most restrictions in design options. For example, there may be restrictions limiting background color or design for the entire presentation. An excellent way to discern the value of a specific presentation software design tool, is to read recent reviews available in the computer trade periodicals or in Presentations, a periodical by Lakewood Publications, that provides specific guidance for these choices. Then, before purchasing, test the software with the hardware (both computer and projection device). Occasionally, incompatibilities will arise. This is less likely to happen if your equipment is top-of-the- line and current--as those in education can usually only dream about!

Many new projection devices are equipped with memory functions and will allow for a presentation to be delivered directly from a floppy with no attached laptop or other computing device. Unfortunately, few schools have these newer, more expensive devices available, although they are often seen in the corporate arena. Good reviews are available as mentioned above, as well as in T.H.E. Journal.

Knowing how to efficiently and effectively interact with the tools is often prime evidence of the presenterís credibility for an unfamiliar audience. The medium should only enhance the presentation, not be the message itself or impede delivery of it in any way. If faced with using ìwhat is available," the cardinal rule is to know the equipment and be the master of it by practicing, practicing, practicing.

Development

Preparation. Creating an effective presentation generally requires some general storyboarding of the show to be developed. A storyboard contains a simple sketch of each slide and the accompanying text along with notes for development. This is similar to an outline for the traditional speech except that it contains intended graphics, sound clip notes, video sources, and intended animation features. Each of these elements should be used sparingly to enhance, not disrupt, the intended message and fluid delivery. The storyboard does not have to be sophisticated, but complete enough to facilitate rapid development of the presentation. Linkages and loops among single slides or groups of slides should be noted at this time. Most software packages have a modified form of storyboarding in outline form. If one builds the outline first, then slides can be automatically generated from that text.

Documentation. Documentation such as outlines or notes can usually be created as the computer-based slides are built. Some software packages default to the development of a script or outline which is then automatically translated into slides. Supporting documents such as handouts of slides for distribution can usually be easily generated by the software. It is a good idea to give the audience something to take with them if no relevant documentation is otherwise provided. For example, a condensed copy of slides or a one- or two-page outline of your delivered text complete with title, name, and brief credentials is usually appropriate. Keep in mind when preparing handouts and speaker notes that they should contain much more information than that shown on the slides. Slides should only enhance and emphasize the key points of the presentation, aid in keeping the audienceís interest and focus, and facilitate understanding and retention. Keep them simple.

Text. Nearly all slides will need a title. Text should be limited to no more than five lines per slide and no more than five to seven words per line. A simple, easy to read font is best, and use only one style per slide. Continuity of type style between slides enhances presentation continuity and increases readability. Use at least 24 point or greater font size and keep contrast between the text and background at the maximum. Reverse fields and text boxes should be used only occasionally for specific emphasis. Spell checkers are usually a program feature and keep the presenter from overlooking errors in textual information and headings.

Color. Colorís main purpose in a presentation is to invoke or encourage emotion in the audience that will enhance comprehension of the intended message. Color selection should be prudent and limiting variations will enhance continuity in the delivery of the presentation. It can be used to enhance three-dimensional effects on slides. Color and color variations can also be used to group objects or define relationships between objects. Similar colors and/or similar hues will cause the viewer to perceive these elements as a group on the slide. With computer-based presentations, in particular, contrast between hues is of vital concern. The greater the differentiation, the greater the visual impact. Maximum contrast between text and background is imperative for readability. Text is the most familiar visual image to an audience, but the most difficult to comprehend in a projected image.

Graphics. The use of graphics, sound, video, and animation should also be used sparingly and only as a means of enhancing communication for a specific purpose. For example, a building ìflyingî across the screen will stir a very different connotation for the audience than a bird ìflyingî across that same screen. Depending upon the purpose, again, either graphic animation may be effective and have appropriate impact. However, there are some general guidelines for each that will help in determining how to use them.

When using these elements, one usually finds the limitations of the software will limit embedding too many different items on a single slide. (This may be because of the massive memory and processing required and the programmerís penchant for efficiency, or perhaps it is just their way of protecting us from ourselves.) There is a tendency for newcomers to the multimedia arena to want to use every feature in each slide because it is so much fun and relatively easy.

The general rule is to use only one clip per slide and only one per group of eight to ten slides. Select elements carefully depending upon purpose, audience, and facilities. For example, if presenting in a small classroom with a laptop, there will usually be no speaker capabilities unless added externally. What may have sounded great when it was developed on the office machine with attached speakers will suddenly be mute. A great animation that zipped across the screen on the fast desktop lumbers erratically due to the slower clock speed of the presentation computer.

Graphics include charts, graphs, drawings, clip art, or scanned images. They help increase effectiveness by defining relationships between data, providing emphasis or focus, and enhancing retention of the audience. For example, most software packages limit the background template to the same form and color for an entire presentation. This increases continuity, diminishes confusion, and speeds up the process of development.

Graphics tend to be static elements which can usually be sized, rotated, flipped, or animated, if appropriate. Most software packages allow for grouping and ungrouping, coloring, and reshaping of objects. The objects should be carefully selected for simplicity and clarity in conveying or enhancing the intended message including appropriate use of color. Most software packages include multiple examples of these and many independent providers have made numerous selections available. Specialty topics can generally be found on subjects ranging from holidays to sports and religion. The World Wide Web services on the Internet are also a valuable resource for graphics files that can be downloaded and sometimes appropriately formatted for inclusion in a slide.

Charts and graphs can be used effectively to quickly show relationships and trends. Pie charts, for example, are excellent for expressing proportion. Good formatting of charts allows for multiple views of complex data in a simplistic format. Bad charting, can destroy credibility as well as presentation effectiveness. The advantage of charts and graphs using computer-based means is the editability of all components from the data itself to the formatting structure. Pictures can also be used to enhance understanding as either data elements themselves or additions to the graphs such as arrows pointing to significant data.

Sound and video. Sound clips and video clips are readily available as part of most presentation software packages. These are copyrighted, however, and may not be included in any commercial applications.

Currently on the market are several relatively inexpensive, non-copyrighted sound and video clips. There is also the option of creating onefs own clips using camcorders and using a special sound card for converting those into digital format. This is a very time-consuming set of tasks, however, and one should weigh the development time investment against the benefits of a five- or ten-second clip, for example. There are also many media items available via the Internet for downloading.

Video clips generally project better when sized to approximately a two to three inch insertion box on the slide. Larger images can often appear ìjerkyî or grainy when projected. Keeping them small enhances their presentation quality, but diminishes the perception of the fine detail for the audience. Therefore, care must be taken to select video images which give the message clearly at this level. For example, if one wanted the audience to see a facial expression from a clip of a head shot, it may be difficult to pick up. Enlarging the shot to pick up this nuance will diminish the clarity of the visual image and fluidity of the motion. What looks appropriate three feet from the computer screen may not be acceptable at a distance of thirty feet from a projection screen.

Animation. Animation generally involves the movement of a static object from one location to another and, perhaps, resizing it. Often, software packages include some limited animation for bringing in bullets for listings or moving text from multiple directions onto a screen. Simple animation allows the builder to take a clip image of a truck or airplane, for example, and make it move across the screen. Usually it is in only one direction and at only one speed. Sometimes, the size can be changed in the process. More sophisticated software allows for morphing images (changing one image into a completely different one such that it appears the second one ìevolvedî from the previous). This should be used very sparingly and only as appropriate. Very expensive and sophisticated resources allow for animating any screen item and rolling them onto and off the screen in multiple patterns. These are generally not used except in commercial applications.

Delivery

Presentation staging is often limited by existing facilities. One of the key problems with computer-based presentation delivery, particularly in large rooms, is the need to reduce the room lighting to the level of moonlight. This diminishes the status of the presenter and limits interaction with the audience. The focus then falls upon the medium and can often negate the impact of the spoken word. Obviously, the key is to get the most light on the speaker and the least light on the screen where the projection resides, which is often a difficult if not impossible task. Using light backgrounds on slides gives more room light and better reflection for the speaker. Dark backgrounds may have strong impact visually, but tend to draw the eye to very limited areas of the screen and make visual continuity between the speaker and the screen difficult. Apart from packing around portable spotlights, this problem is often the least reconcilable.

Effective staging allows for the projection screen to be above the head level of the audience and extend at an angle equal to the angle of the projection source. This prevents skewed images that appear to expand as they rise higher on the screen. Positioning is dependent upon room size, distance from the projection device, as is size, elevation, and tilt of the screen. Since the eye tends to move from left to right in accessing information, the speaker should try to stand to the left of the screen from the audiencefs perspective. This gives the presenter the command position relative to the media.

One constant which can be depended upon when setting up for a presentation is that something will not work properly. It is imperative that set-up take place as early as possible before the presentationís scheduled start time. If taking place at a facility which furnishes experts to assist, their expertise will definitely vary and they may not be familiar with an individualís own equipment. If preparing for delivery in a classroom or other school facility, often limited areas are available for placement of equipment or electrical supply inadequate. (Always have a power strip with at least 15 feet of cord and, if traveling, 50-foot or greater extension cord.)

Some rules of thumb can help the multimedia presenter decide upon the probability of effective delivery. If using text on the screen, use the eight-to-one rule. This rule relates the height of the projected screen to its distance from the audience. Using 24- point text on a five foot screen would mean that the last audience row should be no more than forty feet from the image.

In addition, it generally works best to load the presentation on the hard drive of the computer rather than run it from the floppy. The file loading with be much quicker and, therefore, the presentation will run more efficiently. Avoid using laser pointers as they are almost impossible to hold steady and result in a ìtremblingî effect on the projected image. Drawing pens which can be picked up from a screen image by the mouse are also minimally effective as lines will generally not be smooth nor look professional. Remote devices for advancing slides and moving the mouse are especially helpful and effective and give the presenter freedom to move away from the computer source.

Backup

Presentations can be saved to the hard drive of a laptop and should be backed up to a floppy. If transporting the presentation only as a file to be used on someone elseís equipment, then files should be backed up on separate floppies. Do not carry the two copies in the same folder or carrying bag.

Given the high probability that something will go wrong with the technology, backup is absolutely necessary. If alternative equipment is available, however, time would be needed to become familiar with the differences which will undoubtedly appear. A practice run-through or two will verify the compatibility of the show and the equipment. Otherwise, it is prudent to carry foils or transparencies of the slides. Since these will not contain sound, animation, or motion video, and sometimes limited color, more drama and animation may be necessary in the oral delivery. This is, however, heavily dependent upon the purpose of the presentation.

Summary

This paper has described some of the basic elements of computer-based multimedia design and development. Tools and design criteria vary significantly depending upon purpose and equipment used. These guidelines are not intended to be product specific, but generally applicable for those building and using computer-based multimedia. It is the result of six years of building media-based presentations and teaching students to use the media. The general guidelines presented in this paper are intended to give the novice user an introduction to planning for, developing, and working with computer-based multimedia presentations. The conference presentation includes examples of these guidelines.

Mosaic as a Vehicle for Collaborative Learning

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Last fall Gettysburg College launched an exciting newprogram with first year students which centered on NCSA Mosaic as a vehiclefor collaborative learning.[1] The pilot project involved a selectnumber of incoming freshmen who lived together in the then-experimentalresidential college program. The project had several goals in mind fromthe start: mastery of basic library and computer skills, a familiaritywith internet resources, a focus on technology, and an integration of thistechnology into the classroom and the residence hall experience. One ofthe pleasant discoveries was that using Mosaic as a technologicalcenterpiece provided a marvelous opportunity for group work, collaborativelearning and active learning. This paper will outline our initiative anddescribe the final project, an electronic "research paper" on the web,developed by class members, which linked their own personal research andwriting with others in the group.

To put the project in context, Gettysburg College is a private,residential liberal arts college of 2,000 students located in rural, southcentral Pennsylvania. The College has a long history of supporting the useof computing and technology in the curriculum, beginning with the arrivalin 1968 of an IBM 1130 computer that was used exclusively for academicpurposes. The College now supports a multi-platform network.Campus networking was begun in 1991 and is 99% complete.

IBM (and compatibles) and Macintosh computers are equallyrepresented on campus, along with some NeXT and Sun workstations. Allfaculty and administrative offices and nearly all student rooms havenetwork connections. The College currently operates in a highlyclient-server environment and has developed local gopher, www, news andlistserv servers, all of which are heavily used. While the Collegesupports a number of public labs, students increasingly are coming tocampus with their own personal computers.

In 1994 the computer center and library joined to form a newInformation Resources Division (IR) under the direction of the former headof computing. As you might imagine, the merging of two distinct units,not to mention cultures, has not been without its stresses. The Mosaicproject represented collaborative work on many fronts; it was one of thefirst initiatives of the new division. The project drew upon the expertiseof librarians and computer professionals, working in conjunction with thefaculty and staff of Student Life. It was a learning experience foreveryone involved, and was an important early step in framing the servicemission of the new division.

At the same time the Office of Student life was launching aprogram called residential college where a select number of freshmen wouldlive together and take a class in common. In the fall of 1994, freshmenwere offered the opportunity to choose an academic course that was organizedwith a residential component. The students in each academic section had aroommate from the same class and lived near each other in the residencehall. The dormitory was Hanson Hall and the Mosaic project was oftenreferred to as the "Hanson Hall Project."

The residential college courses were seminars of sixteen students.Because of the small size, classes could be taught in the dorm, andoffered participants the opportunity to converse and develop ideas in amore informal setting. Hanson Hall was networked and the seminar/studyrooms were outfitted with several work stations.

The aim of residential college was to increase studentparticipation in the intellectual and cultural life of the College byproviding a challenging first year experience and fostering class identity.Collaboration had been a goal from the outset. Descriptive informationissued on the program stressed the promotion of formal and informalinteraction of students and faculty in supportive and educational ways.Special programming opportunities included a film series, guest speakers,field trips and weekly house dinners. Collaboration with the InformationResources division for library/electronic media workshops was a naturaloutgrowth of the program's mission.

The centerpiece of this paper is the work done in conjunction withone of these seminars, a course called Colloquy 100: Angles of Vision.The students enrolled in this interdisciplinary course were taught by Dr.Ann Fender, a senior member of the economics faculty who enjoyed delvingoutside her discipline and teaching a more humanities-based courseoccasionally. Angles of Vision explored questions of tyranny, violence,moral blindness, suffering and artistic creativity. Readings ranged fromDarwin's classic, On the Origin of the Species and Alex Kotlowitz'sgritty, urban tale There Are No Children Here to works of fictionincluding A Handmaids Tale and Frankenstein. Through text,film and lecture the students looked at the struggle to overcome poverty,prejudice, hate and examined the forces of nature that give shape toindividual destiny. The freshmen were asked to examine their convictionsand see how viewing life from different angles might transform theirunderstanding of self and society. So how does one get from human sufferingand moral blindness to the world wide web?

All freshmen were required to attend a session early in thesemester which introduced them to the campus network and electronic mail.Students in Hansen Hall were expected to attend two additional sessionsdealing with technology. The idea was to go into greater detail on how tosearch the internet and to teach them the basics of html mark-up languageso they could create their own personal, electronic portfolio. Theadditional sessions were offered at night, in large group setting in thetraining lab and turned out to be one of the less successful elements ofthe project.

Eight freshman residential classes,were chosen to take part in thepilot. Each instructor was paired with one Information Resourcesprofessional to develop a technological component or assignment. The IRstaff was free to take the project in any direction, although it was agreedupon that Mosaic would be the unifying technological piece of the puzzle.

For the unfamiliar, the World Wide Web (WWW) and its most popularbrowsers, Netscape and Mosaic, provide a way for users connected to anetwork to view work posted by others on the Internet. Material mightinclude text, graphics, sound, and/or movies. It allows users to "publish"their own material for distribution across both local and wide areanetworks. An author, for example, can publish a paper on a topic of choiceby storing it on a web server and making others aware of its accessaddress, known as a Universal Resource Locator or URL. The other usefulfeature of the web is that authors can link to each other's work by makingcertain words or phrases point to the appropriate URLs. These are know ashot spots. This technology seemed to fit well with Gettysburg'scampus-wide network and opened up new avenues to incorporate technology inthe classroom.

I was paired with Ann Fender's class. We developed the project"backwards"--brainstorming about what we wanted the final project to looklike and then working our way back to the beginning, defining the steps andcompetencies necessary to get there. The importance of the workingrelationship between the faculty member and IR staff member should not beunderestimated. Without a doubt it was the critical link in the projectssuccess or failure. When faculty were enthusiastic and eager to explorethe technological possibilities with their students the initiative was atits best. When faculty were luke-warm, technology-shy or unwilling toparticipate fully themselves the effort failed. Projects without strongfaculty commitment or without ongoing collaboration in both the projectplanning and implementation stage were not successful.

I was lucky to work with a member of the faculty who embraced thepossibilities and was anxious to learn all that she could. She knew whatresources she wanted her class to explore on the net. the InformationResources staff provided the structure, training and technical expertise toput it altogether. In our conversations, we developed a list of whatskills we wanted the students to master and what competencies we hoped theymight achieve. They included:

1. The ability to "surf the net", find databases, lists, discussiongroups and other information that was germane to the class theme.
2. The regular use of electronic-mail as an important means ofcommunication.
3. The use of technology as a way, not only to communicate aboutassignments, but to submit papers, comment on readings and critique worksof others.
4. The experience of working in a group collaboratively and developinga theme for group exploration.
5. The technical expertise to create a text document in Mosaic.
6. The technical expertise to create a link to an external database.
7. The ability to link to each other's work.
8. The technical expertise to scan an image and incorporate graphicsinto a mosaic document.
9. The development of good library-based and electronic-based researchskills.
10. Good writing

The students were assigned to working-groups of four. Theirassignment: choose a theme from the course and develop it with commentaryon relevant readings, great "finds" on the net, graphics, sound andpersonal reflection. Each member of the group was to contribute to theoverall project but develop some aspect of the theme on their own. Groupmembers were urged to establish links to each other's work, much like onewould footnote relevant sources in a research paper.

The course home page would include a course description, syllabus,home pages of class members, a group projects section and a reference guide(Illustration1). The latter consisted of a descriptive guide of referencematerials both electronic and print sources, in some cases with a link tothe source itself. Professor Fender entered her biographical sketch alongwith information on personal and professional interests under the sectionentitled Class Members Home Pages and encouraged the class to do the same.She used her biographical sketch to demonstrate how one might create alink, making a hot spot for Canada in her text which led to the electronicversion of the Encyclopaedia Britannica.

The students' first assignment was to "surf" the internet formaterials related to the course. The difficulty arose when it came time tocreate a document and establish links. Despite the extra tutorialsessions, the students were uncertain about the mechanics of creating adocument and generally unclear about the purpose of Mosaic. We met withgreat resistance. As a result, it seemed prudent to attempt a differenttraining strategy. This time we did so by offering instruction in smallgroups where active-learning really could take place.[2]

Why were the large group sessions on Mosaic ineffective? Part ofit was timing (mid semester). Part of it was the hour (evening). Thelecture format and large group size (30) also contributed to the poorresults. The training sessions were not project specific. Students fromall eight residential college classes were mixed together. In many casesthe faculty had not yet given them an assignment which accounted for thelack of perceived relevancy. The connections during the demonstration partof the training often failed and there was little time for actual"hands-on" practice despite the fact that each student had their own workstation.

By changing our teaching approach to a small, hands-on,active-learning environment we were able to succeed in our efforts to meetthe initial goals. We changed the time to late afternoon, schedulingsessions at 4:00 and 5:00. We kept the sessions short (30 minutes) andlimited the number topics we'd try to cover at one sitting. Practicalexercises included practice at creating a document, naming a file, moving afile, using the editor program and searching the internet. We could showthem where their files actually resided on the College's network and howtheir work related to other's in the class. Students learned how to linkone of their internet "finds" to their homepage while sitting withthe instructor. We worked in groups of two or three in the instructor'soffice and offered a tri-fold with the basic html commands to carry away.

Of the sixteen students in Colloquy 100, half came in for one ormore small group sessions. They, in turn, went back to Hansen Hall andworked with their classmates. At least one person in each project groupdeveloped the expertise to become the teachers themselves.

At the beginning we envisioned four large projects to whicheveryone would contribute. A drawback was that students would have toshare usernames and passwords--something we wanted to avoid--or would haveto designate one person as the official "enterer of text." We also wantedto avoid that scenario since the emphasis was to be on equal participationin a collaborative effort. This is where Mosaic proved to be the perfectvehicle.

Consulting with one another, the students arrived on a theme[3], divided it into subtopics and decided on how to present it(Illustration 2). They wrote separately but could easily view each other'swork in progress. They began to reference each other's work. For example,a student looking at nonconformism in literature made a link to aclassmate's paper on nonconformist artists. The cross referencing alsooccurred outside the group. A student in the Minorities group wrote apaper on crime and urban poverty and linked to a classmate's project fromthe "Different Lenses" group, whose study was on children growing upin impoverished circumstances. The class went off in many originaldirections but with Mosaic software, joined themselves together as a unit.

Access to electronic mail allowed for easy dialog. I could lookat their works-in-progress, test their links and troubleshoot difficulties.When something didn't work, I sent them e-mail. While my role wasprimarily technical consultant, I occasionally made a comment or twoconcerning content, for instance when a student wrote a lengthy piece onNelson Mandela and labelled it "Famous African Americans. "

The following project descriptions are particularly illustrativeof the many possibilities that Mosaic offers for innovative classprojects. Brad Wedermeyer explored values through the lens of a scientist.He used the film "Day After Trinity": the story of the making of theatom bomb, and the novel Frankenstein as the primary anchors for hisproject development. In addition to his writing he provided links to adatabase on the effects of radiation, the home page of the NuclearRegulatory Commission, the full text of Frankenstein and reviews ofthe novel. He also made creative use of graphics including this example ofa scanned image of a fallout shelter. His project ended with referencesand links to other members of the Different Lenses Group.

Alison Byrnes from the Nonconformism group centered her paper onNative Americans after reading Lame Dear, Seeker of Visions. Shesought out materials related to the native American experience as evidencedin her links to documents as varied as the Iroquois Constitution and adatabase of Native American crafts. One of the most interesting aspects ofher project was the work she did manipulating a scanned image. Sheincluded an image of her family tree, showing her descent from Cherokee andChoctaw Indians and was able to make a faded, hard-to-read, old typed copyof her family tree appear like a well-preserved family document.

Other students experimented with sound. Nicole Hunt wrote a paperon Maya Angelou, examining specifically her autobiographical work, IKnow Why the Caged Bird Sings. She was able to locate the text of many ofAngelou's poems on the net, including "On the Pulse of the Morning" acomposition read at the Clinton Inaugural in 1993. She also incorporatedsound into her project by establishing a link to a voice databank whichincluded Maya Angelou reading aloud.

In a paper on homosexuality and discrimination Chris Killamestablished links to government documents, sources on AIDS and HIV, pollsdealing with homosexuality and news stories on homophobia. Chris found thetechnology daunting at the beginning but attended the small group sessionsand became so proficient that he earned the nickname "Doc" from hisclassmates and regularly held his own "clinic" in Hanson Hall to help theothers.

A final project worth showing was created by Kalyani Fernando, whostudied artists as nonconformists. She chose several artists and genresand began searching art museums all over the world. She impressed ourtrustees during a public presentation of the Hanson Hall Project, bybringing down a full color, larger than life size image of Edvard Munch's"The Scream," demonstrating the power of Mosaic to deliver image as wellas text effectively.

Beyond the projects themselves there were other success stories.One student had been feeling particularly alienated resisted doing anythingthat involved a computer, insisting that she was an "artiste", not a"computer nerd". We encouraged her to become the projectphotographer and she is responsible for most of the graphic images in theHanson Hall Project. She learned to use the scanner, crop pictures, createa gif file and translate her photography into Mosaic illustrations. Shenow works for us in Information Resources as one of our resident computernerds! Four other students from Colloquy 100 were hired by ResidentialLife to serve as Mosaic tutors for courses taught in the spring of 1995.

Those were a few of the personal outcomes. The Hanson Hall Projectalso has served as a useful planning device in the areas of budget,training, design and user education. Support is a very big issue--both interms of personnel and finances. An initiative such as this is costly interms of training time. While small group training may be superior tolarge instruction sessions, small groups are also more costly and laborintensive.

The solution was to move some of the training to the leastexpensive form of labor--student assistants--and establish drop-in htmlclinics in the library. Students working on Mosaic projects could dropin, unscheduled, for help on any aspect of their project. This eliminatedthe burden on staff for very specific training and freed up InformationResources personnel to work with faculty to develop the conceptual side ofmosaic projects. The drop-in clinics have been enormously successful. Insome cases the student tutors became so familiar with particular classprojects that they were able to make usefuldesign and graphicrecommendations to the staff overseeing the project.

Other costs occur in equipment. We needed a second scanner. Wehad to make sure that our lab computers were upgraded to handle the newestversion of Mosaic, and later Netscape. The computers had to have thecapacity to handle the sound, text and images that students wereattempting to capture into their mosaic documents. We discovered agrowing gap between what computer facilities accessible to students and theCPUs sitting on faculty desktops. Word about Mosaic travelled fast. Thefaculty, excited about the possibilities of this new technology, did nothave adequate computers to search the internet efficiently, let aloneembark on course related development with Mosaic. The need to replacefaculty machines (and hardware in general) on a regular basis suddenly hadmuch more immediacy when cast in the framework of what people could not dowith their existing CPU. When it comes to equipment (or lack thereof) itis easy for a successful initiative to turn into a nightmare.

In fall 1995, we will conduct more training in the dormitories.Rooms have been set aside for Mosaic tutors and several students have beenhired to provide that service to the next crop of residential collegefreshmen. We've also addressed the need to enable the faculty to a largerextent so that they are doing more of the architecture and design workthemselves. This will mean more training for faculty. To this end, ourTraining Team is offering a web class this summer for interested faculty.

We've looked at group training with a different lens. While smallgroup sessions are more effective they are often not practical. A group ofInformation Resources has begun discussions about dividing fall training offreshmen into more manageable thematic units, particularly where theteaching of the internet is concerned. The Hanson Hall Project not onlyhas challenged us to look at new ways of doing old things, it has alsounearthed new, thorny, unresolved problems. Copyright compliance is anexample. Does the incorporation of sound and graphics, the scanning ofpictures from magazines and books constitute fair use and require simply afootnote indicating the source? Or does the electronic incorporation ofthe works of others constitute a copyright violation unless permission issought and obtained? How do you footnote electronic information? Who willmcnitor this process?

In terms of infrastructure, how much Mosaic development can oursystem handle? Can our budgets accommodate the demand for training andequipment to support this technology? If the answer is no, how do we dealresponsibly with limited resources but not discourage creative andintellectual development of this excellent teaching tool? Those questionsdo not have answers but they are part of our ongoing dialog, as we continueto explore ways to encourage collaborative learning in a changingtechnological environment.

[1] Collaborative learning is the notion that students becomeaccountable for their individual effort as well as a group product. Socialskills and peer coaching are important outcomes of collaborative learningstrategies. For an excellent account of collaborative learning in theinformation technology environment see Marjorie Warmkessel and FrancesCarothers, "Collaborative Learning and Bibliographic Instruction,"Journal of Academic Librarianship, 19 (March 1993):4-7.

[2] See Paula N. Warnken and Victoria L. Young, "Application ofTraining Principles and Techniques for Successful Library Instruction,"Reference Services Review (Winter 1991):93-4 for a discussion of theimportance of maintaining student's active involvement in the learningprocess as a learning and motivational technique.

[3] The themes included Nonconformism, Minority Groups, IndividualDestiny and developing Different Lenses to view life experience.

Distance and Distance Research
The Need for Internet Proficiency in the Shadow of Shrinking Resources.

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Introduction

I teach public speaking and theatre courses at a small New England university located in Downeast Maine. We have an enrollment that hovers at about a thousand. When my students are charged with research, they face an immediate challenge: the lack of accessible resources. Funding cuts have limited the size of our library holdings and reduced the amount of updated material. Time and time again, my students are forced to change their research topics because either the information was not available or it was hopelessly out of date. Although we are linked to the rest of the state via an on-line holding catalog, a book can take from five to twenty days to arrive.

Many students and faculty have found their own solutions. One is to travel to the main campus in Orono, a journey which will easily eat up an entire day. A second is to forage local and private libraries for more reliable information. The final option is to use our computer network to voyage electronically to campuses and libraries throughout the world via the Internet. Our local computer network is gradually acquiring the ability to send electronic mail, read news groups, and use Gopher, Telnet, FTP, and the World Wide Web. Both our Macintosh and DOS computers are being upgraded in hardware and software to surf the net with ease.

But having that ability and using it are two quite different things. Only ten percent of our faculty are comfortable with Internet travel, and I fear the number of students is at the same level. Computer usage tends to be relegated to the old troika of word processing, spreadsheets, and data processing. The problem could thus be posed in this way: although we lack immediate resources, we have them available at a distance. Although the tools are available, we aren't using them. The challenge for the computer administrator, and indeed, for everyone who needs information, is making these tools easily available for everyone.

Our goal must be to make Internet acquisition of information, whether it be text, sound, pictures, or movies, both easy for the novice and worthwhile for the adept. That last qualification comes from seeing systems such as Gopher servers that offer a relatively small menu of selections. Such systems are user-friendly, but a user comes up against their limitations rather quickly. A higher level of user ability needs to be easily available.

The University Library and Research

As a graduate student at the University of Maryland and then at Ohio State, I took their large libraries for granted. I had two or three research papers due each semester, papers that required extensive

- surveys of the available literature. In both libraries, each with holdings best expressed in the millions, I could start my work with either generalized or specific bibliographies, take citations and then start tracking down the originals. Other papers and articles would yield still more sources and I would track them down. I was amazed when I found just how many obscure sources were languishing in a musty corner of the Ohio State stacks. Let me give you an example.

Several years ago, I was studying changes in Bertolt Brecht's *Galileo*. This play has been through two major revisions, both carefully documented by the playwright. The biographies and articles I could find pointed to an excellent source which traced Brecht's creative process in both words and pictures, something Brecht called a model book. I knew it wasn't in the theatre stacks, because I had come to know those intimately. However, once I knew it existed, I was able to track it down in the German-language oversized section.

This was not a matter of calling for an inter-library loan or traveling out of state or even leaving campus. Once I knew the bibliographic details, I was able to find the text easily. Such ease of use is vital to scholars. It is to be expected on a large campus. It is difficult to attain on a smaller one.

Consider such a research project at the University of Maine at Machias. First of all, our campus holdings on Brecht consist of three general books and an LP. A search of the system collections shows many critical commentaries but no model book for Brecht's *Galileo*. The student immersed in this project would either have to travel, work on interstate library loans, console himself or herself with secondary sources, or change the project.

Research at the Smaller School

Let's come forward a few years. I teach theatre and public speaking courses at the University of Maine at Machias, a small campus with just under a thousand students. Merrill Library holds about 66,000 volumes. This isn't bad for a school our size. We certainly aren't at the top of the list, but we aren't at the bottom either, especially considering the enrollment.

My students must give five speeches that require research. They are short speeches, from three to seven minutes long, but the students have to find reputable sources, accurate statistics and current information to support their statements. In other words, if someone is going to give a speech advocating a reduction in Maine's fishing fleet, he or she had better have solid and convincing data to corroborate everything. A personal anecdote is interesting and often convincing, but a good speech deals in facts that back up opinions.

My students often feel forced to change their topics due to a lack of library resources. The cry I hear all too often is: "the library just doesn't have anything on my topic." What is even worse is hearing: "I found a book, but it's fifty years old." "I found some great articles in *The Reader's Guide* but we don't have that periodical." Their frustration is palpable.

Sometimes they make a pilgrimage to Orono, home of the University of Maine, the flagship campus of the Maine system. It has 11,000 students, and the main library houses 646,000 volumes. For the really dedicated student, this is usually a suitable solution. It is a two hour trip from Machias to Orono, at least if you stay close to the speed limits. Four hours for travel, several hours research and at least an hour for lunch take up an entire day. One should take into consideration that the student who is motivated enough to make this journey is taking several other challenging courses, is usually busy with extra-curricular activities and, more and more, is also looking after a home and family. These trips tend, therefore, to be few and far between. If a student can change a research topic to something available locally, she or he often does. The quality of research suffers and the student does not really have exposure to the true research experience.

The libraries of the University of Maine System are linked electronically in the URSUS system. Thus if you are looking for a book, you are not limited to where you are located. URSUS will match search parameters and give the locations of books, telling a researcher what is available and where. You can order the texts you want from your terminal, and, depending on a number of interesting circumstances, you will receive it one to four weeks later. URSUS also offers ERIC, CARL, and the expanded Academic Index for periodical searches. Journal loans must be processed by hand and can take several weeks or, in some cases, arrive via fax.

As well as this system works, I would like to address this question to other educators: How many of your students actually know their topics so far in advance that they can do preliminary research with a one-month lag time? Let's look at the research process: how many times have you been able to proceed clearly and evenly from first preliminaries to final research? How many times have you needed to recheck that quote, confirm the statistics or see exactly what the author said just before you started taking notes? Human nature works best with a flexible and forgiving system, one that can work well with last minute and emergency demands. A large university library gives us that kind of research support. Smaller facilities just aren't up to the task.

Utilizing the Internet: Just the FAQs, man.

So, what sort of alternatives can be found on today's campuses? What can the researcher do if the library is just too small or lacks the needed resources? This is where the Internet comes into play. Gophers, FTP programs, and World Wide Web readers give us access to information around the world. Search engines simplify the researcher's trek through cyberspace, but a little bit of knowledge can take you quite far.

Last year, one of my students came to my office. She had been very excited over her speech topic, a short historical look at her sorority. Unfortunately, her sisters could not help her out: they had no local resources. The library had no information on the subject. The national office of the sorority was not responding. She had resigned herself to changing her topic, which was to be the topic of our discussion. I asked her if she had tried the Internet. She hadn't. Within a few minutes we had located the *alt.fraternities.and.sororities* FAQ listing. It contained the information she needed to get a good start on her research.

Another example has more of a bearing on serious, long-term research. One of our students is pursuing a master's degree in molecular spectroscopy. I freely admit that I have no idea what this is. I do, however, know my way around the Net, so when she had exhausted the local resources, she came to me. We found *sci.techniques.spectroscopy* as well as the Society of Applied Spectroscopy's Home Page. She has established correspondences with researchers in this field throughout the world and her work continues with renewed vigor. I still have no idea what she's working on.

Potholes on the Infobaun

These are the sort of success stories that technology enthusiasts love to spread. They are unfortunately the kind of tales that lead to wild hyperbole and, for some, frustration. A novice who expects quick and easy answers is likely to be disappointed. In a recent *Newsweek*, Clifford Stoll takes the curmudgeon's chair to declare that "no on-line database will replace your daily newspaper, no CD-ROM can take the place of a competent teacher and no computer network will change the way government works." For the moment, this is true. The Internet can be compared to a toddler who has just learned to walk. He is into everything and all over the place.

Two aspects of the Internet help to illustrate both the excitement and the frustration a newbie (novice user) finds when peeking into this brave new world. Usenet groups number in the thousands, some with mundane names such as *alt.adoption.agency*, others with cryptic titles such as *alt.alien.vampire.flonk.flonk.flonk*. Logging onto the more serious discussion groups will yield important information. It can lead you to correspondents whose knowledge and insights can help you find answers to sticky questions. It can lead to firm friendships. It can also be a colossal waste of time. Anyone who has been flamed by a twelve-year-old will attest to that. There are far more frivolous "news" groups, groups that come and go month by month, than established and practical groups.

The World Wide Web also shows the effects of the information explosion. You will find pages that catalog the holdings of Italian art galleries, pages that lead you to photography from the Hubble Space telescope, and pages that document Broadway productions (an important page in my field). You will also find pages that tell your tarot for the day, take you on a tour of the Starship *Voyager*, and tell you lawyer jokes. Just like Usenet discussion groups, there is much here that is useful. There is much here that is ludicrous. Sifting through it can be a colossal, if not ultimately daunting, task.

Last semester, our computer manager held a workshop to introduce faculty to Internet resources. They had fun sending e-mail, finding recipes on the Gopher, and browsing the various groups. Unfortunately, the trivial nature of *alt.alien.vampire.flonk.flonk.flonk* and other groups led most of them to conclude that this was a cute toy that would never replace a couple of hours in a good old-fashioned musty library.

The Role of the Individual Campus

What must we do to enable our students and faculty? What must we do to disable the "high priest" mentality that keeps people away from the technology? What must we do make the Internet a quality research tool for all researchers? I believe the solution lies in two areas: the campuses and the Net.

If a campus is to make a commitment to technology, it must make computer labs available to all students. It must put computers on each instructor's desk. It must employ faculty who use computers and use them well. This is, however, only a start. The faculty and support staff need to be shown how to use software, hardware, and the Internet. This means a support staff who has some insight into faculty and student needs. This means an administration which supports technology with upgrades to meet faculty needs. It means careful consideration of software. For example, I don't use any of the standard packages that work on UNIX and Windows. My computer of choice is a Macintosh, so I have downloaded NewsWatcher for browsing the groups, Eudora for my mail, and Netscape for the Web. If I had to use the UNIX packages, I would not use the Internet as often or as effectively as I do.

Familiarity with the technology is only the first step. The campus that wants to use technology well will integrate software and Net work into the curriculum. I now require my students to learn our e-mail system. We take time in class to learn it and they receive extra credit for assignments handed in electronically. I would refer you to two excellent Web pages: *Education: On-line Teaching and Learning* for an excellent accumulation of teaching resources, and *New Tools for Teaching: J. J. O'Donnell*, by James J. O'Donnell, University of Pennsylvania. Dr. O'Donnell has a delightful discussion of ways to use the Web in a classroom setting, ways that require effort from the instructor, but effort that is assuredly worthwhile. The instructor who embraces this new technology and who also receives support from her or his administration will benefit from it.

Changes Needed in the Internet

The main work in making the Internet a reliable research tool does not rest solely with the individual campuses. It remains for the Net to change, to grow up in some ways. It is good that anyone with the know-how and the resources can make a Web page. I applaud that freedom of expression. It is, however, bad that there is nothing to help us cope with the explosion of information. We need mechanisms to sift through the dross. We need something more sophisticated than a word search engine.

The text world gives us an interesting contrast. If you have a manuscript, you submit it to publishers, usually publishers who specialize in your field. If it is accepted, it goes through an editing process. Once the book is published, the job is not over: the bookstores have to pick it up and the customer decides to buy it. This simplified model doesn't begin to address the complexities of the entire process (including reviewers and publicity), but it points to a process that imposes some standards. We need such standards on the Internet.

Essentially, what we now have is an underground press. It is wild, woolly, independent and unfettered. That should not disappear. We don't want to lose silly newsgroups or ridiculous web pages. We should instead institute some sort of ratings system, something that would tell me, before I head out to a site, that this is useful for serious research. We should have a guide that helps me get where I need to go. A standard such as this calls for an institution that commands academic respect to catalog the Internet and create standards. For example, do we have a site with numerous raw documents available through Gopher or FTP? Are they useful for professionals and serious scholars? Do we have a site with interconnected web pages? Again, are they useful for professionals and serious scholars? There are many Web pages that do an admirable job of cataloging their specialties, and those who use the Internet on a regular basis have lists of their favorites. We need someone to come forward and set a standard that any researcher can consult with confidence.

Some organizations such as the Association of Research Libraries and the OCLC Online Computer Library Center have started to develop on-line catalogs of the Internet. The proposed services range from simple listings to reviews of holdings. One of the more promising efforts is being developed by Columbia University librarian David S. Magier. Working with the New York Public Library, New york

University and Rutgers University, Magier plans to explore and catagorize and evaluate Internet resources.

We will need a major educational institution with a firm grounding in library science to examines the Home pages, and FTP and Gopher sites on the Internet. These information sources would be rated according to content, ease of use, and layout. This information would go onto a well-designed database that can be easily accessed from the web. It would be mirrored throughout the world to increase accessibility. The database would be updated on a regular basis. In this way, when I want to find commentary on translations of Brecht's *Mother Courage*, I would check the main database. Of course, if I have already found suitable sites in my field, I could look at them first. If those sites are well-maintained, they will feature links found from the central database. In this way, the knowledge spreads out along the web without fetters.

Many of the current pages out on the Net are well-designed and attractive. Many of the current pages out on the Net are connected to vast amounts of information. As we learn more and more about how to disseminate this information effectively, we must take the reins and guide the process. The Web, as we know it, will remain essentially the same. If we have a well-designed guide, it can lead researchers into the twenty-first century.

Consider a freshman coming into the main library research section for the first time. He goes slowly, hesitantly, because he doesn't know where things are. If he asks, the job will go much faster. By the time he is a senior or graduate student, he can go right to the indexes and sources he needs. Proficiency on the Net should be no different than proficiency in the library. For the Internet to reach that level of usefulness, we must develop skills and support on campus and standards that will stand the scrutiny of serious researchers.

Local university library resources, especially on small rural campuses, tend to be under-funded. As computer networks become more prevalent, the Internet has the potential to begin to equalize resources. We must, however reach out with guidance databases that can help the novice navigate the enormous amount of information which is generated. We must establish standards that will enable the serious researcher to make his or her best usage of this fantastic new hyper-library. We must make ease of use and accessibility personal credos for our electronic age.

Mobile Computing at Grove College

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Introduction

With the implementation of the first year of the Grove City College Computer Initiative, the College had committed to implement a mobile computing strategy. Each member of the Class of 1998 was "issued" a personal notebook computer upon arrival for freshmen orientation. Freshman orientation included introductory training to use the notebook system and software. The Grove City College Computer Help Desk was staffed and ready to meet the needs of this large, anxious group of new computer users. Faculty, given their notebook computers during the spring of 1994, were ready to integrate meaningful computing activities into the curriculum.

Now the College prepares for yet another freshman class to arrive. What has this first year of the Grove City College Computer Initiative taught us? What lessons have we learned? What has been the impact on students, faculty, and administration? This paper provides addresses to these questions.

Review of 1994-1995 Plan

Each member of the Class of 1998 received a Compaq Contura 4/25c with Intel 486SL-25 microprocessor, 4 MB RAM, 120 MB hard drive, 1.44 MB 3.5-inch diskette drive, dual-scan passive matrix color LCD, large Compaq (Logitech) Trackball point device, internal 96/24 FAX modem, MS-DOS 6.2, Windows 3.1, Microsoft Works for Windows 3.0, Wolfram's Mathematica. All software was installed by student workers during the summer after the machines were delivered on campus. The systems were each "burned-in" for a 72-hour time period. Approximately 20 of 550+ systems experienced major component failure (hard drive, motherboard, diskette drive, etc.) and were repaired.

To meet the printing requirements of the students, an HP Deskjet 520 Inkjet was placed in each freshman dorm room. Each student had their own print cable to attach to the printer. Each printer initially had an ink cartridge and paper; additional cartridges and paper were supplied in the bookstore at the student's expense. Printers were also placed in the computer center for commuters.

Students received two hours of preliminary instruction and training during the first couple of days of freshman orientation. This instruction included orientation to the Compaq system, and an introduction to Windows. Subsequent training covered Works for Windows word processing and spreadsheet modules. Additional training was provided during the first week of classes.

The cost of the system was met by a technology fee of $325 per semester, or $2600 payment in full plus sales tax. The cost of purchasing the Compaq system outright was $2300 plus tax. Approximately 40 freshman purchased the system outright. Twenty-five upperclassmen participated in the program by either purchasing a system outright, or by joining the payment plan option, paying $325 per semester of attendance.

Keeping 575 freshman computer users happy is no small task. The Help Desk staff, managed and trained by a full-time manager, did well in answering the many questions that followed the freshmen class arrival. The Help Desk, located in the Technological Learning Center (TLC) was staffed by three students workers during the TLC's operating hours, 8:00 AM until 2:00 AM. Students were able to carry their notebooks to the Help Desk for assistance; telephone assistance was also available during operating hours (campus number was extension 2255 -- CALL.) Access to the Help Desk was provided 24 hours via the FAX hotline (extension 2329 -- AFAX). Off-campus users used a toll free number (1-800-33GROVE.)

Initially the Academic Computing staff directly responsible for supporting the mobile computing initiative consisted of three full-time people (help desk manager, hardware/software technician, secretary) and one administrator. Other Academic Computing staff and personnel assisted as required, depending upon the magnitude of the task at hand.

1995-1996 Plan

Introduction

Generally, the first year of the Grove City Computer Initiative has been very successful. The fall distribution of the notebook systems during freshmen orientation was accomplished very smoothly; the training sessions were moderately successful in giving the students foundational skills to begin to use the systems for classroom work. The Compaq systems were reliable; system failures were minimal. The Help Desk was very successful in meeting the needs of the large user population for both software and hardware problems.

Keys to Success

Many factors contribute to the success of a project of this magnitude. Many potential problems were eliminated beforehand during the initial 72-hour burn-in period. Approximately 20 systems (3%) had major component failure (hard drive, diskette drive, motherboard, color panel.) The system burn-in is key to assuring the reliability of the distributed systems and will again be conducted during this next go-round. Important also in keeping the hardware up and running was the implementation of a "while you wait" repair response for selected items. A database was created for all equipment serial numbers (computers, trackballs, AC adapters.) The database was used for equipment maintenance, inventory, and accounting purposes, as well as for the return of lost equipment.

Central to the success of the GCC plan thus far has been the design, staffing, and management of the Help Desk. Through the efforts of the Help Desk, a large and diverse user population (students and faculty) has been kept "on-line!" The following statistics compiled during the first semester of this past academic year shed light on the level of service provided by this facility.

Help Desk Statistics

Questions answered:	2,653
Most calls in one day:	104
Average length of call:	5 minutes
Average notebook system repairs:	1.5 days
Printer repair:	7-10 days

Most of the questions directed to the Help Desk have been from students (96% students, 4% faculty.) Access to the Help Desk has been split evenly between walk-in (50%) and phone (50%.) Most of the questions have dealt with software (75%) versus hardware (25%.)

Additionally, procedures were put in place to train and give direction to student workers including the introduction of a three tier help system for question response, training meetings for Mathematica and customer service techniques, and the creation of a "supported software" reference library for student consultants.

Progress of integrating information technology into the curriculum continues. Significant strides have been made in the business, mathematics, humanities, and computer systems departments. Activities involving the notebook systems are limited, however, in any class where the students are a mixture of those who have the systems and those who do not.

The significance of the public access lab in the Technological Learning Center has diminished somewhat. The machines found there (Windows-based 386/20 PCs) are still reserved by faculty for class activities, but those systems have nearly outgrown their usefulness. The Macs found in TLC continue to function as a word processing pool by upperclassmen.

Changes for '95-'96

The System

The most obvious change this next year will be the notebook system itself. The Class of 1999 will be issued the following system:

1995-1996 System
Compaq Contura 410c
50 Mhz 486 SLC cpu
8 MB RAM
350 MB HD
PCMCIA slots
19.2 modem
4 year warranty

The Compaq 425c met the needs of most students, but the 120 MB hard drive filled up quickly on a Windows machine. Additionally, performance is greatly improved in Mathematica with an additional 4 MB of RAM. The 19.2 modem will be a big improvement over the 2400 baud modems that are packaged with the Compaq Contura 425c models. Dialup access is used for libary and Internet access.

Training

Attendance at the introductory student-training sessions was voluntary. The initial sessions (system introduction ,Windows, and word processing) were well attended. Attendance dropped significantly for remaining sessions of spreadsheet and database introduction. Refresher sessions were given later in each semester. Many freshmen students received formal training in courses required of all business and engineering majors. The only change in the initial introductory training will be to postpone the first training session from the first night of freshmen arrival to later during orientation.

Printing

Placing an inkjet printer in each of the freshmen rooms provided quality printing conveniently and inexpensively to the students. It became a logistical nightmare, however, to keep track of those printers when roommates changed, students left school, or when new students transferred in. To avoid this problem further, each student of the class of '99 will have a printer bundled with his/her notebook system. The printer of choice will be the Canon Bubblejet 200EX, a quality printer priced significantly lower that the HP Injet 520 or 540. The existing HP 520 Inkjets were distributed this spring to half of the class of '98, the other half of the class receiving new Canon 200s.

The Cost

The final significant change for the '95-'96 academic year is the fact that the Information Technology fee of $325 per semester has been canceled. The cost of the notebook/printer bundle has been rolled into the GCC tuition. This change requires a sliding scale of charges for the four classes next year, but the annual cost of tuition, room, board, and the notebook/printer bundle is still under $10,000.

Staffing

Staffing will largely remain the same except for the addition of one additional hardware technician. Much of the hardware repair and software support was the responsibility of one person. That responsibility will be divided. Additional support will be necessary as the campus network grows.

Conclusion

This Fall half of the student body will have notebook systems and printers. Faculty will have one more year of experience taking advantage of the available technologies. The GCC Computer Initiative continues to progress and evolve. The Campus will continue to strive to foster an environment that prepares our students for this information age and the turn of the century.

Electronic Portfolio: Assessment, Resume, or Marketing Tool?

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Abstract:

Assessment and its management has been perceived as missing some of the aspects of the talent and skills found in individuals, but which were not readily displayed for the evaluator. Incorporating the use of a variety of technological approaches we can capture visual displays, tape the student, display materials, interview the student, let the student voice a philosophy, or incorporate any creative effort that will better represent the student's achievements. A completed portfolio can be viewed to determine the effectiveness and skills level of the student and to provide valuable decision making information for the job market.

Introduction

As our graduates make plans to begin a career in teaching, it is made quite evident that they must be prepared to compete in a technologically rich environment, as well as, provide traditional instruction. In an effort to provide them with the best means possible for demonstrating this duo nature, we have developed a plan of action called PROJECT TASK. The TASK is to use technology to prepare a resume that provides more than a traditional resume. The best hybrid description is an "Electronic Portfolio". Using the elements of an established portfolio and then rendering them with the assistance of electronic devices and software packages, the student exhibits the skills necessary to develop a high impact presentation of basic resume data, produce visual materials that lend themselves well to photographic format, utilize all the graphic and visual elements to create aesthetically pleasing support materials, demonstrate mastery of the software package(s) to produce the portfolio, and edit raw video, audio, and visual materials into compact, high-impact, clips that display skills and talents essential to the teaching process.

This presentation will cover the benefits of using an electronic portfolio as opposed to the more traditional type for the professional resume. In addition, it will treat the use of the electronic portfolio as a means of assessment of student, student teacher, and teacher performance, as well as the use of it to gain favorable consideration in the job market. This includes the obvious one of ease of distribution, storage, and use. The ability of the "reader" to select areas of interest from a simple menu, rather than having to thumb through page after page in search of a supporting item, and missing the point, is a strong reason for utilization of this approach. The capacity of hearing a statement of support rather than read a letter of recommendation; seeing the person in a teaching situation, rather than reading that he/she teaches science, etc.; having a map show areas where experience was obtained rather than seeing a list of states; or seeing examples of the creative talents rather than reading the person has mastered a drawing/paint program, animation program, etc. are all reasons for the embrace of this emerging use of technology.

From the standpoint of the student involved in this project, this approach does require more time than the traditional resume. The time spent should be weighted against the type response one might expect from such an approach. Since it is impossible to learn all one would like in the course of a quarter or semester in a computer/technology course, the student is presented with an opportunity to revisit this area of study and use newer facilities, newer software packages, try new equipment, and receive help in learning about advances in the field, all of which will increase job market appeal. Many times, the activity involved in the development of such a display will cause the student to access areas of strength and weakness and prepare to enhance or correct as the need is indicated.

For the person having to serve on a search committee, or the interviewer, it is much easier and creates a more positive impression if the complete documentation for an individual will easily fit in a shirt pocket! Can you image, being able to take the entire stack of applicants materials with you in a small disk storage box, rather than wheeling it out in a box! If your notes are vague on a point, is it not easier to go to a menu and "click", rather than search, because there are no page numbers? The addition of color, motion, sound, and touches of creativity make the task less difficult than facing another copy on buff-colored paper.

The presentation will also provide information on the tools that are used, both hardware and software, will be discussed and sample products will be included in the handouts. As we developed the concept of the "Electronic Portfolio" we had to deal with all the possibilities of what might be included, such as: written materials, photo/portrait, pictures of display materials, recording of "Philosophy of Education", a verbal recommendation, a video of classroom activities, a rendering from a software package, a special report in the newspaper, outlining, menu items, and "?", the question mark representing an unknown that a creative person might think about that we had not yet put into the framework. [Example: Credits section to take care of unusual support or to take care of copyright.] In starting the project we dealt with the Macintosh platform as it was already in place and we had HYPERCARD and were ordering HYPERSTUDIO. In addition, programs such as ComputerEyes, Adobe Illustrator, Publish It!, Video Spigot, and QuickTime were already on the machines or readily available.

Part I Description of Project Task

In Winter 1994 our project work began with assessing our own abilities and facilities to determine just what could realistically be accomplished in the time allotted. We decided that we would limit the number of participants to 30 and that those should be volunteers. Our rationale was based upon the fact that we felt that a volunteer would have a self-motivating goal for completion of the task and the number was determined by the number of available computers. By Spring 1994, we were ready to pursue the project goals. Thirty students were selected to see if they wanted to volunteer for this task. Of this number, we had eleven who elected to do the project and stuck with the commitment even though there were numerous problems with the technology. First, using 4mb of RAM would not support plans for digitized images within the framework of the electronic resume. OCR software was missing. Our lab caught the Merry Christmas virus. etc. Needless to say, this was a period of great learning and mastery of problem solving.

Using HyperCard as the format for the electronic portfolio, the students developed individual cards for the various elements of a resume. Though we encouraged creativity, there were key elements that were required. These elements included such things as personal data, education, experience, philosophy, and skills. It did not take long before students were asking for color capability, so we began searching for a tool that would fit our design as it existed, but allow for changes and expansion of the ideas. After a year of testing products that we could obtain, the software package we selected was Digital Chisel, from Pierian Spring in Portland, Oregon.

During this quarter of work with the student teachers, we had a beta product that let us get a better feel for what would work and what would not; how to proceed with fewer problems for the developers, and a long list of things that would permit us to develop a better product. One of which was a series of workshops for fellow faculty to help them become familiar with the technology and therefore use it more in classes. The trickle down effect was viewed as a way to enhance the student's view of what might be done to showcase work and visualize him/herself as a proficient user of technology.

Summer quarter gave us the opportunity to invite 31 teachers, working within the School of Education or teaching Education support courses, to participate in a series of workshops being taught in three levels: beginner, intermediate, and advanced. The participants were encouraged to take two of the three. With this approach, only one participant dropped out. This approach provided us with a base of instructors who would know and feel comfortable with the technology and could, in turn, help the students as they planned and developed materials applicable to the portfolio.

With the coming of Fall quarter we had taken the information we had picked up from our "beta" group, and done some revamping of the requirements. First we selected only students known to have had the computer course, a record of being dedicated students, and who might volunteer for this activity. This time we had a smaller group to ask to volunteer. Our bonus to this group was the use of a laptop for the quarter to use to develop the electronic portfolio and to help in making out lesson plans, developing handouts, making tests, etc. Of this 15 elected to try it, with 4 dropping out after a couple of weeks for lack of time. After the group began work we received our site license and software for Digital Chisel, so we only told the students we had it available for them, if they wanted to use it. Several experimented with it, but only one actually produced his electronic portfolio on it.

At the end of the tenn, the quality of the portfolios was improving. It seems that the volunteer group does devote time and energy to this project. In fact, several of the participants wanted to continue work on the portfolio into the next quarter. With the current quarter underway, we have 11 participants with laptops. They meet on Monday nights for specialized instruction, and on Saturday mornings for tutorials on software, skills, etc. It may say something to handpicking a group from the start, because none of the students has missed a session yet.

Part II - Applications of Project Task

A. Assessment

The measurement of knowledge and skills acquired by the student at any given point in education is a prime concern for the evaluator. In our case, many courses in the School of Education have the student develop curriculum materials, thereby requiring skills that are put on display in the forms of printed materials, whether they be in traditional text format or in artistic endeavors such as bulletin boards, posters, banners, labels, etc. As the student progresses through the planned curriculum, these materials become greater in volume, and may even emerge several times in different courses (with no apparent changes) . Each person placed in the role of evaluator has the task of determining IF the student has gained skills, rides on pre-existing skills, or is using someone else skills. Since the evaluation is valuable to the on-going process, it is desirable that it be as thorough and accurate as possible.

The electronic portfolio is evolving to the point that students are now starting the design and accumulation of data for it in the early stages of entry into the teacher education program. The placement of the basic development of the design and the instruction necessary for acquisition of technological skills are contained within the required EDU 365 Computer Applications course, and followed up with an elective EDU 365 Instructional Technology course. Since these courses may be taken prior to admission to Teacher Education, the student has the opportunity to have the foundation in place for the eventual use of Electronic Portfolios as a required assessment tool.

The electronic portfolio will permit any evaluator, instructor, supervisor, or potential employer, to view the overall creativity and skills development of the individual. Within the portfolio will be the scanned images showing materials the student has developed. The scanned images may be still or motion video, commercially processed images of photographic work, lesson plans, sound clips, animated art work, or computer created designs. In essence, the only handicapping feature of the accumulation of data is that of technological support in the form of powerful computers, software packages, and knowledge of how to use these tools.

In the use of the Electronic Portfolio, the evaluator may view the samples of the student work in any order, and not be frustrated by having to shuffle materials around, plow through a box of "stuff", nor be restricted in comparing early versions of a piece with a later improved version. As the technology supplies us with more creative tools, the developer of an electronic portfolio and the evaluator will be brought closer together in the process. The developer will have clearer guidelines of what is being sought in this medium, and the evaluator will be trained to access the information in a more productive manner, using those aspects of the finished piece that are needed for this evaluation and not spending time on elements that are unrelated.

The entire evaluation of a person can be presented in a package that is easy to handle, fits in a "shoebox" , can be edited, up-graded, and made a personal statement. At present, this is a developing process and not as free of complications as it will be in the near future.

B. Resume

The very idea of having to compete with another person for a job is a frightening experience for today's student. The job market is structured in such a way that many times the job title does not necessarily reflect exactly what the work entails. The Electronic Portfolio, due to its compact size, permits the developer the luxury of designing a branching program that displays his/her talents and skills in several different lights. The developer may have a section for job placement in various areas of employment, such as: management, teaching (training), or technical support. After preparing the master portfolio, it may be sent out in answer to totally different job description notices. The employer may then look at only the section that is applicable to the position that is available, but may also see the relevance of other training and skills and a valuable resource in someone with multi-level training or placement. Still, the employer did not have to wade through all the materials that were unrelated to the specific position, unless it was by personal choice. In addition, the volume of information does not cause the employer to hesitate to view the materials as it is not evident from the package what volume might be hidden there.

For the developer with beginning skills, the Electronic Portfolio may appear as a stack of slides (or cards) that contain the same information, presented in the same manner as the traditional resume. As the skills are developed, the product may take on a more refined and diverse look. The up-grade ability makes it possible for the student to work in new information and never be without an updated package to present for consideration in less time than it takes to update text materials and then print it out in the quality necessary to distribute, and at much less cost!

C. Marketing Tool

The appearance of the packaging of the Electronic Portfolio is easier to prepare than trying to second guess what appearance is required to impress a potential employer. The development of a simple, tasteful label is the best start. Later, more commercial appearances may be developed in order to attract attention. At present, the very size and ease off handling is the most attractive feature.

The content of the Electronic Portfolio is the next phase of impressing the job market. For the developer, the ability to display works, and not risk their being damaged, displaying them at their best, and increasing the manner in which they might be used, are all factors that may attract the potential employer. In our case, students who have developed Electronic Portfolios have been hired in the positions of choice and though we have no supporting data at this time, we would like to believe that the demonstration of technological skills, without flaunting them, was an important factor.

The jobs of choice are difficult to obtain and just the percentage of success of our developers leads us to believe that the project was a success in the area of marketing their skills.

The distribution of copies of the portfolio is easy, the duplication costs are very reasonable, and the disks may be recycled after they serve their purpose at the point of evaluation, unless needed further. In this case, they are easy to store and maintain.

As we consider the overall impact of Electronic Portfolios, we see this phase as one of adventure, skills development, and certainly one in which the final product may vary greatly from developer to developer. The very nature of the project is such that there is little chance for an end to its importance to the student. We must serve the needs of the student in the areas of assessment and marketing of skills, and this is one approach in which the student developer has the final control on how to display the events of his/her professional development in the best manner. Finally, we stress that all the skills used in the development of the Electronic Portfolio are only the start. The student/developer must realize that life-long learning must continue if the he/she is to continue professional development and present the evidence of acquiring knowledge and display the technological mastery necessary to remain current.