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ABSTRACT

This document contains 102 one-page conference demonstrations/posters of individual research in the use of multimedia and hypermedia in education. Teaching and learning strategies and styles are addressed; multimedia applications for cooperative learning, problem solving and decision making are related. The uses of object-oriented modelling, authoring systems, intelligent tutoring systems, computerized testing, computer simulations, image processing and video conferencing for educational purposes are described. Discussion in the posters also includes the use of interactive systems for faculty development and for distance education. Other topics include microcomputers as alternative communication aids, information retrieval, library instruction, programming languages and computer system design. (AEF)

DEMONSTRATIONS/POSTERS

Object-Oriented Data Modeling in Hypermedia: A New Data Model

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Although the object-oriented paradigm is well suited for the modeling of self-contained independent objects, it is not suited for modeling relations (or static links) between abstract data objects. At the same time, the concept of computer-navigable links is a main part of the hypermedia paradigm. In contrast to multimedia, where the object-oriented paradigm plays a leading role, this "confrontation" considerably reduces the application of object-oriented methods in hypermedia.

The HM data model incorporates the well-known principles of object-oriented data modeling for actual management of large-scale, multi-user hypermedia databases. The model is based on the notion of abstract hypermedia data objects called S-collections. Computer navigable links are encapsulated within a particular S-collection and are also bound between S-collections. Thus, a hypermedia database is nothing but a set of *S-collections*. Each S-collection has a unique identifier and a so-called *content*. The content can be seen as a primitive node attached to an S-collection. The content (text, pictures, audio, video-clips, etc.) is visualised when the S-collection is accessed in some way.

An S-collection encapsulates a particular navigable structure . The navigable structure is a set of other S-collections (called *members* henceforth) related by a number of computer-navigable links. Note that we connect S-collections but not primitive nodes. Note also that the links are encapsulated within a particular S-collection. In other words, links may be defined only between members of a certain S-collection , and in this sense, links belong to such S-collection, but they do not belong to a hypermedia database or to members that are related by means of links. An S-collection devoid of such an internal structure is called a primitive S-collection.

All S-collections can respond to the message "*access*". It implies executing the S-collection's content (i.e., presenting some text, picture, audio, video clips etc.). Typically, a chunk of hypermedia information associated with the current S-collection is visualised on the user screen, but any kind of action can happen in response to the message "*access*" if the corresponding method has been overridden. Complex S-collections without content forward the message to their head.

Link following within the HM Data Model is simply a form of message passing. At any particular moment in time, the user can navigate only through a single, specific S-collection called the *current container*. Only members of the current container can receive messages during navigation. A concrete member of the current container is the *current member* for each particular navigational step. More precisely, the member that most recently received the message "*access*" is the current member. Only members related (linked) to the current member can be accessed (can receive the message "*access*") in the next step of navigation.

Since links are encapsulated within an S-collection, they become available (or become activated) for navigation only if the S-collection has been "entered". Such an *entering* of an S-collection to activate the encapsulated links will be called the "*zoom in*" operation. In analogy, the operation "*zoom out*" is the complement to the most recent "*zoom in*" action. More precisely, the operation "*zoom out*" recovers current container and current member to the state they had just before the previous "*zoom in*" operation. Extending the functionality of "zoom out" to give access to any S-collection of which the current collection is a member is provided by the operation "zoom up". Generally, the "zoom in", "zoom up" and "zoom out" operations provide users with the possibility to navigate in direction orthogonal to the conventional plane of link-based browsing. Thus, we can say that the HM data model supports an additional dimension of browsing hypermedia databases.

The HM Data Model has been implemented as a prototype system called HM Card, The system, its documentation, and a number of articles are available via anonymous ftp from "iicm.tu-graz.ac.at" in directory "pub\hmcard".

Software to Involve the Instructor in Creating Multimedia Listening Comprehension Lessons

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The Goals and Challenges

Our research supported the sense of some students, faculty and staff of a lack of student material requiring comprehension of, and engagement with, spoken language. We decided to develop such material based as much as possible on principles used in reading comprehension exercises. Development would be computer-assisted - exploiting instructor's teaching and content expertise and interests, and minimizing their design, development and detail work. Self-administered listening lessons require the use of mechanical devices, and the control of those devices in response to student input calls for a computer. We had to accept limits on the degree of control of audio/video presentation and on accepting and evaluating natural language input, especially sound.

The Solutions: Ideal and Actual

Ideally, we want to allow authors to apply their instructional goals easily to a variety of source media (audio/video on disc or tape, text, graphics, digitized audio/video) by accepting a variety of input from students (typing, clicking, utterances), and using a variety of output media (computer/video monitor, speakers, printer).

Currently, our program accepts videodisc, CD audio, text and graphics. We intend to add animation and digitized sound. We do not yet accept oral input from the student because of its technical demands and our inability to evaluate it. The program corrects only short pieces of text (a few words). Testing indicated that tape players were not mechanically practical, and that pressing CDs can be a viable alternative.

We hoped to be able to divide the process of developing a lesson into modules, and provide a computer program for each module. Ideally, the modules would reflect different skill sets (such as planning versus data entry), and should reward, but not require, advance planning of material and of the development process. Each module's program should make suggestions at each step, but allow the author to override whenever possible.

After research, we divided the development process into Planning, Detailing and Creating modules. The Planning module of the computer program helps the author (likely a professor) decide on the overall structure of a lesson, the number and type of instructional goals, and of activities (such as multiple choice) for each goal, drawn from a total of about twenty. The Detailing module helps the author decide for each activity which elements (clips, introduction, hints, feedback etc.) to include, and to fill in as many details as are desired. The Creating module prompts the author (likely a teaching assistant) step-by-step to fill in the required information for each element of each activity. It then adds the activity to the program the student sees.

The program the student sees allows him or her to follow the path set by the author, move to any activity in the lesson, repeat activities that were answered unsatisfactorily, or search other lessons for related activities.

Still to Go (or Making Multi Media Marginally More Manageable)

Transfer source audio and video from tape to disc, and simplify the transfer process.
Solve technical and instructional problems introduced by recording student utterances.
Improve listings of instructional goals and mapping of instructional goals to activities.
Complete full-scale testing of planning, detailing and creating programs and resulting student material.
Minimize features that cause authors to construe formalizing lessons as mere computer programming.

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LECTURE: A Macintosh Multimedia Authoring System and Self-instructional Student Video Program

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Lecture was created to provide a self-instructional vehicle to the student for the total comprehension and mastery of authentic language video in the CAV laserdisc format. Exploiting video of native speakers directing themselves to other native speakers creates too many classroom obstacles to the student in terms of comprehension and feedback problems and to the instructor in terms of time restraints to permit adequate utilization and mastery of such video material in a normal classroom situation. Our first objective was to provide the student with the means to raise his/her aural understanding from 95 percent to 100 percent of the spoken target language. As the program developed, we saw the need for variety and breadth in the self-instructional program in order to enable the student to explore and practice the language being comprehended through problem-solving and a hyperenvironment which would permit a variety of activities built around selected video segments.

The project required both an overall student program design containing varied and demanding student input activities and an authoring program which facilitated the easy development of such activities. The result of our effort was the creation of the Lecture Authoring Program which permits the exploitation of CAV laserdiscs through simple typing and "point and click" lesson production. Lecture now links texts to video frame numbers and to specially designed internal dictionaries which in turn link to other texts, graphics, QuickTime video, CD-ROM, and sound files. The program also contains reinforcement exercises (multiple choice, fill-in-the-blank, and question/answer exercises with error feedback), a composition creation activity, a stack editing feature, the ability to convert a student program to another target language, and the ability to build activities on a second laserdisc sound track when available.

In the demonstration we will exhibit the student self-instructional program and discuss the pedagogical rationale behind the program's structure, its varied activities, and the emphasis on student input. We will show the flexibility inherent in the self-instructional program when used in conjunction with video and also discuss how the program can also quickly create classroom presentations which in turn feedback to the self-study program. Although the program may be used and converted to a variety of languages, we shall use examples from the intermediate to advanced ESL programs based upon Welcome to Bellingham, a laserdisc created at Western Washington University. I may also include excerpts from the beginning Italian BBC program, Buongiorno, Italia, and/or France-TV Magazine, French in Action and Destinos.

Next we will give a survey of the Lecture Authoring Program and explain its case of operation in creating text and video control exercises, multiple choice, fill-in-the-blank, question and answer, and composition creation. We will demonstrate how the editing capacity of the program permits all aspects of the student program to be developed, edited, and amended.

Multimedia Technology in the Calculus Classroom

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Over the last ten years there has been an ever increasing focus within the mathematics community to examine and modify the traditional college calculus sequence. It has become apparent that the "chalk and talk" presentation style is not successful with many of today's students and that the technology that is now readily available to calculus students forces their teachers to reexamine what material they are teaching to their classes as well as how the presentation should take place. Most of the National Science Foundation funded Calculus Reform Projects strongly encourage the incorporation of technology into the mathematics classroom. Typically, the technology that is used is a graphing calculator or a PC with a graphing software package. In this poster session, we will demonstrate some multimedia applications that are used for presentation and tutorials in Calculus I and II at Westfield State College.

Westfield State College has gone through a natural progression in its reform of the Calculus sequence. Initial change in the course was introduced by assigning occasional computer labs with a graphing package on a PC. At present, we have just concluded our fifth year of teaching a Reform Calculus course. Major components of the course now include assigned computer labs, the requirement of a TI82 graphing calculator, group projects, and the use of a Reform Calculus text.

The use of multimedia to present application problems in calculus is a natural extension of the use of technology within the calculus courses. The development of calculus was initially motivated by physical problems, and today's student is more clearly able to appreciate this if the situation being modelled can actually be demonstrated at the time of study. Video is a natural medium for presentation of physical problems. The use of the authoring package Toolbook allowed development of calculus lessons where difficult points could be reviewed and expanded upon by the learner; it also gave us the opportunity to present the visual and auditory reinforcement which is helpful to today's student.

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Creating a Multimedia Infrastructure for Faculty Development

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North Dakota State University (NDSU) is establishing an aggressive, university-wide approach to incorporating multimedia into the classroom. NDSU has been working on building an infrastructure of support and resources for faculty development of multimedia in the form of personnel, equipment, training and support for information sharing.

A multimedia project was funded through an internal funding process run by the University's Planning, Priorities & Resources Committee (PPRC). The project was formed through the combination of ideas from several of the proposals submitted that were related to multimedia. The faculty involved in the funded multimedia proposals have formed a campus Multimedia Coordinating Committee (MCC).

Personnel for supporting the multimedia project came in the form of the MCC, a full-time multimedia specialist and student assistants. The MCC has defined ambitious goals for supporting multimedia on campus. The multimedia specialist supports the component parts of the multimedia project. Her responsibilities include taking care of the equipment, conducting training, working with faculty and supervising the student assistants. The student assistants were trained on the authoring software taught to faculty and provide technical support (telephone and on-line) to faculty. Other services, such as slide scanning and CD-ROM mastering, are also handled by the student assistants.

Understanding that many of the faculty who wanted to get involved with multimedia did not have the funds to purchase high end computers for their office, the multimedia project purchased authoring stations which were made available to faculty. To support both platforms, a Macintosh Quadra 800 and an IBM Ultimedia Model 77 were purchased. Both have video and audio capture and editing ability. A 35mm slide scanner was purchased and is supported on both the Mac and DOS/Windows platforms. To handle storage and access to the growing amount of information associated with multimedia, a CD-ROM mastering unit was purchased. This also is supported on both the Mac and DOS/Windows platforms. A third computer (DOS/Windows based) was purchased to support slide scanning and CD-ROM mastering.

Another "form" of equipment available to faculty is a multimedia classroom. This is a 180-seat lecture hall which is equipped with a Mac and an IBM computer along with several audio/visual devices. All video is projected through a ceiling-mounted SONY projector. Audio is played out of a stereo sound system.

Training is conducted by the multimedia specialist. Introductory and advanced workshops on selected authoring tools were offered. Both Macintosh and PC classes were conducted.

Support for information sharing were offered in two mediums. A multimedia user group (MMUG) was formed which met monthly to hear presentations and have discussions about methods and software and how to apply it in the classroom. Electronic support was also provided through the creation of a local newsgroup. Announcements of upcoming meetings, software tips, and conference announcements from Internet were posted to this newsgroup. It also supported on-line discussions & questions from faculty.

Many lessons have been learned about slide scanning, CD-ROM Mastering, and courseware development. They include: acquire wisely, be realistic, start small, establish a scheduling priority for appropriate use of multimedia classrooms and equipment, and be aware of copyright issues.

For successful implementation of campus-wide use of multimedia campus-wide, it is crucial that a foundation of support be built. Providing technical support through training and hiring of support personnel, providing funding to purchase the required hardware and software and providing the means for fostering partnerships through user groups and on-line discussion builds the necessary foundation that faculty can "stand on" to start developing multimedia materials.

The Shaping of Knowledge: Aesthetics in Designing and Engagement in Educational Multimedia

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The development of *Collector's Box* a HyperCard stack to be used as an off-site natural history museum enhancement led us to consider: a) the design process rather than simply the product, and b) explore the aesthetic point of view on design, i.e., the epistemological issues of interaction between designer, object, and viewer.

Aesthetics, a branch of philosophy, provides reflections on the process of creating objects and events that engage users. Creating computer-based multimedia environments may be considered in a similar way. And, in effect, issues of engagement and motivation are being included in current research on educational multimedia. Aesthetic issues, far from being decorative or secondary to the instructional goals (Levin, 1987; Rieber, Boyce and Assad, 1990), form an inherent part of design, furnishing the basis for its motivation and evaluation. They allow the designer to mentally juggle the instructional and multimedia design components in order to create an organic, meaningful whole. This analysis draws on the interaction between cognition, motivation, and aesthetics (Berleant, 1991; Dufrenne, 1987; Polanyi,1975), and the rhetorical dimensions of art and design (Buchanan,1989; Eco, 1979).

Similarly, the *role of the user* (to paraphrase Eco, 1979) in this aesthetic process, is one of involvement, interpretation, and "imaginative integration" (Polanyi, 1975) in order to construct coherence, meaning and knowledge. This provides the basis for investigating genuine engagement between multimedia and user.

We will be illustrating aesthetic considerations that occurred in the design of four features of the *Collector's Box*, presenting the most recent version of the stack in progress, along with digital "sketchbooks" showing the aesthetic, problem solving process of idea, action, judgment, and re-action. The four features are: 1. stack metaphor; 2. "field tools"; 3.user "field notebook"; 4. networking. Briefly, the *Collector's Box* is a multimedia museum enhancement for Grade 6-12 that presents fundamental concepts and procedures of identification and classification used by natural historians, and seeks to positively affect attitudes toward natural history. Basically, the *Box* encourages students to think as natural historians, and stimulates the students' interest to explore the "real world".

Stack development began with metaphors establishing the relationship between the student and the *Box*. Metaphors furnished the visual inspiration and structure needed to dir ect, objectify, and unify domain and instructional information, and resulted in stack structure. Meanings associated with the metaphor of a collectors' box generated ideas for other instructional features: "field tools", including binoculars, magnifiers, video, etc., support multiple representations and enhancement of observation skills; user's"field notebook", including graphic and text applications, encourages user cognitive strategies, and gives the user symbolic and functional screen space; networking applications linked to the *Collector's Box* provide a "real world" overlay to the metaphorical context.

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Intelligent Strategies For The Presentation And Interpretation Of Video In Intelligent Tutoring Systems.

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Multimedia systems can now have cheap video, and Multimedia Authoring Systems are being used for creating Intelligent Tutoring Systems (ITS). Thus interactive film/video is now available as a resource for ITS designers. Film however must be used carefully because film clips take on new meanings when juxtaposed with other clips. D. Kuleshov in 1920 conducted an experiment (from Pudovkin (1958)) which highlights several aspects of film clip juxtaposition. Visualise five clips of film...

1. A young man walks from left to right. 2. A woman walks from right to left. 3. They meet and shake hands. The young man points. 4. A large white building is shown, with a broad flight of steps. 5. The two ascend the steps.

"The pieces, separately shot, were assembled in the order given and projected upon the screen. The spectator was presented with the pieces thus joined as one clear, uninterrupted action; a meeting of two young people, an invitation to a nearby house, and an entry into it. Every single piece, however, had been shot in a different place: for example, the young man near the G.U.M. building, the woman near Gogol's monument, the handshake near the Bolshoi Teatr, the white house came out of an American picture (it was, in fact, The White House), and the ascent of the steps was made at St. Saviour's Cathedral. What happened as a result? **Though the shooting had been done in varied locations the spectator perceived the scene as a whole.**"

It is investigation of film phenomena like this that leads me to formal rules for film editing.

The strategies (from the title) consist of a film structure, an event structure and a set of rules for translating the event structure into the film structure. This approach was first described by Carroll (1980), however I have taken his embryonic film grammar and extended it with particular relevance to film being presented as part of an ITS or any Multimedia Application. I feel Carroll experienced problems with his film grammar because he scoped it too widely. By narrowing a grammar's application area I feel it becomes more relevant. A fragment is shown below.

1. Scene	==>	Scene*
2. Scene	==>	Establishing Shot + Detail Shot*
3. Scene	==>	Detail Shot* + Revealing Shot
4. Establishing Shot	==>	Extreme Long Shot | Long Shot
5. Revealing Shot	==>	Extreme Long Shot | Long Shot
6. Detail Shot	==>	Detail Shot + Scene + Detail Shot

(* meaning one or more , + meaning concatenation, and | meaning exclusive-or)

The problem with such a notation for expressing the structure of film is that the structure is dependent on what you want to communicate. Thus, on the whole, rule 2 would be used for scene structure, but rule 3 used when we want to bring the viewer to a particular point then reveal some extra information which shows them the actual conclusion. Such strategic decisions would be made by the ITS. The ultimate aim is to amalgamate this grammar with a knowledge base describing the content of some film (see Parkes (1989)) into an ITS which dynamically edits the film for presenting a given concept and parses user input in the same manner. Research is currently underway at Lancaster into this problem.

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Computer Use with Adult Students: Addressing Multiple Learning Styles

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All individuals do not process information in the same ways. For some, a verbal description or a lecture can be a very meaningful form of learning. Others process visual information much more readily. Still others need the physical act of writing something down to fully process it. And most individuals who have been successful in the educational system have learned to gain information from printed media. The degree to which meeting of the individual's learning styles has selected thosewho have succeeded is only now beginning to be more clearly understood. Recognition of various learning disabilities is one example of this.

Some individuals who work with adults have come to recognize that an adult's learning style may play a very significant role in learning, and that it may have had an effect on past educational success. It is not easy to always meet these various learning style needs. And when those working with adults attempt to incorporate computer-assisted instruction into the learning program, many adult students, who may be more technophobic to begin with, do not always find a good match between the approach of the software and their individual learning styles. The difficulty in learning continues. But designing software that accommodates multiple learning styles, while more work, may pay significant benefits in meeting the needs of this broader audience.

For purposes here, the following learning styles will be considered, with the recognition that even this list is not complete. Print-based learning is the most commonly used method of acquiring information and may be the most *acquired* learning style; one that individuals have adapted to in order to succeed in the established educational system. Individuals who cannot adapt to this style often find educational failure, both as children and adults. Auditory learners are those who need to hear something to fully process it. In lectures they may sit with their eyes closed to focus on the auditory stimulus. Visual learners may focus more on what is shown than what is said. For them, a picture may be worth a thousand words. Graphs and charts may also be quite helpful in retaining information. These individuals can frequently *see* the information in their mind. Interactive learners may need to respond to the information to fully incorporate it. For example, they may need to repeat the information aloud or respond verbally to it. Kinesthetic learners often need to be *doing* something (or moving) while learning. For some this may take place by physically writing the information. For others it may mean doing something while listening—like knitting or doodling. And, it is possible that another learning style may involve the keying of information to symbols. Few people have only one learning style, but commonly one is prominent.

The Demonstration Programs

A short diagnostic element at the beginning of a program determines some characteristics of an individual's learning style and in turn accesses a matrix of learning elements designed to fit that style. The programs contain modules appropriate to different styles but covering the same material. Students use the software modules covering the material in the most appropriate manner. An added benefit of this type of programming is that having available the additional modes for use after a student has viewed material in a primary mode can be used to reinforce the learning in the activity.

This demonstration will utilize simple HyperCard™ programs designed to do a very simple diagnosis of the learning style of the user and then demonstrate some strategies for meeting those needs. One of these programs was created to show graduate students in adult education the nature of some adult learning styles and how given material can be presented to more closely meet those needs. These programs cover print-based, visual, kinesthetic, interactive and aural based elements. Some symbols have also been incorporated. An additional goal in these programs was to encourage practitioners to develop their own simple programs to meet specific learning goals.

Learning Research Skills: a HyperCard Lesson

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Information retrieval skills are essential for successful research and the achievement of sound scholarship. Students should be taught efficient research methods as early as possible so that they can develop critical thinking skills. In order to help students acquire research capability, Colorado State University Libraries offers scheduled classes each semester to teach students efficient research methods. Although these classes are highly successful, student enrollment is limited. An alternative for students who cannot enroll in the scheduled library classes is, in the opinion of the author, crucial.

In recent years, multimedia technology has been implemented as a learning aid in the classroom. Multimedia is a system that combines text, graphics and sound to present training and information (Dahmer 1993) and is an excellent tool for a non-traditional learning environment. Students can engage in interactive dialog with the computer and choose various lessons from the menu provided. Although this HyperCard program is not exactly a multimedia courseware, the author has incorporated text, graphics and animation into the content. Menus allowing student to choose their own learning options provide interactivity.

The stated objectives of this HyperCard program are:

* familiarize students with the physical layout and collection arrangement in the Colorado State University Libraries.
* teach students to use SilverPlatter CD products.
* help students to define and identify different types of reference sources.
* guide students through the intricacies of using the CARL system.

Since computer learning programs provide students with an individualized learning environment, students from diverse groups who may have different learning styles (Wayman 1984) and language barriers would benefit from this HyerCard program.

Future Planning

This HyperCard program is a preliminary study for future multimedia projects. The future goals include:

* incorporate sound - music and speech (in different languages)
* create full-color versions
* create 2 versions - Macintosh (HyperCard) and IBM (ToolBook)
* include reference sources in different disciplines
* demonstrate research methods - how to narrow down the topic and verify information

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UTLearn: Interactive, Online Instruction at the University of Toronto Library

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How to Reach Large Library User Populations with Instruction

The University of Toronto has three large campuses, over 60,000 students, and 49 libraries. In 1992, the University of Toronto Library (UTL) introduced a new online information system, called UTLink which contains the 7-million-item UTL Catalogue, online periodical indexes, a campus and library gopher, and other programs. Many students and others using UTLink and other online library services, access these remotely from their home or office by modems or through networks.

Instructing such a large and diverse library user population, which includes undergraduates, graduates, and part-time students is a challenge. The Library continues to use classroom-based instruction and other methods to teach information searching skills and strategies. But to meet the challenge of numbers in a more comprehensive way, the Library has developed an online interactive learning module called UTLearn.

UTLearn Offers Interactive, Online Instruction

UTLearn consists of two programs: MedLearn, which instructs users on how to access and search the locally installed Medline databases; and Teach Yourself, which contains information on how to search catalogues and databases, research and write essays, and find information in libraries. UTLearn contains more than 500 screens of information, is self-paced, and allows users to choose the level of detail they want to view. It contains both concept-based and procedural units. The premise of the concept-based units is that procedures on different systems vary but that general search principles remain similar on many systems. The procedural instruction units deal with the specifics of searching the Library's catalogue, which uses the Data Research Associates (DRA) interface, and the locally installed CD-Plus Medline.

The UTLearn project grew out of the Library's previous CBL programs in HyperCard and studies of users' learning methods and preferences on University of Toronto Library system. UTLearn offers a cost-effective way to reach more users than possible by other instructional means.

UTLearn: Successes and Limitations

- approach of choice for many learners
- gives identical approach in all locations
- available whether or not staff is available
- reaches a large audience of remote learners
- eliminates interpersonal bias (gender, race, age)
- gives no opportunity for real-time dialog
- is relatively easy to do and update

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An Architecture for Interactive Hypermedia Training Systems

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We developed an Architecture for Interactive Hypermedia Training Systems based on our experience in constructing Knowledge Based Systems, Hypermedia interfaces and Computer Based Training. To test these ideas we have prepared a prototype system to train people to repair a car.

The architecture consists of 4 modules: an interactive hypermedia interface, a knowledge base, an inference engine and a pedagogical strategy including evaluations.

The hyperdocument permits the user to choose among the options and thus create his own training.

The development of the architecture considered the following aspects:

- . The advantages of using a Multimedia interface (texts + figures + images + videos and so on) which provides motivation and makes possible the use of both sight and hearing senses. (Researches in training shows that learning is more significant when students' senses work together.)
- . The interactive power of hypertexts giving the user the freedom of making his own training.
- . The necessity of a pedagogical strategy with evaluations orientating the student and completing the learning cycle: motivation, perception, understanding, assimilation and the transfer of knowledge being exploited.

This Interactive Hypermedia Training System generally speaking, also stimulates the development of a critical sense once a constant interaction with user is needed. Aspects such as agility and organization of thoughts, as well as formulation of new ideas are also developed by trainees. When using this system Multimedia provides the motivation and the use of all senses helping to improve perception.

Conclusion

Our experience in constructing such systems has shown that putting together technologies on Education, Multimedia and Artificial Intelligence improves Computer Based Training Systems substantially.

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Computer supported co-operative problem handling

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The method COMPRAM supports the process of co-operative problem analysing of complex interdisciplinary societal problems. Interdisciplinary problems are problems which are often undefined, on which it is hard to find a 'solution', which has a great impact on society, and in which many people are involved. Knowledge and data of these problems are only partly available. An example of a complex interdisciplinary societal problem is the Aids problem, education in general, or building a world wide computer infrastructure. The method is specially developed for those problems, which can be analysed in causal relations. It can be applied to policy problems, but also for learning creative co-operative problem solving in education.

The knowledge of a complex interdisciplinary societal problem is, as far as it is available, known by experts of the different disciplines. Each expert has a good and detailed view of the problem on his or her domain, however often a vague view of the whole problem. In order to get an overall view of the problem, what phenomena are involved and how they are related, the knowledge of the different domains should be combined, and the white spots should be filled. In order to combine the knowledge the experts should come in contact with each other, discuss and exchange their domain knowledge in order to construct in a mutual effort the conceptual model of the problem.
However communication in a multi-disciplinary team is difficult. Except from the normal problems in group-interaction such as hidden agenda's, group think, and blind spots, there is the difference in professionally habits, language and methodology.

COMPRAM is an interactive method that supports the information exchange of a team of multi-disciplinary experts in their attempt to analyse complex interdisciplinary societal problems. The method is based on ideas coming from cognitive psychology, computer science, theories about group-processes, using system dynamic modelling and group decision support tools. The method can be regarded as a framework which includes several information retrieval methods from social science in combination with computer tools to support the exchange. In order to cope with the different professional background of the team, the method emphasizes the defining of concepts and the explanation of the theoretical ideas. A six layer model is used to express the model. In this model the problem is next to words, also expressed in graphical models, such as a semantic model, a causal model and a simulation model. The six layers together express the conceptual model of the problem. These different ways of expressing the problem makes it easier to understand the way the phenomena are related with each other and create. a kind of mutual language.

Because complex interdisciplinary societal problems are seldom fully defined the problem should be defined first before interventions can be considered. In several sessions of alternated individual preparation and group sessions the multi-disciplinary team will try to formulate the conceptual model and with this define the problem. In order to prevent group think on moments of discussion and brainstorming, groupware software is used to guarantee anonymous information exchange. The co-operative information exchange takes place in a Group Decision Room, and the whole process is supported by a facilitator. The method COMPRAM is developed by DeTombe ©.

Further research

Until now the method COMPRAM is defined and described till the definition of the problem, the first sub-cycle of problem handling. In the next years the method will be further defined till it includes all the phases of the problem handling process from awareness of the problem till evaluation of the implementation.

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Appropriate technology for a developing society: CAL for Basic Concepts in Chemistry

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The University of South Africa (UNISA) is the oldest (1946) and one of the biggest (120 000 students) distance teaching institutions in the world. Most of UNISA's students are located in southern Africa. For economic and geographic reasons, all aspects of teaching are handled by academic staff situated on a single campus. The method of communication with students is mainly by means of the postal service.

We need to use new methods or approaches to teaching that will benefit not only the student, but will leave more time for the teaching staff to improve the standard of tutoring in their specific subject areas. We also need to overcome third world's distance-education problems. These problems include:

* a sparse and dispersed population,
* a poor telecommunications network,
* students with varied cultural, technological and educational backgrounds,
* restricted financial resources resulting in limited options regarding hardware, and
* the expected increase in the number of young students that will result in an even poorer ratio of students to teaching staff than exists at present.

These are in addition to the normal disadvantage of distance education in that students feel isolated due to lack of interaction with lecturers and fellow students.

We have met these challenges by producing CAL that:

* does not rely too heavily on infrastructures outside our control,
* can be distributed to our geographically dispersed student body on diskette by post,
* motivates students by requiring active participation, and
* provides intelligent and individualized responses.

The study package for chemistry has consisted of study guides, prescribed text books and tutorial letters. In addition, a practical component is conducted over a limited period of time at a central venue. Distance teaching of a practical subject such as chemistry has many short-comings which can be overcome using computer-based learning. Animation is used to advantage to explain complex concepts as it is dynamic and visual and therefore students can see what happens; interactive problem solving gives practice; and simulations augment wet-laboratory experiments. We have developed our courseware package, "Basic Concepts", for first-year analytical chemistry students. This will be used to supplement the usual study material. The courseware is designed to run on standard, DOS-based microcomputers with EGA screens, equipment which is reasonably affordable and available throughout South Africa. This approach meets most of our teaching requirements. Our courseware:

* provides structured tutorials and detailed examples,
* generates questions randomly which require students to practice basic skills,
* accepts and analyzes a wide variety of student inputs, and
* gives detailed model solutions and appropriate feedback depending upon student input.

The results of pilot testing for a group of 27 students on campus are encouraging. Factors which were identified as being improved are increased motivation, mastery of concepts and active participation by students.

The Biology Sleuth: The Development and Evaluation of an Interactive Learning Environment.

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The Biology Sleuth is an interactive learning environment developed to give high-school students exposure to health science issues and medical problem-solving. Learning is explicitly supported in the following areas:

1. Increasing students' understanding of the scientific method and diagnostic reasoning, and helping them to develop skill and confidence in applying these methods.

2. Reinforcing and extending students' knowledge of concepts pertinent to the biological and health sciences.

3. Supporting "incidental" learning of certain skills (computer literacy; social and communications skills; algebra; reading graphs and interpreting data) and knowledge (geography; history).

The Biology Sleuth software has two components. The first allows access to factual information about several diseases which are genetic in origin or may be caused by nutritional deficiencies or environmental effects. The second component is a series of problem-solving exercises in which students must determine which diseases could account for a patient's symptoms.

Initial formative evaluations of The Biology Sleuth have been conducted. These evaluations have allowed the developers the opportunity to observe two classrooms of high school students using the software. These evaluations were video taped and segments will be available as a part of this demonstration to show students working through the problem-solving exercises.

The video tapes show that The Biology Sleuth was successful at encouraging students to participate in the formation of hypotheses, to discuss the methods used to generate those hypotheses, and to select additional data to be gathered. The performance of the students while working with the system raises two questions:

1. Should group members be solving problems individually at some point in order to maximize their development of the problem-solving skills involved?

2. How does the design of the system influence such group problem-solving behavior?

These questions should be addressed in future studies.

Speech Interactive Strategies Learning with Hypermedia System Assistance

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The animated debates on the last East-West Conference in Kiev have proved that modern computer aided education is characterized by swift changes of information technologies and concept paradigms. In information technologies, key positions are now occupied by Multi, Hyper, and Telemedia systems being actively used in creating educational courseware.These technologies significally expand the opportunities for learning speech interaction with computer.

In Simferopol State University, we have a three years reseach project for investigating cognitive and environmental principles of verbal communication and elaborating computer language usage courses on this theoretical base. Some results of the reseach work were published in (Dikareva, S., & Ilovajskaya, H., 1992; Ronginsky, V., Dikareva,S., & Ilovajskaya, H., 1993).

This poster presents a module LANA (Linguistic ANAlysis) of the linguistic educational-information system, which support learning speech strategies by access to an Interactive Knowledge Base (IKB).

Theoretical background. Speech activity is a complicated social and cognitive process based on a different type of knowledge: language, encyclopaedic and interactive. Language usage is determined by complex interrelation of these types of knowledge, and depends on opinions of communicants.

A distinguished russian scholar L.P.Yakubinsky (1986), in his paper 'O dialoguicheckoi rechi'(first published in 1923), mentioned 2 manners of language usage: a conscious choice preceded by 'a struggle of senses', and speech automatism (using speech stereotypes, or patterns). A person falls into 'a struggle of senses' when he/she is confronted with a speech problem. We mean situations in which one senses conflict about an answer to the questions 'What needs to be spoken (or written)'. To analyze such situations we use an approach to decision making developed at the field of AI (Underwood, John H., 1989). According to this approach making decisions is seen as a heuristic search among alternatives in a problem space. The decisions which determine one's speech behavior over some time is a speech strategy.

Module LANA's architecture. LANA's learning material is a collection of texts, pictures, schemes,and graphics. The IKB consists of interactive rules; dialogues types; dialogue diagrams; speech acts vocabulary articles; illustrative examples. Each dialogue type is connected with dialogue rules and diagrams. To solve a speech problem means to answer to some questions with the aid of the IKB. (what is desired, under what conditions, by means of what tools – spoken, written, or electronic, etc.).

In organizing Multimedia material, we use an authoring Hypermedia system (Dikareva, S., & Ilovajskaya, H., 1992). The system functions on the base of IBM PC/AT or compatible PC.

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Teachers Guide: Classroom Instruction Utilizing CBI

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In the arena of elementary and secondary education there have been many technological innovations that have been introduced and placed into hiding in audio-visual closets. Computers and computer based instruction is next in line, after many technological innovations, to fall into disuse because of lack of preparation and guidance for the teaching population. In order for diffusion of the innovation to occur, teachers need to receive the necessary support for them to successfully utilize computer technology in the classroom. The computer can be a powerful educational tool if incorporated into the curriculum properly. With the advent of microcomputers teachers gained a valuable teaching tool, a tool that is able to instruct, involve, and motivate almost any student; unfortunately, the computer is also able to bore, infuriate, and confuse almost any student. What the computer succeeds in doing is determined by the quality of software being used and the expertise of the teacher who is trying to incorporate microcomputers into the curriculum.

With the use of appropriate software and a certain amount of teacher expertise, the computer can be an asset to many educational programs. If used properly, the computer can aid students in the mastery of curriculum content and teach skills such as: math comprehension, reading comprehension, computation, vocabulary, grammar, punctuation, brainstorming, problem solving, scientific investigation, sequencing, editing techniques, and building mental schemas. These and many other skills can be easily and effectively taught with the aid of computers. In teaching these skills, the computer, when properly programmed, is able to use multiple learning modes: bright contrast and movement enhance the visual; kinesthetic learning is brought about by the use of the keyboard; and group interaction facilitates auditory learning (Morrison, 1983). Because a variety of learning modes can be used during instruction, retention of concepts that have been presented may be improved.

Unfortunately, many teachers are ill prepared to take advantage of the many teaching and learning opportunities the computer could afford them. According to the Turner Broadcasting System (1990), 97% of the schools have computers but only 50% of the teachers know how to use them. One teacher expressed the problem quite clearly, "There could be some giant mistakes if we think technology alone is going to change things. We need a staff that looks at how a child learns and asks the question 'What learning do you want the child to do?'" (Schulz, 1991). In order to utilize the computer effectively as a teaching tool, teachers need to know how to use the computer and to be familiar with the many teaching activities that it will enhance. For these ends to be accomplished, teacher inservice needs to be provided in these areas.

The use of computer technology needs to be addressed by and exemplified by our public schools. The question, "Why use technology?" was addressed by Finkel (1991) in his text *Technology Tools in the Information Age:*

1) To prepare students for the world they live in.
2) To prepare students to be a part of the technological work force.
3) To increase productivity of teachers and students.
4) To teach problem-solving.
5) To make it easier for teachers to provide a variety of learning and teaching strategies to meet the individual needs of learners.
6) To give teachers more time to spend with individual students.

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Developing a hypermedia package on reproduction in plants, protists and fungi.

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A hypermedia remedial package has been developed for first year students studying botany at the University of the Witwatersrand, who find it difficult to understand and apply certain fundamental concepts about organisms' life cycles. This problem is especially prevalent amongst educationally disadvantaged students, and is found in other courses on plant reproduction at both secondary and tertiary levels.

An action research approach has been used, comprising three stages:

1. A combination of research methods was used to identify specific learning problems of the students.
2. A hypermedia package was developed to remedy the learning problems identified. Formative evaluation was carried out as sections of the package were developed, and consequent modifications were made.
3. A summative evaluation of the package will be conducted during formal implementation.

The outcome of the first stage of the study was the definition of instructional objectives for the package, in the light of the learning problems identified. Elements of constructivism, meaningful learning, schema theory, and conceptual change formed the theoretical basis for the design. The instructional objectives are to promote deep level conceptual learning with large numbers of students by ensuring that:

- the relevance of the practical component to the theoretical component of the course is made explicit,
- students practise transferring and applying fundamental concepts to different representative organisms, divisions and life cycles,
- alternative explanations are provided (to those given in class, as well as some in the application),
- students are offered a conceptual model of reproductive mechanisms in order to expand, re-structure or practise using new knowledge structures.

The following broad instructional design strategies were used during the second stage of the study, in order to meet the instructional objectives:

- Traditional computer-aided instruction modes (tutorial, quiz) and hypermedia features were combined to provide a flexible, yet structured learning environment.
- Varying levels of detail of explanation and questioning, as well as a variety of explanations for similar concepts were used to cater for the diverse learning needs of the heterogeneous student group.
- A conceptual model for learning about reproductive mechanisms, with visual "cues" to show similar patterns for different organisms, was used within individualised interaction sequences.
- Fundamental concepts that were incorrectly understood by students were incorporated into feedback cycles, which differed according to students' responses to specific tasks.

Students' lack of exposure to computer-based learning environments, and a predominance of learners with poorly developed metacognitive skills, necessitated that:

- "high risk" features (such as the user-interface and content structure) be identified, developed and tested with students and staff early in the development cycle,
- cognitive demands of the hypermedia user-interface be minimised to enhance ease of use,
- a strong diagnostic research component precede and supplement design and development.

The Design of a Computer-Based English Composition Prewriting Assistance Program for use in the Classroom

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A great deal of research in the eighties focuses on using the computer as a tool in English composition courses. Many researchers (Flood, et al., 1991) maintain that the word processor has helped students in English composition because students are able to compose and revise essays, and share text with other members of the class. Selfe (1985) finds students reluctant to use the computer for more than the final draft of an essay. Higgins, Flower, and Petraglia's (1992) research focuses on the planning process or prewriting. They believe the collaborative effort makes students better writers. Because of this research the authors have undertaken the design and programming of a computer assisted prewriting program called CAPP.

Model Based Development

To develop CAPP, the authors sought a basic model that describes the planning and organizing techniques of writing compositions. Two main sources, Axelrod and Cooper (1991) and Sorenson (1992) provide the main ingredients for the model. By combining these models, a typical CAPP session guides the student through finding a topic, gathering information, discovering what is already known, and writing a thesis sentence. Because of the structure of the program, students can analyze their audience or assemble their research either before or after choosing a topic.

The overall design and implementation follows a typical menu-driven model. The top-level menu has five main choices: FILE, PROJECT, RESEARCH, EVALUATION, and HELP (see figure 1). The entire program centers around the idea of the composition being a project.

FILE	PROJECT	RESEARCH	EVALUATION	HELP

Figure 1– Top-level Menu

The testing of this software is qualitative in nature to determine how students will react to mechanics and aesthetics of the program. The primary concern for the authors is to learn how the students interact with the program and to learn if any kind of logic error or failure to consider user needs have been overlooked. The primary question that must be answered is, "Will instructors or students use the program?"

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Curriculum Delivery via Remote Means

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This paper will centre on a program called Electronic Classroom. It will also be hopefully possible to see the program in action via a live demonstration across Australia where a colleague of mine, Richard Owens, from the Apple office in Queensland will use the Electronic Classroom program to show the audience how the program works. During the course of the demonstration, we will be showing aspects such as an ability to read compact disks remotely as well as the ability to transmit graphics and quicktime movies.

In the state of Victoria, there is burgeoning interest in distance education or remote delivery mechanisms. The reason for this lies in the fact that given that the state is small by Australian standards, there are still some very large distances within it.

The program has been written in the Pascal programming language by Robert Crago who has a company called Revelation Computing in the state of Queensland.

In principle, it behaves like a very powerful electronic whiteboard which supports graphics transmission as well as Quicktime. It can connect upto five remote locations simultaneously thereby making it possible for a teacher to use it in a distributed teaching situation. The teacher can enable the program to accept student input which all of the other participating students can view.

The Electronic classroom arose out of a need to teach subjects in a situation where there were great distances between teachers and students. One of the main uses of the program lies in the LOTE or Languages Other English Area. For example, the program has been used in the teaching of Japanese in a situation where there are small groups of students and one teacher in geographically isolated locations.

The state of Victoria is in the throes of condensing the number of schools especially in the senior high school area. The object is to provide a smaller number of larger secondary colleges where a more comprehensive curriculum can be offered. A consequence of this is an interim arrangement where some of these colleges might have multiple senior campuses. In much the same manner as above, the Electronic Classroom program has been employed to teach classes across the campuses which might never have been able to run due to a shortage of teaching expertise or an insufficient number of students.

It has also been used to enable classes to be conducted between secondary colleges and feeder primary schools, thus enabling valuable links to be developed.

By the time this paper is given, there will be a community-based project called the NE telecentre . This is situated at Wangarratta (200km NE of Melbourne) and the people in the centre will be using this program to run a series of community based education projects situated in towns over 130km away from the centre itself.

Over 650 copies of the program have been sold as at February, 1994. In Victoria, there are over 200 users of the program.

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Distance Education
At California State University, Chico

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Distance education (DE) is a concept that has been around for sometime. Certainly the concept of a "book" originated so that information could be communicated to people throughout time and at a distance from the information's original source. DE spans both these dimensions: time and distance. Budget problems are forcing education to think about new paradigms for teaching more people with more diversity, but with less money and fewer resources. As technologies become more affordable and the capabilities ever-increasing, more attention is being brought to this field.

Flexibility, equality, cost efficiency and cost effectiveness are some of the advantages that DE has to offer. For students in the rural communities and students in big cities, avoiding the commute saves both time, money, and frustration. The flexibility of learning in the students' own environment makes distance education appealing to students. Students who need to stay closer to home to manage a family or to supervise employees can now have the opportunity to educate themselves. No longer are the students reliant exclusively on the education that is available within their own area. DE gives students the possibility to be taught in their field of study by some of the best teachers around the world. Universities no longer need to have a faculty member teach 4 sections of the same class. Less real estate is needed to teach a larger number of people and maintenance costs therefore decrease.

Simplistically there are seven tools used to achieve DE: print, radio, phone, TV/monitor, playback devices (e.g. tape recorder, VCR), computer, and FAX machines. Each of these devices can be used with different "delivery methods" to create a rich learning environment. Methods include the use of ISDN, tele- and videoconferencing, satellite, and multimedia. The use of these tools and methods are changing rapidly and allow unlimited possibilities for the future.

California State University, Chico is using five different methods of DE on campus. First, the ITFS Program, Instructional Television for Students, has been serving 16 sites in Northern California since 1975. Over 650 courses have been offered in 40 disciplines to the 11,159 students enrolled in the off-campus ITFS program. Second, Chico State also the SEN Program, Satellite Education Network, which delivers courses for a BS or MS in Computer Science via satellite to 14 corporate sites in 12 states. Many of the participants in this program are employees from companies such as Alcoa, Hewlett-Packard, IBM, MCI, and Pacific Bell.

Two separate software products are being used on campus to promote DE and develop interaction in the classroom. CUSeeMe is a free program developed by Cornell University that allows a Macintosh equipped with video capabilities to view a colleague over the Internet. FirstClass is a "groupware" product which is used by students in Physical Education and Recreation courses to send e-mail to one another, the instructors, and teaching assistants. FirstClass also allows conferencing on particular subjects, and uploading/downloading Hypercard and multimedia files for use in their projects.

The last DE method being developed on campus is curriculum for CSU's Project DELTA - Direct Electronic Learning and Teaching Alternative. Curriculum modules are being developed to run with multimedia, ISDN, and/or videoconferencing.

Chico State has an outstanding reputation for doing DE over the last 20 years. Still today Chico State continues to develop new ways to do DE with the new technology as it becomes more affordable and more available.

Hooked on Hypermedia

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Introduction:

Today, tomorrow, and for tomorrows after that, our students and ourselves will be bombarded with a continuous and relentless stream of massive amounts of information. To turn these quantities of material into usable knowledge, we have to be able to organize it in such a way that permits us to retrieve information efficiently. HyperStudio, HyperCard, and HyperScreen software programs are information organizing tools, that enables our students to present information effectively. Using hypermedia, students are able to relate text, scan images, draw, and include sounds for original and interesting presentations in a variety of subjects.

Background:

Eighth grade students in Freehold Township School District have successfully used these hypermedia programs over the past four years. To focus and motivate students interest, a student project is to design a stack that is based on one of the topics covered in the fourth grade science or social studies curriculum. The students plan, revise, and test their individual stacks until they are error-free. Then, they demonstrate their stack to a group of fourth grade students in our district. A copy of their stack is left with the fourth grade teacher so it can be used during class time for review. The eighth grade students print-out each screen and put it in booklet form to take home. Stacks are also videotaped so they can show their programs at home.

Educational Advantages:

In the process of planning and creating a stack, students develop and refine skills for problem solving, goal setting, analyzing data, synthesizing ideas, thinking in a non-linear way, organizing information, thinking visually, making decisions, developing a point of view, designing, testing, and revising a system as well as locating, gathering, and evaluation information.

Using hypermedia programs has enabled students to realize the importance of computers as a tool. They find that using the computer is a highly motivating and develop a greater appreciation for the skills involved in creating stack presentations. Student self-esteem rose as they realized near professional results achieved in their final projects. They were able to analyze their perceptions about their work and realized that one of the primary goals of computer education is to effectively integrate information assimilated in a computer class across the curriculum.

Conclusion:

This project has proven to be effective. It has enabled students to understand the importance of the computer as a tool. This was demonstrated by students realization of the value of the experience by applying what they learned to other areas of study. They are hooked on hypermedia.

Acknowledgements:

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Inside the T9000: Hypermedia Explanations of a Parallel Microprocessor

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Continuous advances in VLSI technology have recently made it possible to produce more and more complex microprocessors and, as a consequence, the need has arisen for innovative documentation tools. Conventional purely textual technical manuals, even if supported by several graphics, fail to clearly explain the dynamic behaviour of these devices.

The key concept of the illustrated work is to combine a hypermedia information framework with interactive graphic animations to simplify the educational and training activities on microelectronic devices. The Hypermedia approach has been adopted to develop an original form of technical documentation for the INMOS T9000 transputer (INMOS is a member of the SGS-THOMSON Microelectronics Group). The T9000 is the last member of a family of parallel microprocessors which are normally used to build distributed computers. To complicate documentation issues further, it can simultaneously perform internal parallel operations and exchange messages and data with similar devices; this makes its description very difficult.

The developed system consists of a fully interactive graphic model of the T9000 which can be explored to observe the architecture and the working mechanisms of the transputer. Dynamic behaviour is made much clearer by interactive graphic animations integrated in the model. The modelling of the T9000 has been performed through multiple levels of abstraction of the real physical architecture of the system. At the highest level, we consider the T9000 as a whole; at the next level, the T9000 is structured as a set of subsystems, which in turn can be broken down to obtain deeper and deeper detail levels. Consequently, at increasing detail levels there are correspondingly more and more accurate explanations and animations.

User interaction is based upon a direct manipulation of the objects shown on the screen; these can be labelled boxes representing the model circuital components or buttons providing users with tools to control navigation. Components are explored by clicking on the corresponding labelled boxes. A backtracking button provides a link to the previous abstraction level.

An animated guide acts as the presenter of the microprocessor. Users can watch the guide at work on the screen, while it explains - through typical balloons - the component or animation of their choice. Consequently, the developed hypermedia application resembles a fully interactive comic-strip story of a rather sophisticated subject such as the INMOS T9000 transputer documentation.

Vocal comments can be activated through a "microphone" button during lessons and animations, in order to have more details on a component or mechanism.

The user interface has been designed in such a way that users are not aware of the hypermedia structure of the documentation. Yet, the fully interactive model adopted by the system permits users to establish their own navigational paths through the model: at each level, users are allowed to explore components in the order they prefer. As a consequence, users have complete control over the presentation order. A pleasant side effect of the multilevel model is that the system can be used by users with different knowledge requirements. In fact, users can stop their navigation at the wished detail depth.

In the opinion of the authors, hypermedia presentations, such as the illustrated system, can be used as effective communication media to document microelectronic devices and, consequently, to reduce technical training costs and teaching efforts.

Acknowledgements

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Using the A* Search Space to Develop a General-Purpose Intelligent Tutoring Shell

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Many applications for an intelligent tutoring system involve problems that require quantitative judgment -- for example, scheduling, automotive repair, and manufacturing design. We wanted to use a single paradigm to model these problems so we could build a library of lesson material on different subjects while minimizing resource requirements. The solution we found is a tutoring shell, called ASTutor, using the A* search algorithm. A* has the advantage of being able to handle the widest range of search problems. Problems that can be adequately solved using best-first or branch-and-bound can be solved in A* by eliminating the use of some A* functions. Conversely, we would be unable to model an A* problem using best-first or other search techniques.

Overview of the ASTutor System

ASTutor is a problem-independent interface shell written in Quintus Prolog and provides the main command loop, standard input and output routines, and general-purpose tutoring rules to detect a student's errors. ASTutor problems can be compiled into an executable file, or interpreted from within the Quintus Prolog system.

Teachers build lessons by writing Prolog rules for problem-dependent A* search routines (goal description, cost and evaluation functions), database management requirements, and input/output routines. The database management requirements are the lesson-specific facts and rules. For input/output, the teacher must prepare templates for displaying the current state and providing means for a student to query for more details about some aspect of a state or potential actions to take. We do a qualitative comparison of actions ("better", "much better", etc.) since numbers produced in an A* search will rarely mean anything to the student.

Upon running an ASTutor problem, the student will receive an introduction to the problem along with a display of the initial state. He then must perform an A* search towards the goal, aided by ASTutor. At each step, the student must choose from a list of possible actions. If the action does not appear to be the best action based on the results of the problem-dependent A* routines, ASTutor will notify the student. The student may try a different action, continue ahead, place a bookmark on the current state while he explores other possible actions, backtrack, or prune known incorrect actions. He continues to run the problem until he reaches a goal state.

Case Study of Decryption and Future Research Directions

Our primary case study is the problem of decoding a monoalphabetically encrypted string. This is a good case study because of the large number of choices a student has at each step. It identified some key problem areas to explore: First, that we must provide a system of tolerances so that ASTutor will accept approaches not siginificantly more costly than ASTutor's solution. Second, that we must build checking and heuristic-naming routines to ensure the cost and evaluations functions are adequate. Third, we need to build lesson-construction tools in order to hide the Prolog code implementation from the teacher.

We are exploring combining ASTutor with means-ends analysis based tutoring. This will afford us the ability to quickly evaluate both the student's choice of action and the student's choice of parameters. We have built a preliminary lesson-building program for teachers which uses object-oriented modeling of the scenario and provides checking routines to ensure a lesson description is both complete and consistent.

Neuroinformatics at the Secondary and Post-Secondary Levels of Education in Lithuania

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The traditional informatics is based on the paradigm of sequentional computations to evaluate functions and solvings. Today a wider and more coplex notion is necessary. The computer is to be seen as a component in a distributed, interactive systems of human, computers, machines and other artificial and natural dynamical systems such that the paradigm of a group of communicating individuals is more adequate. In particular the areas of artificial intelligence and of artificial neural networks are considered to be subareas of informatics. Therefore the neural computational linquistics and cognitive science are very important for engineering, communication theory and cybernetics as well as for education processes at the secondary and post-secondary levels. The main aim is to get to know pupils and students new ideas of informatics: neural models, neural networks, parallelism in computing, learning with/out superviser and recalling, introduction in neuroinformatics, neural network software applying in different practical areas.

The main objectives of this activities are following:

a) to introduce a new area of informatics, i.e., neuroinformatics for older classes of Lithuanian secondary schools and students as well as in other Baltic Countries;

b) to create simple with high visualization education neural network software and to promote in practical classes of the secondary and post-secondary levels of education;

c)to use wide the computer-electronic networks for education process together with new ideas of neuroinformatics;

On the basis of the teaching of informatics (Bauer, Goos, 1982, 1984; Brauer, 1987) and the neural network software made by NeuralWare, Inc. (Klimasauskas, 1989) and ourselves we have been created the neural network introduction curriculum for older classes of the secondary schools. This course will be promoted by computer network using the electronic mail principles.

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Computerized Testing Using an Authoring System

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Currently available computer software authoring packages offer many options for the development of educational applications. One such application is that of computerized testing. Considerable research has been conducted regarding the feasibility, advantages, and effects of using computerized testing in educational settings (Bugbee & Bernt, 1990; Legg & Buhr, 1992; Mizokawa, 1991; Powell, 1992). Although much research has been conducted regarding computerized testing, its use in the classroom has not been widespread. This may be due to the fact that many educators do not have the programming skills necessary to develop this type of application (Mizokawa, 1991). An alternative for those who lack the necessary programming skills and/or the time to learn a programming language is one of the many authoring packages currently available. One authoring package, *Authorware Professional*, employs an object-oriented interface and has been used in the development of a computerized testing system.

The purpose of this presentation is to demonstrate the use of multimedia technology using the authoring package, *Authorware Professional*. The computerized testing system that has been developed using *Authorware Professional* enables the user to develop many different types of testing formats and generate equivalent tests with randomly selected items. The tests are computer-administered and utilize several types of formats including multiple choice, true-false, and short answer. Some test items include graphics, digitized video, and/or sound, and responses are given in several different ways, including pushbuttons, text, and use of the mouse. Testing systems have been developed for use on both the Macintosh and Windows platforms.

Advantages of using a computerized testing system have included more time for direct instruction and teaching, rather than using class time for exams; students are able to take the tests when they feel they are ready; tests can be adapted for students with disabilities (i.e., key pressing vs. mouse); instructors spend less time developing and correcting tests and more time in preparation and research for class instruction; students receive immediate feedback on test scores and incorrect items; the test can be stopped for students whose responses indicate they do not know the material, thus reducing frustration; different versions can be administered to discourage cheating; because items are given one at a time, it's difficult to use clues from other items; and test items can be added, revised, or deleted with little difficulty.

The advantages of using an authoring package to develop a computerized testing system include less learning time than that needed for learning a programming language; use of graphics, digitized video, sound, etc. within a test, ease of use; and because models can be developed and used over and over in various applications, less development time. These advantages make the use of an authoring package for development of computerized testing as well as other educational applications a feasible alternative for educators.

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Distance Learners' Perceptions of a Computer-Assisted Learning Programme Designed to Enhance Their Decision-Making Skills Integral to Nursing Practice

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Developing Decision-Making Skills by Using CAL

Decision-making experience in nursing practice is essential for nurses to develop skills in management. Yet, practitioners cannot normally acquire these skills except by experience in a management environment itself. A specially designed computer simulation programme in decision-making allows the development of these skills in such a situation without risk to student or client (Curry, Elliot, Wheeler, and Robert, 1991). In pursuing this point Lauri (1992) describes how computer simulations can be used as a means of assessing the decision-making processes of nurses who are working in public health. However, students need to feel comfortable with CAL in order to obtain maximum benefit from its teaching programme. Additionally the structure, content and presentation of CAL needs to complement the individual student's learning style. Most nurses are adult learners and, according to Knowles (1986) are orientated towards and motivated by learning which is relevant to their purpose. This is of especial importance to distance education nursing students, many of whom select distance education courses as a means of development.

Decision-Making Skills, CAL and Distance Education Nursing Students

Distance education programmes for nurses in Australia still depend mainly on printed text-based materials. Little has been done to make computer-assisted learning (CAL) available to these students, lack of research into learning styles and CAL compounding the problem. A study was conducted to investigate the students' perceptions of a CAL programme designed to enhance and develop their decision-making processes. The programme was based on theories of problem-solving and decision-making, and on knowledge of nursing management and leadership styles. The programme uses a case study simulation approach, presenting nursing management situations coomon to the health care environment. The distance education students responded positively to the simulations and the programme worked well. Two of the main conclusions from the study showed that the programme was effective as a learning strategy for the majority of the participants, regardless of their individual learning styles. The interactivity between the student and the computer programme combined with the feedback to the student, emerged as a factor crucial to the success of the programme. The main findings suggest computer simulation case studies can stimulate, enhance and motivate learning and be used as a means of promoting the development of decision-making skills for distance education nursing students. Other findings include:

F1: CAL content, structure, format and presentation are more important than sophisticated technical or visual capabilities.
F2: Written guidelines and lecturer support are a priority for distance education nursing students who are using CAL.

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Using Distance Learning Technologies to Provide Mathematics Inservice for Middle Grade Teachers

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The concept of distance education using information technology has been explored and found to be a viable substitute for traditional modes of delivering instruction. Distance education in such forms as correspondence courses and instructional television has been used for some time. Distance education via satellite has emerged only within the last decade with extensive efforts in the state of Alaska as early as 1983. Other agencies, such as Oklahoma State University have taken the lead in the development of this form of distance education.

Information technology, as it relates to distance education, continues to develop with dramatic speed. One of its major contributions is to provide training and staff development in locations where formal instruction, expert teachers, and sorely needed resources are difficult to obtain. Distance and lack of resources make it difficult for many teachers in Missouri to receive continuing education. The major goal of this project was to make use of information technology to update and revitalize the training of middle grade mathematics teachers.

Overview of the Project

In this project, a one semester hour, graduate course was developed using a video tape format and broadcast via satellite to 19 school sites in the state of Missouri. The focus of the course was on identifying strategies, activities, and resources useful in teaching middle grade mathematics. The course consisted of eight meetings, one per week, of which six were broadcast sessions. The mathematics content of the course focused on estimation, statistics, probability, geometry, patterns, and problem solving.

For one-half hour before the start of a broadcast, participants engaged in a variety of activities at individual Host Sites. At each site there was a designated Site Facilitator who directed discussion of activities that the teachers had used with their students the preceding week. The Site Facilitator also provided introduction to the topic(s) to be investigated during the broadcast session to follow, provided the participants with materials they would need, and answered questions concerning the topic(s) of the previous week's broadcast.

For one-half hour after the one hour broadcast, the participants worked on homework and other assignments and discussed the broadcast session they had viewed that day. The Site Facilitator clarified homework and other assignments, monitored each teacher's portfolio, and served as a resource person during this time.

The broadcasts were interactive in that a school site could call the broadcast facility on a designated toll-free line and ask questions about the current lesson or seek other information regarding the course. These questions were answered "live" at specified times during a broadcast.

The six video tapes were planned, scripted, and narrated by eight TV Presenters, each of whom was a practicing middle grade mathemtics teacher. Resources, technical expertise, and production facilities were provided by Central Missouri State University while broadcast faciltities were provided by The Missouri State School Boards Association. Each video taped lesson contained the following components.

1. Two or three TV Presenters introducing and developing the topic for that particular lesson
2. Computer generated graphics used to illustrate and amplify the mathematics concepts for that lesson
3. Vignettes showing middle grade teachers and students in classrooms engaging in a variety of activities
4. Vignettes showing how the mathematics from the lesson is applied in "real-world" settings

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Distance Education: Interactive Video Conferencing in Music Instruction

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Communications media—in the form of radio, television, motion pictures, telephones, and computer controlled information systems—have defined modern culture on a global level since the 1930s. Burtenshaw's (1993a, 1993b) ideas about distance education and previous experiments with video conferencing have provided us with a glimpse of how video conferencing technology could revolutionize music instruction transcontinentally. Rather than fully-interactive sessions, where participants are able to immediately respond in an echoic (rote) or sequential manner to a teacher's instructions, most video conferencing experiments involve the observation of teacher-student interactions in live teaching situations. In a distance education context, Gouzouasis (1994) has successfully experimented in a limited interactive context with preschool children. Based on that study, he concluded that even though video resolution quality was not optimal with a two line transmission, video conferencing is a cost effective communications technique and distance education tool.

With the intent of exploring mass media in education, the purpose of this live demonstration experiment will be to learn more about the use of video conferencing in a music learning environment. Specifically, the the primary problem will be to examine the efficacy of video conferencing—between sites in Vancouver, British Columbia and Sydney, Australia—in a multifaceted, interactive, music instruction segment with preschool children. Concomitant with the purpose, the secondary problem will be to further develop objective techniques for the evaluation of teaching techniques and materials in video conferencing instructional sessions.

This work is important from a number of perspectives. First, although music is an essential component of multimedia, visuals are usually the emphasized media of expression. Second, children's educational programming does not adequately provide a broad base of music information to young children. Moreover, the developmental appropriateness of televised materials may be questioned on a number of levels, especially in a music education context. Third, video conferencing applications in distance education tend to lack total interactivity between presenters and participants. It is from that perspective that the researchers wish to explore the full potential of video conferencing technology in an interective setting that requires the transmission of sophisticated acoustic and visual information.

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PRABODH: An Intelligent Tutor for Teaching Language Skills to Young Children

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Intelligent Tutoring System (ITS) is characterized by inclusion of three kinds of expertize, domain knowledge, knowledge of students learning behaviour and tutoring strategic knowledge. The programmes incorporating these expertize are embedded in a sophisticated instructional environment which facilitates tutorial communication.

PRABODH is an ITS designed for teaching Hindi language skills to young children to provide them meaningful practice to develop the requisit level of automaticity in grammar skills. It is an authoring system which allows a teacher to construct individualized tutorials, drills & tools for students.It can be easily integrated into the curriculum of primary level language teaching and learning by practicing teachers.

Description of the framework

It has six components. *The domain knowledge component* contains the knowledge of Hindi grammar appropriate for primary school teaching. The sequencing of this knowledge is maintained by a topic network where a topic represents a unit of knowledge that can be taught.

The strategic knowledge base, acquired from teacher experts, contains knowledge of how to teach. PRABODH has a structured curriculum. There are lessons linearly structured but topics in them are componentially structured. The tutor module facilitates acquisition of strategic knowledge from the tutor and presentation of the information to the student and acquiring students' responses, by - *tutor* interface, student *interface and tutor engine* respectively.

The student model component keeps track of students' knowledge and needs through diagnosis and modelling.It allows to detect the students' misconception or missing conception and then through the presentation of right remedial material the errors are overcome. The student model also has a *learning component* to incorporate learning new facts about students' behaviour from their responses.

Beside teaching Hindi as mothertongue it can also be used to teach Hindi as a second language or foreign language by the inclusion of right kind of tutorial material.

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Developing Effective Simulations for Problem Solving

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Simulations provide an environment in which learners interact with a knowledge domain in ways different from that of either direct or tutorial instruction. However, many computer programs which purport to be instructional simulations are instead a type of adventure game or simply graphic representations of events or processes. Essential criteria for simulations are identified by Gredler (1992). First, simulations for instruction are dynamic evolving exercises in which the student accepts a functional role and/or responsibilities and interacts with other individuals or with a complex evolving situation. Second, simulations involve the ongoing interactions of at least two variables according to a verifiable qualitative or quantitative model that relates the changes in one variable with changes in others.

Types of Simulations

Analysis of the relationships between the learner's role and other variables indicates two major types of simulations (Gredler, in press). They are (1) experiential and (2) symbolic. Experiential simulations establish a particular psychological reality and place participants in defined roles within that reality to interact with an evolving scenario. Examples of experiential simulations include diagnosing and managing the treatment of a comatose patient in the emergency room, managing the finances of a bank or corporation for several business quarters and interacting with one's neighbors concerning the proposal of a nuclear power plant to locate in the village. In contrast, symbolic simulations are intact data bases, complex systems (e.g., an ecological system or complex equipment system), or sets of processes in which students conduct research on the data base or attempt to discover key components of the system or set of processes. In an experiential simulation, the student is a major component of the situation whereas the student operates on but remains external to the symbolic simulation. Experiential simulations, in other words, provide students with opportunities to practice complex professional roles whereas symbolic simulations provide opportunities for developing mental models and conducting complex projects.

The creation of effective simulations is a complex task, much more difficult than preparing a classroom lecture. However, their use adds immeasurably to the development of the students' repertoire of higher order thinking skills including those such as cognitive strategies, decision making, and problem solving.

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Infusion and Transfusion of Instructional Technology at NAU: Exploring Models for Professional Development in Higher Education

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The Transfusion for Infusion Model

The Center for Excellence in Education (CEE) at Northern Arizona University (NAU) prepares teachers, school administrators, educational psychologists and counselors for our nation's schools. CEE's Mission Statement includes a technology initiative which calls for the infusion of technology by faculty into all discipline areas, where educational technology is modeled for undergraduate and graduate students in all courses where appropriate. With most faculty teaching full time and with overloads, with growing student numbers causing increased class loads, and with research and service obligations, most faculty have not had the time required to learn new technologies or develop classroom applications supported by technology.

The CEE Technology Committee received a 1-year grant which funded release time (transfusion) for one faculty member from each of the following areas: special education, instructional leadership (elementary & secondary), educational leadership, educational psychology, bilingual and multicultural education, and instructional technology. Each of these seven faculty members were granted 1/4 release time for two semesters for staff development in the area of multimedia. College administrators have taken seriously the recommendations of their faculty to provide release time in technology development and provided this release time as their match to a university-funded technology grant. The grant participants believed it was through the transfusion of time that infusion of technology would take place.

Using a trainer-of-trainer model, the faculty spent the first grant semester learning a particular application or portion of multimedia (i.e., still video camera, interactive video, HyperCard) and are teaching other grant participants that application. Participants are applying that knowledge by developing an application for their particular area or discipline, and will demonstrate the direct application to classroom instruction to colleagues in that area. This development process is documented throughout the project by journals and through a tracking model for innovations in technology. Four seminars are planned during the second semester: three instructional seminars for CEE faculty on instructional design and goal setting. A fourth general session on multimedia equipment available at CEE has been held for all interested NAU faculty. The grant participants will also write working papers which will be published and distributed to CEE faculty, then to any interested NAU faculty.

Two areas for future study have emerged. 1.) Participants report that release time for technology learning and development is not a particularly ideal solution when administrative priorities do not also include finding teaching replacements. Six of seven participants are participating in the project as an overload and time still appears to be a critical issue. All 7 participants have continued their involvement to various degrees, and overload compensation has been appreciated. Real release time, however, will be sought for future projects. 2.) Goals set by individuals with guidance from educational technology faculty, rather than the goals outlined in the project, also became important for successful participation. Just as with our preservice teachers, amount of familiarity and comfort with technology available determined the extent of participation by faculty on the grant. Three faculty participants, who were minimally involved with instructional technology before the grant, worked with an educational technology faculty member to find an appropriate place for themselves in this project--finding software applications and infusion strategies that worked in their content areas. All other participants spent their time in learning to use multimedia hardware and software. On reflection, it may be these three faculty who were able to move the farthest in technology infusion and to impact student use of technology integrated into course projects the most.

Distance Education Technology:
A Course for Teachers and Librarians

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Description

Distance Education Technology is a course offered by the Educational Technology Department at the University of Hawaii at Manoa. The course was developed to serve two populations: teachers and librarians; therefore the course was cross-listed with the Graduate School of Library and Information Studies. The goal of the course was to explore various technologies used for delivering and retrieving information for school-based and distance instruction. Voice, data, and video served as the topics as well as the mechanisms for interactive delivery of course content and student projects. Emphasis was placed on the application of technologies in Hawaii's public schools. The course was delivered live and interactively over the Hawaii Interactive Television System (HITS), a 2-way audio/2-way video system. Class activities included lectures, guest speakers, demonstrations, mediated instruction, class discussions and team presentations. Assignments were telecommunicated to the instructor using fax and electronic mail. Class projects were presented by students live over HITS.

The coursed aired daily for 3 weeks during the 1993 summer. There were 45 students enrolled in the origination site and 22 enrolled at 5 receive sites on 4 neighboring islands. A combination of fiber-optics, coaxial cable, microwave and ITFS technologies were used to broadcast the course statewide over HITS. All students were given Internet accounts and used modems, videotex terminals, computing center terminals, and computers on ethernet LANs.

Course Objectives

1) define terminology and acronyms of technology used in education.
2) describe major characteristics of information technologies and analyze their strengths and weaknesses in delivering school-based and distance instruction.
(3) describe applications of technology being used to solve instructional problems in Hawaii's schools.
(4) discuss implications of telecommunication systems and networks in providing and accessing information from libraries, government and other public resources.
(5) discuss potential problems educators face in designing, producing and delivering direct instruction and resource information over telecommunication systems.
(6) write a grant proposal for improving the accessibility or delivery of direct instruction, resource information, or communication at a school or resource center through technology.
(7) present grant proposal orally and visually over HITS.

Outcome

A course evaluation confirmed the appropriateness of the content to both teachers' and librarians' needs. There were no differences in overall course ratings between on-campus and receive-site students. The use of electronic mail was clearly identified as a critical component for the course's success. The grant proposal was another component of the course receiving especially positive ratings. Students worked hard on their proposals. A number of proposals were submitted for actual grants and one of them was awarded $44,000 by a school district in Honolulu.

The Effects of Videodisc Training on Student Learning

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Purpose of the Study

The purpose of this study was to determine the effect of using videodisc-assisted instruction on student learning in a business education classroom as part of the regular curriculum offering.

Methodology

Subjects were drawn from the four sections of BADM 350: "Legal Environment of Business" offered during the 1993-94 school year at the University of South Dakota. There were 69 students in the experimental group (two sections) and 46 students in the control group (two sections).

A 20-item knowledge test was developed by the investigators to reflect the objectives for the section in the course which deals with "Contracts". The instrument was tested to determine its readability and clarity and was reviewed by School of Business and Law School faculty at the University of South Dakota for content validity.

The study took four class periods to complete the unit, which spanned a two-week period. The control group received coverage of the material using traditional lecture methods. In addition to the lecture method, the experimental group received an intervention consisting of commercially prepared videodisc supplements presented by the instructor.

Results of the Study

Statistically no differences ($p \leq .05$) existed between the two groups at the time of pretest, so the groups were considered comparable. Comparisons were then made between the groups to determine the effect of the experimental intervention. Statistical analysis of the group data was performed using paired t-test and analysis of variance. Results revealed no significant differences between the control and experimental groups ($p \leq .05$).

Findings and Recommendations

Results indicate that the use of technology may not always improve student learning, no matter how well-developed the medium. Two factors which must be considered and which warrant further investigation are the ability of the instructor to use the technology effectively (which involves training, familiarity with the equipment, and ease of use) and the role of students in learning (active vs. passive) when technology is used.

Findings of this study could prove to be significant in further development of the business law curriculum at the University of South Dakota and other institutions which prepare business professionals. Decisions must be made relative to the emerging role of technology, but the pedagogical value of the technology must also be determined. Ultimately, innovations in the use of technology must lead to better student performance in terms of their comprehension, as well as their application of the material to real-life situations.

Evaluation of a Video as Distance-learning Material for Dental Practitioners

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Conventional dental postgraduate courses often require practitioners to give up clinical sessions and to travel a significant distance to a postgraduate centre in order to attend . These barriers are common reasons given by practitioners for not attending such courses. Distance-learning methods overcome these disadvantages. Therefore in 1986 the UK Dept of Health commissioned the British Postgraduate Medical Federation (BPMF) to produce educational videos for dental practitioners to study in their own homes. The videos were planned by a steering committee of general dental practitioners, dental academics and postgraduate advisers. Dental specialists produced the scripts but the final results were very much influenced by the general dental practitioner (consumer) advisers. Professional television teams were hired to produce the videos which were then distributed free to all principle dental practitioners working in the UK General Dental Services. Many of the videos were accompanied by an illustrated booklet which expanded on the topics covered in the video and also provided a bibliography to guide further study. It has been reported that a large proportion of those receiving the videos perceived them to be of value[1]. However, a formal evaluation of individual videos had not been carried out prior to the present study.

This study was set up as a joint initiative between the BPMF and the Committee on Continuing Education and Training of Dentists (COCET) and was funded by the Dept. of Health. The video ('THE ALLIANCE") which formed the basis of the evaluation was concerned with the design of dentures and was produced by three of the authors (RMB, JCD & JPR) in 1991. The investigation was carried out through two postal questionnaires sent to a random sample of 636 dentists in England and Wales before and after watching the video. The questionnaires covered the dentist's profile, method of designing dentures, and preferred options from a variety of denture designs. The objective was to identify any change in design practice resulting from watching the video and also to record the dentist's opinion of the usefulness of the video.

Both the pre- and post-video questionnaires were completed and returned by 257 (40%) of the practitioners. The vast majority of those (82%) felt that the video had been useful. Intentions to improve design practice by providing more satisfactory types of denture than previously were recorded by 68% of practitioners. These positive effects of the video were greatest amongst the most recently qualified. In spite of these effects 40% of respondents indicated that they would not always carry out the whole of the denture design process, leaving some or all of it to the dental technician who does not have the clinical training necessary for the task. The lack of a denture design fee within the National Health Service was identified as the main reason for this resistance to change. In the final section of the questionnaire there was little evidence for a shift of preference following the video from examples of less satisfactory designs to more satisfactory ones.

It was concluded that the programme had been well received and in the short term had produced some favourable changes in intention; more objective evidence of improvement in practice was less evident.

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Various Hypermedia Presentations Developed for Huge Amounts of Data

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We present hypermedia applications that have been developed at the IICM (Institute for Information Processing and Computer Supported New Media, Graz University of Technology) and the IHM (Institute for HyperMedia Systems, JOANNEUM RESEARCH). The demos include:

- HyperM: A PC-based hypermedia system that can handle large amounts of different kinds of data. It has been successfully used as a presentation tool at various expositions (e.g. EXPO'92 and EXPO'93) and for research projects (as for example the use of question/answer-dialogs in hypermedia systems which is especially suited for educational purposes). The project "Images of Austria" e.g. contains some 3000 high quality images with texts in six different languages, extensive maps and a number of video clips, all fully digitized.

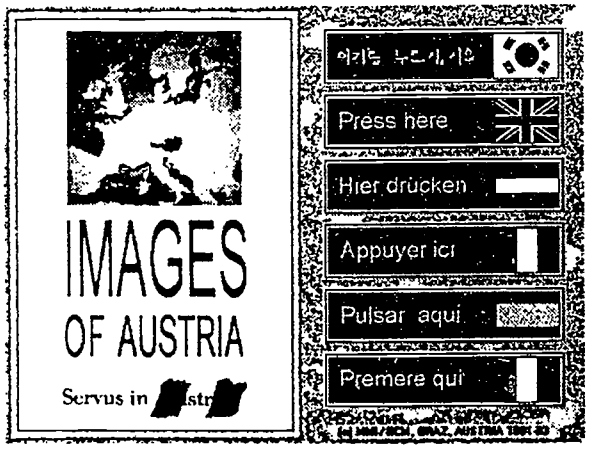

Figure 1: Start screen of "Images of Austria"

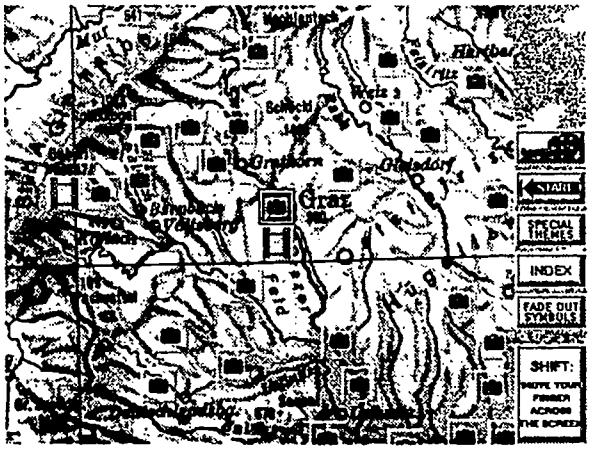

Figure 2: A part of the detail map of Austria

- Hyper-G: A workstation-based hypermedia and information system that operates in distributed networks. All kinds of multimedia information can be stored in databases on different machines. The data which can be browsed, searched, linked and annotated, can be accessed from different platforms such as workstation, PC or Macintosh.

- PC Library: An archiving system for the PC under Windows containing encyclopedias and dictionaries which pays special attention to hypertext features. Included features: keyword and full-text searches in phonetic, prefix and exact form; bookmarks, links and annotations.

Application of an Intelligent Tutoring System Authoring Shell to Develop a Course for Teaching the Fundamentals of Orbital Elements

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Although simulation-based Intelligent Tutoring Systems (ITS) have been shown to be instructionally effective (Johnson, Fath, 1983; Lesgold, Lajoie, Bunzo, and Eggan, 1992) the cost to develop, deliver and maintain them is high. The USAF Armstrong Laboratory is seeking solutions to this cost-effectiveness problem by developing and testing a variety of ITS authoring shells. These shells reduce the cost of developing and delivering tutors by attempting to permit instructional developers and subject matter experts with little or no programming experience to develop, deliver, and maintain ITSs without relying on software programmers, knowledge engineers, or expensive hardware.

One of the first such ITS authoring shells was the Rapid ITS Development System (RIDES). RIDES was built by Behavioral Technology Laboratories at the University of Southern California for the Armstrong Laboratory. In order to test and demonstrate RIDES functionality, the Orbital Elements Tutor was built. It focused on familiarizing students with the classical set of six orbital elements, using quantitative modeling to simulate earth satellite orbits and explaining the relationship of each element to the resulting orbit. The tutor provided a test of several desired capabilities including ease of building simulations, kinds of instruction that could be generated from the simulation, and the ease with which the instruction could be modified or augmented.

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Hypertext As A Theoretical and Practical Tool: The TIP Project

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Despite the plethora of theories and research findings about human learning, educators seldom find this information useful. This situation arises because the information is descriptive in nature whereas practitioners need prescriptions that are specific to the learning tasks at hand. In addition, learning theory and research tends to be distributed across many separate documents, making access difficult.

At a theoretical level, there is a problem of isolation between the various theories and research paradigms. Each theory and paradigm uses different constructs and terminology and hence it is hard to identify commonalities. A meta-theoretic framework is needed that makes it possible to see the overlap among theories and research paradigms as well as their unique contributions.

The purpose of the Theory Into Practice (TIP) project is to develop such a meta-theoretic framework that will also be useful to practitioners. Hypertext is used as the methodology for meta-analysis. By putting learning theories and research findings into a single hypertext database, it is possible to create links between common ideas. In addition, each theory and set of research findings can be linked to task-specific prescriptions. Thus, the database allowspractitioners to investigate specific concepts across different theories as well as locate all principles that pertain to a specific learning situation.

The specific research issues addressed in this study are: (1) What are the common and shared elements of past and current theories of learning and cognition? (2) To what extent can extant theories of learning be mapped onto a prescriptive framework for instruction? (3) How can inferences from a theory be made explicit? and (4) How useful is hypertext as a meta-analysis tool?

TIP currently exists as a HyperCard stack for the Macintosh and a Hyperties database that runs under MS-DOS/Windows. TIP is intended for use by teachers and training professionals in the design and implementation of instruction. It will also be of interest to educational researchers who are interested in hypertext as a theoretical tool.

The Hands-On Image Processing Project*

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We have developed a multi-media package to introduce teachers and their students to the principles and techniques of digital image processing. This package is explicitly designed for teachers who cannot participate in a more detailed "live" workshop due to constraints of location or funding. In order to better understand the context for this package, it is necessary to look at the Image Processing for Teaching project, of which this effort is a part.

The Image Processing for Teaching (IPT) program, developed at the University of Arizona Lunar and Planetary Laboratory, is educating teachers in the use of digital image processing and in the scientific content of digital images. Recent advances in computer and imaging technologies make it possible to place professional quality research tools and materials in the hands of learners of all ages. Using these resources, master teachers in the IPT program have developed classroom activities for students in a wide range of grade and subject areas using the technology currently available in schools.

In the pilot phase of the IPT program, funded by the National Science Foundation and Apple Computer, students have been introduced to image processing in over 80 schools in 16 states, from kindergarten through high school. These schools represent a diverse range of student populations and geographical settings. Experiences at these test sites show that we have discovered an extremely effective way to excite both traditional and non-traditional learners about science and mathematics. IPT activities place the student in the role of decision-maker, using a constructivist approach to learning and encouraging the use of cooperative learning strategies in the classroom.

The IPT program is currently in its dissemination phase. Funded by the National Science Foundation, the program is conducting in-service workshops for schools nationwide through the Center for Image Processing in Education (CIPE). Curriculum development is continuing, with the production of activity units and data sets on CD-ROM. In addition to curriculum materials and resources covering a wide range of disciplines, CIPE provides follow-up support for teachers by phone and computer network.

There is considerable demand for the Image Processing for Teaching materials and workshop. A number of rural districts now have satellite receivers and sophisticated hardware. We have found this to be the case in areas as disparate as the Alaskan bush and Navajo reservation schools. Our standard workshops, with large groups of teachers from a district or a combination of local districts, cannot easily serve these rural populations. There are many schools that for various reasons (insufficient budget, size or remote location) cannot obtain the group training. There is a need for a remote education capability.

We have met this need by developing a CD-ROM-based package using the latest advances in computer-based learning, thereby allowing us to disseminate this unique program to locations and student populations that would not otherwise have access to it. This remote education course will integrate video from teacher workshops and classrooms where the program has already been implemented and which model the IPT style of open-ended inquiry and discovery, real-time interactive software demonstrations, and exercises using an integrated multi-media package centered around an interactive hypermedia program. As a teacher works through the course she/he will learn to use the NIH Image software by working through training activities, see image processing activities being developed, listen to teachers talk about IPT implementation in their own classrooms and see students as they work with the material. The course will be self-paced and open-ended, in the spirit of inquiry and discovery that is the IPT hallmark.

We will demonstrate our hypermedia package and give people an opportunity to have their own hands-on experience.

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R-WISE
Reading and Writing In a Supportive Environment

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Goal: The goal of this project is to design, develop, field and evaluate an intelligent tutoring system to teach critical thinking skills, as manifested in the reading and writing of expository prose.

Method: The R-WISE project uses a problem-solving paradigm to explain writing and emphasizes the power of representation in helping the writer to move gracefully through the activity spaces of the task (Neuwirth, 1989). The complete tutoring system adapts Bereiter & Scardamalia's (1987) notion of a *content space* (summarizing, analyzing, and synthesizing information about the topic) and a *rhetoric space* (planning and organizing the domain information into a logically and stylistically appropriate formal artifact). Six distinct suites of tools work in tandem to teach powerful patterns of behavior and to help with the mental overload: Crossword Puzzle, Sticky Notes, Freewriting, Cubing, Idea Board, and Revision. The R-WISE package also includes two other "free-writing" spaces called Thought Log and Writing Pad.

Prototypes: R-WISE has been in development since 1991 in an object-oriented programming environment. During the 1992-1993 academic school year, a prototype was implemented at MacArthur High School in San Antonio, Texas. In that same time period R-WISE was modified, readjusted and generally improved in response to comments and evaluations that it received during its pilot year. In the fall of 1993, the tools were shipped out to various schools across the nation for further prototype testing.

Results: Each test site is required to have both a treatment group and a non-treatment group. All students in each group take a pre-test and a post-test (at the beginning and end of the academic year, respectively) which include a reading test, a writing sample, and an OLSAT (Otis-Lennon School Ability Test). During the school year the treatment group uses all of the R-WISE tools while the non-treatment group uses only its "non-intelligent" subset of tools (Sticky Notes, Crossword Puzzle, Thought Log, and Writing Pad). Results of the writing sample for the 1992-1993 year showed a gain of approximately 7% in the treatment group. (Please note that although this figure alone is encouraging, caution should be used considering that the software was in beta version during the pilot study.)

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Issues of Phenomenography and Learning Using Hypertext Systems

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This paper discusses issues on the use of hypertext system as learning and teaching aid in relation to achieve learning as defined in phenomenography. Lawrence (1990) proposes a need of developing a tutoring software which simulates the one-to-one interaction between dealers as a means of teaching and reinforcing the bid and offer concept in financial training. The tutoring software supports classroom teaching and helps the students in consolidating their understanding of the bid and offer concepts. Bid and offer concepts should be taught and learned in relation to the context of financial markets and not separating from the complexities of money and foreign exchange markets. It was initially thought that if students can grasp the idea of selling prices in relation to daily commodities, such as apples and oranges, then they would be able to make transition to financial markets. However, experience of teaching staff highlighted a need not to separate the content (Lawrence, 1990). This is consistent with the view that how students learn about a concept should not be separated from what the content is (Prosser, 1993). With this in mind, a tutoring software with hypertext as an instructional medium was developed.

Laurillard (1988) proposes two models of knowledge, the "didactic" and "communication" models. In the didactic model, teacher has the control of the subject content and how it is taught. On the other hand, in the communication model, students are given control on what the content can be, how it is learned and teacher plays the role of facilitator. Thus hypertext system provides a more "communicative" medium of instruction. Students formulate their own conceptions and develop their own experiences about a phenomenon individually. However how do we ascertain that students' conceptions have changed as a result of learning in a hypertext environment? A good teacher takes initiative in understanding students' weaknesses and allow students to ask questions. A good teacher also provides guidance and advice appropriate to the levels of students' state of understanding. There should be no difference for learning in hypertext environment. In Laurillard's (1988) discussion, research into student misconceptions in the subject area is necessary because it helps students to be aware of their conceptions and decide what knowledge to receive. With this in mind, a phenomenographic study was carried out to identify the outcome space which show the relation of conceptual view of two-way price (Lau, 1992).

By carrying out phenomenography study before designing the system, a systematic approach is used to incorporate outcome space, which is a set of relation, in understanding a concept. The hierarchical structure of outcome space also serves as a mechanism of linking pre-defined path. The study provides a logical way to segment information and subject content according to what the students already know, what the students should learn, and what the missing conceptions are and misconceptions students have, in relation to each category of outcome space. It provides an opportunity to depict conception as a logical relation which form the basis of knowledge structuring and linkages in hypertext systems.

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DEMONSTRATION OF A CANCER PREVENTION HYPERBOOK

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Cancer has become one of the three main chronic diseases of our time. Many forms of the disease can be prevented through life style changes that can be learned at school, at home, and at work. It is especially important to reach college-age students, who have the chance to adopt healthy lifestyles that can prevent many major cancers. With the aim of reaching both college students and general public audiences, we designed a hypermedia/multimedia system that can serve as both an instructional and reference system.

PROBLEMS AND OPPORTUNITIES

In designing and developing a Cancer Prevention Hyperbook, we confronted and resolved several key problems related to the dual purpose of the system and to its many audiences. To support classroom teaching requires a focused knowledge base that complements course materials, as well as interactive presentation techniques to engage students in acquiring and using information, and study activities to help students learn topics relevant to classes. To provide a reference tool requires a broad knowledge base with comprehensive coverage for continuous, often unplanned reference, as well as a complete index to the subjects, and interactive presentation techniques for personalization of information. Satisfying these different purposes and audiences presented many opportunities for creative design and development with multimedia/hypermedia.

APPROACH

The knowledge base is organized into five main topics that allowed us to address differences in interest and coverage required by our targeted audiences: 1) general cancer information to introduce the disease, screenings, prevention tips, early detection, diagnostic tests, cancer statistics, and treatment methods; 2) specific information on the 19 most prevalent cancers in the U.S.; 3) diet and cancer, including general guidelines to reduce cancer risk through diet, diet and exercise, and dietary asssssments, as well as specific shopping, preparation and eating tips to prevent cancer; 4) tobacco and cancer, covering physical effects of tobacco use, secondhand smoke, assessment of smoking behavior, benefits of quitting, and strategies to quit smoking; and 5) cancer in the family, with information on cancer treatments and support services to help cope when the disease strikes the family.

The functional design aims to reach the largest installed base of IBM compatible PCs, and with such a goal, emphasizes graphics and animation that can run on a common PC, as well as includes small sound bites for special effects. The functional design highlights multimedia capabilities for interaction, personalization, and various modes of reinforcement including: numerous hyperwords and hypergraphics that allow users to get many or few explanations; color coded topics or chapters; numerous assessment tests for users to personalize screening and prevention; a note pad that is activated across all topics, subtopics and hyperwords/hypergraphics for personal notes and study tasks; study activities that actively engage users; hypersound to pronounce new, technical terms about cancer; graphics that reinforce common associations, practical steps, positive approach; a comprehensive index and glossary, as well as a full text search capability.

The poster demonstration is an opportunity to share our design principles as expressed in the system and get feedback from AACE colleagues.

Multi-User Shared Environments (MUSE) In Education

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Goal

To provide an interactive environment for students to acquire and practice communication skills.

Solution

Multi User Shared Environments (MUSE) are text based, virtual worlds for people to explore and adapt to their own needs and desires. During the exploration of a MUSE one has the opportunity to meet other players and talk to them in real time. Meeting with others actively encourages communication. Students connect to MUSEs from all around the world. During any one visit a student might communicate with people living in the same town or country as they live in or someone on the opposite side of the world. MUSEs encourage the growth of truly global communities.

The text based nature of the game improves reading skills. As the student wanders from place to place in the world each area is described and directions for looking at objects or moving to other areas are laid out. There are no pressures to rush when the student is wandering about or when interacting with another person. It is not difficult to explain that for one reason or another you may be a little slow in responding. People tend to be patient and helpful when they encounter newcomers. The student has time to formulate a thoughtful response before replying.

If the MUSE is being used for second language acquisition, one has the advantage of interacting with native speakers in the target culture. This summer the University of Victoria's Computer Assisted Language Learning (CALL) facility hopes to integrate some English as a Second Language (ESL) students into an existing educational MUSE. The object will be to have them create their own area based on a story they have all read. As they go through the tasks of creating characters for themselves, building homes and outdoor areas they will encounter native English speakers with whom they will communicate. Along with a multitude of English MUSEs, there are also worlds created in German and Swedish.

In this demonstration I will show, with input from participants, how to create and flesh out a persona, how to communicate with other players, how to explore existing areas and how to build an environment for others to explore.

Acknowledgements

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The Courseware for Learning Technical English Using Hypermedia

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Introduction, Concept and Design

The Japanese Technical Colleges have suffered a bad reputation regarding their method of teaching English. It is a fact however that the industries of our country require graduates to posses linguistic abilities. Generally speaking, technical English terms are translated into 'KATAKANA' for books on technology. This tendency makes the present situation more complicated. Most students can't spare the time to master English phrases and its grammar because technical colleges have adopted special curricula emphasizing the necessity for studying technology oriented subjects. As our courseware is well organized based on computer skills and incorporates voice and movies etc., we believe that learners will find it fun to brush up their command of English, while looking at the screen of computer. To achieve this, we started to develop new courseware which realizes our aim. We regard Robotics as a sort of technology because our speciality focuses on mechatronics.

This courseware has several features: (1) Recording the learner s progres s (2) Introducing to robotic manipulator (3) Offering G.U.I.

This is implemented using HyperCard on Macintosh. The stacware consists of five parts as follows. (1) Introduction (2)Contents (3) Main Parts (4) Quiz (5) Final Test The main parts is made up of three sections. Each section has ten or twenty cards to learn fundamental robotic manipulator and each card provides English and Japanese texts, movie and voice sounds. The outstanding feature of this courseware is that users read the English texts. In this case, a movie can be a clue to full understanding.As for voice sounds, we can listen to them in the book order as shown on the card. Quizzes are planed to check whether a user's comprehension is correct or not.

Conclusion

We produced and worked out the courseware for Japanese college students to practice short-term, quick English of specialized words using Hypermedia. If we memorize Japanese pronunciation of technical terms only through 'KATAKANA', then we run a great risk that students won't be able to grasp the technical words necessary for oral communication. Applying this new courseware is worthwhile for all language learners to improve their listening abilities in the field of technology. This courseware is now improving.

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Learning through hypermedia supported cooperative work: a case study in the field of environmental education

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Hypermedia supported cooperative work (HSCW) is a particular instance of CSCW (Computer-Supported Cooperative Work). HSCW refers both to cooperative production based on a hypermedia development environment and to the fact that the product is a hypermedia system.

Exploring HSCW as a learning strategy has been one of the main aims of a research project in environmental education (EE), dealing with the problem of the decay of Genoa's historical centre. This research activity involved 60 seventeen-year-old students of an artistic secondary school, 8 teachers and 2 researchers.

In our approach the pedagogical design involves choosing an environmental problem, choosing a specific real environment, defining aims and content domain and linking the content domain to the curriculum. A significant understanding of an environment problem can be reached by interacting with a real environment embodying that problem. Interacting with this environment implies dealing with several tasks such as: formulating the main problem related to the specific environment; detecting the relevant components of that environment and their relationships; studying the dynamics of this environment. Summing up, interacting with a specific environment means performing field research, in which the students gather, interpret and communicate data and information related to that specific environment.

A single student working individually cannot conduct a significant study of any real environment given the complexity this involves. How then can a task that would be unfeasible for the individual be accomplished? Cooperative work can be a suitable solution to this problem as it augments the mechanical and information processing capacities of human individuals. In our case, the students were divided into 15 small groups. Each group studied a particular aspect of Piazza delle Vigne, a little square of Genoa's historical centre, in depth and got a general view of the whole system through the results of the studies carried out by all the other groups.

"Cooperative work" signifies people working together to produce a product. In our project, this product is a Hypercard system, which has been used in a demonstration in Piazza delle Vigne. Six computers were used by the students to guide people through the space and time of the square. The aim of guiding people by means of hypermedia was twofold: making the students understand the whole system (not just the single component they developed) and promoting a general awareness of the problems in that environment.

Piazza delle Vigne was modelled by representing its components and links and one or more groups were assigned with the task of developing a stack related to each component. Seven stacks were devoted to the buildings, one to the history of Genoa, and one to the socio-economic functions of the square. changing over the time. In general, a hypermedia system allows us to deal with system complexity through the encapsulation of each component in a module corresponding to a stack in Hypercard . This structure determines also the work organisation, since each stack is a work package assigned to one or more groups. The main stack linking the students' ones was provided by the researchers as a shell to be filled in.

Several studies claim that hypermedia systems are effective learning tools only when used by gifted students. This seems to hold true for hypermedia used in individual learning. However our experience suggests that when hypermedia are used in HSCW they can bring great innovation to the school environment and make learning motivating and fun.

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The Use of the Macintosh as an Augmentative and Alternative Communication Aid

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The use of augmentative and alternative communication (AAC) aids with individuals who are unable to speak and/or write through natural modes has increased in the past two decades. AAC aids include both dedicated communication aids and computers. Dedicated communication aids are electronic aids that have been designed and manufactured specifically to be used as communication aids for speech/writing impaired individuals. Computers also can be used as communication aids when they are adapted with special hardware and software.

HyperCard can be used to create customized augmentative and alternative communication (AAC) aids with individuals who are unable to speak and/or write through natural modes. These HyperCard stacks may includes both text and visual symbols and control buttons (so the user can activate the synthesized or digitized speech). For those users, who can not activate the buttons with the mouse, they could access the buttons by programming linear or row-column scanning. Conventional input devices such as a trackball mouse or touch sensitive tablet can be used to control the scanning technique. An alternate input device such as Ke:nx (Don Johnson Developmental Equipment, 1990-91) could be used for individuals that require special switches. Another possibility is the use of a voiced activated switch.

To create an AAC aid, you start by deciding whether you will using visual symbols or pictures, or text or both. If you are creating a AAC aid with symbols or pictures, you can create them by drawing with a paint or draw program. The easiest way to include symbols or pictures is to import them from a clip art program, where a library of different pictures is available, or another HyperCard stack. Most clip art programs are organized according to different themes. If text is used, you must define and position fields in the card. Once these fields are defined and positioned in the card, text can be entered. After you have created the symbols and/or text for the card, you then define and position buttons to activate synthetic or digitized speech. Each button that is created has a button number, name and script associated with it. A button script contains instructions detailing the actions the computer is to perform when the button is activated. If you are using synthetic or digitized speech, you would program the message to be produced in the script of the button.

In order to use synthesized speech, you must have a speech driver, such as Macintalk 2.0 (Apple Computer, 1988-89), installed in your Macintosh. Macintalk is a software speech driver that produces speech on demand. After the Macintalk driver is installed in the System Folder, strings to be spoken may be delivered to Macintalk either in traditional English text or in a special phonetic alphabet. The installation consists of copying all the XCMDs associated with Macintalk with ResCopy XCMD 4.0 (Apple Computer, 1987-88 or some alternative copying program. Although the voice sounds robotic, especially compared to the digitized speech, the advantage of using Macintalk is that it does not take too much space on the floppy or hard disk.

If you are interested in using digitized speech in your AAC aid, the audio pallette within the HyperCard program is recommended. This tool enables you to record , edit , play and store sounds and speech. This application works well and the software is generally easy to use, but the digitized speech and sounds take a great amount of space on the floppy or hard disk.

In many cases, providing a AAC user with access to computers may open many other benefits, such as educational, vocational, and environmental control applications. In closing, it should be noted that computer applications for speech and/or writing impaired individuals have already begun and continue. The decreasing costs and increasing capabilities in computers should lead to the rapid exploration of this technology as a viable solution for many speech and/or writing impaired individuals.

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Online tutorials even YOU can create!
Computer-based, multi-media, training slide shows

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How can one be sure specific training is available when it is needed? One answer is to create your own computer based slide-show. Add narration and you have a special training tool that can be produced at a workstation in your library. Slide shows work especially well for relatively static information that must be repeated over and over to new or changing staff. My poster session demonstrates a slide show our library uses for NOTIS Fundamentals staff training.

The necessary equipment includes a 486 microcomputer with a soundboard, attached speakers, and a microphone. Enhancing the slide show with sound not only makes it more fun to watch, it increases the level of comprehension by engaging both the eyes and the ears of the trainees!

We used WordPerfect's PRESENTATIONS[1] software. It took me most of the summer to create my first slide show, learning the Presentations software as I went along. Once one gains some experience the production time is much less. I can do now in two weeks what it took me two months when I first started. We started out with inadequate equipment although we did not realize it at the time. I cannot over stress the importance of having adequate equipment, which for WP Presentations mean having a **486 with a minimum of 8 mg of memory** regardless of what you might read to the contrary.

One develops the information presented in the slide-show the same way any other training guide is done. I worked from the training guide we were already using for our NOTIS Fundamentals training. Thus, the goals, the objectives, the scope and the audience were already defined, freeing me to concentrate on the production aspect. I recommend this approach for the beginner.

WP Presentation software has many built-in helps, including 30-35 pre-designed backgrounds. One begins by selecting the background that will be used for all the slides. Then you're ready to start designing the slides. I did this at the computer. The outline feature is a wonderful help for the text. You type the information and the system automatically formats it. Creating appropriate graphics is more time consuming, but very important to the finished product. Remember, protect your efforts by SAVING YOUR WORK OFTEN!

The Presentation software lets you attach a text file to each slide. These files will become the narration script. If you work from an already developed training guide, creating the text files is mostly just typing. Be prepared to revise, revise and revise some more--especially when you are just getting started. I found discussing the slides with a colleague very helpful. All the slides need to be pretty well completed before you begin recording sound files.

Creat a copy of the script by printing the slides and speaker notes. Each slide will have a separate sound file. The software lets you preview the recording before naming and saving the file, thus always giving the option of doing it again. After everything is recorded, sound files must be attached to appropriate slides. The new file is very large because the sound files run from 250K to 600K each. Twenty slides without sound is approximately 350K. The same file with sound will be from 8-10 megabytes in size. Creating a run time program is the final step. Run time shows can be viewed without having to access the WP Presentations software. Run time makes the slide show very portable and, of course, reduces the cost since the expensive presentation software needs to be installed only on the creator's workstation.

We like having the ability to create quality, narrated, computer-based training with ordinary software and a minimum of cash outlay for equipment. I hope some will leave the demonstration today inspired to go home and create a slide show tailored especially for their own library.

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[1]WordPerfect® Presentations, Version 2.0. ©WordPerfect Corporation 1992, Orem, Utah.

Power to the Students

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Marketing of public services

The University of Economics and Business Administration, as a public - service institution, has for the last two years sought with great success to market its computer-services. The target group is students. Through professional marketing we have reached a better utilisation level of our high investments (about 5 million US$ in the last 5 years) in networking, hardware and the devolpment of multimedia-based software. At the same time we have been able to reduce costs of pc-classrooms, energy, personnel and hardware through the application of technical innovations.

Situation of the University of Economics and Business Administration

With 25.000 students this university is Europe's biggest business-university. Computer training and internationalization are the major focuses of all student courses. This summer we will open a new training centre fitted with 250 networked high-performance computers (investment US$ 1,600.000) which will be accessible 24 hours per day. The use of computers and communication-technology is the principal educational goal, through which new work methods such as cooperative or workgroup-computing, mobile computing etc. are encouraged and trained.

PowerStore

The project PowerStore based on the idea to issue notebook computers to students on a loan-basis, thereby enabling students to maximize the use of available facilities. The number of 50 notebooks at the beginning of this project increased to 250 after one and a half years because the acceptance by students of this new service has been very high. Importantly the implementation of notebooks technology has led to the reduction of service costs, such as electricity, staff and rent by more than 95 percent. The initial hardware investment in notebooks is approximately a third of normal desktop-computers. The students pay a small fee, which is used to cover insurance, maintanance, staff-costs and a part of the reinvestment. In our opinion this project represents a revolutionary step towards a new form of computer-based education.

PowerNet

On October 28 1993, we opened the campus network, which is connected to the Internet, to all our students. Now students can use all Internet-services via the PowerNet-system from any pc-classroom, faculty-department as well as any telephone outside the university. Our goal was to attract 1.000 new student-users before the end of 1993. To achieve this aim and increase general awareness of the PowerNet-system we organized a grand opening-event, the „PowerNet-Party". As result of this presentation the target was reached within four days of the opening.

Next „Power"-Projects:PowerCard & PowerBrain

PowerBrain, a professionally organized multimedia library, with contents ranging from economics courses, through behaviour-training, to language-learning courses for diffrent computer-platforms, loadable over PowerNet and over Power-Store-docking-stations. PowerCard is the project-name for the introduction of a machine-readable student-ID-card, with additional debit-functions.

Conclusions - Why is marketing necessary?

Enormous investment in communication and computer infrastrukture must be used to an optimal level to reach the expected benefits. For the first time in its history, the University of Economics and Business Administration has begun to actively market its computer services. Up to now the marketing of two projects, PowerStore and PowerNet have been trusted to a professional advertising agency. Planning, execution and post event analysis were conducted in close cooperation with the IS-team. Both events were mainly financed through sponsorships of well-known computer companies. The marketing costs amounted to US$ 40.000,- for the first event and US$ 60.000 for the second. The success justified the costs in both cases. PowerStore and PowerNet will be continuously expanded and broadened to incorporate new services. Only through ongoing information of potential "clients", special marketing events, a high service level and reasonable prices can the optimal price/service-ratio be achieved, so that the demand for services never sinks below the offered services.

VISUAL (VIdeo-SUpported Active Learning) Resources

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Children growing up in this television age take it for granted that TV and video are an important source of information, but until recently most CAL specialists and course designers have made little use of video-based resources, owing not only to the obvious resource difficulties but also to conceptual difficulties in how to harness the power of video to the directed support available in traditional CAL packages. Although videos are excellent for creating interest, it is by no means clear that they are an effective means of fostering learning, since they tend to force a passive attitude on the learner, they sweep the watcher along inexorably giving no time for reflection, they create a high working memory load, and, unlike a book, they are well-nigh impossible to index or skim. A meta-analysis of existing interactive video materials (McNeil and Nelson, 1991) indicated that they were typically about as effective as traditional CAL, though the variability was high.

The objective of the project to be reported was the development of a methodology which exploited the recent technological development of low cost video digitisation for enhancing immediacy and motivation, while maintaining the tutorial support available from traditional CAL programs. The specific project described is the creation of such a resource using a video of a session between a speech therapist and a client with a voice disorder, winner of the Apple Computer Prize in the 1993 UK national 'Partnership Awards' competition. The poster will describe the 'Voice Disorders' resource and outline the methodology required for creating such a resource. A demonstration will also be available. Further information is available in Nicolson, Syder and Freeman (1994).

In brief, Apple's QuickTime™ conventions allow digitised video to be stored and played from the hard disc of an Apple Macintosh™ or IBM PC microcomputer. This provides an opportunity to create interactive video-based tutorial support which combines the motivational attractions of videotape material with the targeted, active learning available with CAL. The VISUAL (VIdeo SUpported Active Learning) shell has been developed for creating and using such resources. The technique required involves, first, digitisation of the video into a QuickTime 'movie'; second, analysis of the movie into individual segments which correspond to meaningful units of the transcript; third, creation of a hierarchical outline of the transcript into 'scenes', 'sequences', and 'clips', and 'segments'. Finally, tutorial questions, answers, and discussion issues may be interleaved with the script so that they may be asked at specific points. The VISUAL resource allows the user to interact with it via the hierarchical descriptive script of the contents, and to select and reorder just those parts of the video that they wish to use, thereby giving unprecedented user control over the resource.

A generic methodology has now been developed for the construction of VISUAL resources, and we are currently developing a meta-shell which allows the user to select from, and integrate a number of such resources. We believe that the VISUAL technique provides a cost-effective method for adding value to existing video resources, and that it is particularly powerful for applications involving 'learning by observation', one of the most natural of human learning capabilities, yet not easily captured until now in computer-based learning.

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Today's Level of Multimedia Development in Higher Education of Russia

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The problem of multimedia implementation into education being acute, the Russian Federation State Committee for Higher Education made a decision to organize and finance Russian scientific and technical program "Multimedia Technology" in 1991. This allows to financially support scientists' teams of different Higher Schools and to join their efforts in the frameworks of a single research program.

The Infostudio with a team of specialists in fields of both technical sciences and humanities has become the leading organization for multimedia products development.

Principles of Multimedia Titles Development

We use the technology of distributed development of multimedia titles on the basis of the original software. On the first stage the script of the product is inputted into the central data base. It includes a formal description of scenes, their parts and connections. Specialists at the audio, video working stations and that of computer graphics and animation, realize the scenes of multimedia titles on the basis of these descriptions. Then the realized elements of the product are sent into the data base. And at the final stage all the elements and scenes are assembled at the Editing Working Station. A data base can store several versions of separate scenes realization to give a script-writer an opportunity to choose one of the versions.

The main special feature of training courses and home application multimedia title developed in the Infostudio is using the game methods. The product script connects all the information units on the basis of either a single plot or its several versions. Besides the training courses have game exercises for mastering the material learned.

All these help the student to quickly adapt and the process of understanding information is more intensive. Besides such an approach arises greater interest for a title. The instrumental software developed by our specialists uses an object-oriented approach. The basic notion used in describing a scene is an animation object. It's described by a set of rules, defining reactions to the user's actions and the influence of other objects. Various methods can be used to visualize animation objects, i.e.: RLE-coded frame sequences, bitmap sprites, calculated projections of 3-D sprites. This concept makes rapid creation of interactive games possible. In fact we have an instrumental shell for creating computer games.

The Infostudio script-writers are specialists from various fields of art and culture as well as from Universities' Faculty.

The Developed Multimedia Titles

The products worked out by the Infostudio are produced either on CD-ROM or a video tape used both as a carrier of analogue live-video and of digital information. Mainly these products and training courses concern humanitarian subjects: "Business in Russia" (the Russian language for businessmen), "The Russian language for foreign school-leavers", "Cathedrals of Moscow", "The Power of planets" (home application horoscope). Universities in cooperation with the Infostudio have developed and now use in training multimedia titles on fundamental disciplines: electrical engineering, optics, theoretical mechanics, electrical dynamics and others.

Multimedia technologies in Russia Higher Education have been used not for long. But great interest they arise and today's rates of their development will make them successful in education in future.

THE USE OF OBJECT ORIENTED APPROACH TO MODELIZE AN ENVIRONMENT OF DISTANCE LEARNING

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We have been seeing for some years a growing development of computer systems. The communication network which is one of its branches does not escape this rule. Such a development has been possible thanks to some progress, made about the production of hardware as well as that of software. Among the lattest, computer networks take an important place. It also resulted from a study [Diaz 90] that there is a great shortage in the field of network engineers. Situated between computer science and telecommunication, networks constitute a theme which is judged to be too applied. It is advisable to first of all teach and promote this domain. This should first start with an effort of identification of the tackled concept in an approach system, putting an emphasis on the richness of the domain. Three steps are unavoidable. These are : • Make a particular effort in order to develop post graduate training so as to put an end to the shortage of researchers. •Develop in every scientific training a teaching of network which will be complementary to computer sciences knowledge. •Promote specialisation teaching in schools of engineers, either by teaching tools or by training in the presence of a teacher.

Our motivation to conceive an apprenticeship environment which will allow an integration of knowledge in communication network comes from this fact.

The objective of apprenticeship environment presented here is to maintain the technological training in the context of computer networks. This can be achieved either locally or remotely in the case of teleteaching. It aims at students, also to teachers wishing to create and send their courses to learners of training centres in the field of computer networks. Most of network books available now on the market are too theoretical. So a study for more practicability allowed us to set a system of teaching of networks.

For this objective we have chosen to use an Object Oriented Programming for several fundamental reasons : -The paradigm of object is particularly adapted to distributed systems because objects are entities which contain data, methods to handle data, and attributes (properties) and these objects can communicate by messages. -The object oriented approach is also the basis of powerful User Interface Management System. -The object oriented approach is well adapted to multimedia project at user's level. From these consideration we have chosen the [ISO 10165] as ideal platform. The modelling of the environment entities is based on the object oriented approach. The preceding defined model and object formalism [ISO 10165] will allow us to build pedagogical objects (lesson, module, apprenticeship units, didactic objects, exercises, glossary, bibliography).

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Campus Support for Multimedia Information Retrieval: A User Interface Configuration

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Multimedia and digital resources have enormous potential for enhancing the learning process in the University of the Twenty-First century. Given rapid access to large quantities of information using advanced search methodologies, a student spends less time hunting and more time learning. This poster presentation and accompanying paper illustrate a viable architecture for such a large scale information retrieval system.

A Multimedia capable information retrieval system must include a repository for large quantities of information combined with mechanisms for searching and delivering this information to end users. This information may be locally stored, or it may be public and private information available via national networks. The data involved includes digital video clips, reference volumes, image data, sound and voice recordings, scientific data, and private information services [1]. Access to this information must be equitable across the entire campus population, including students, faculty, and staff. Since the user base is very diverse, encompassing both instruction and research, the available datasets are also necessarily diverse. A practical system must adapt to changing user, data, and equipment needs.

In this presentation, we describe and analyze the components of an architecture for a campus wide information retrieval system with emphasis on the central depository. We argue that such a system is not merely an expansion of the campus networks of today, but a vast and powerful repository of diverse types of information that can be accessed at high speed by a large number of users. It is important, therefore, to carefully plan for and design a system and interface that will anticipate the new types of data that will be available in the future, rather than simply networking large numbers of general purpose computers. This paper addresses issues which should be considered in such a design, including volume information delivery, adaptability, redundancy, storage backup and scalability.

Large Scale Information Retrieval: An Architectural Model

The architectural model presented can be broken into several major components: end user equipment, the multimedia network, network routers, data storage nodes, and central depository nodes. In order to maximize immediate utilization, the model is designed to integrate into existing computer networks and, therefore, attaches to those networks and coexists with existing storage. The major new components described in detail in the presentation are the new links in the multimedia network, new network routers, and the central depository nodes.

The presentation focuses on the Central Depository Node, as this is the common throughput bottleneck of traditional approaches to high volume information systems. The purpose of the central depository node is to provide a very large central storage point that can be accessed by a large number of users. It is argued that a large, scalable system can not be effectively built from general purpose hardware. Even using very fast general purpose hardware combined with an optimized design for multimedia server applications, the StarWorks video server can only support twenty users simultaneously [3]. Hence, our modular Central Depository Node design is built from storage nodes, stream channel controllers, and network interfaces. Additional components, including knowledge processors and a master catalog are integrated into the design. The model allows for evolutionary growth as the number of users and the volume of data increases.

A storage node consists of storage devices and control. The stream channel controllers provide buffering to manage the delay sensitive delivery of the multimedia data streams [2]. An important proposal of the model is the isolation of the stream channel controllers from the storage nodes. The stream channel controllers are thus shown to be usable for not only buffering, but synchronization and object composition.

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Mesa Verde National Park, Mesa Verde Museum Association, The Avalon Group and Kansas State University
An Interactive Collaboration

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The development of interactive materials to be used in schools or homes across the United States or in international settings as well as within the host Park site, is the major focus of a partnership which involves Mesa Verde National Park, the Mesa Verde Museum Association, an interactive multimedia development company known as The Avalon Group and Kansas State University. The partners have entered into this formal collaborative arrangement to enhance the educational opportunities of the clientele served by schools as well as the clientele served by the Park. The products being designed by the partnership are interactive and take advantage of a variety of media. The first product is currently under development and is designed for students in school settings, but may also be used by visitors and others with an interest in the cultural history of the area. It will feature an instructional CD, a resource or "scrapbook" CD, a teacher's manual, learners' guide and an excavation simulation project. This product should be ready for distribution before September 1994.

Mesa Verde National Park as the first United States National Park dedicated to the preservation of a cultural heritage, offers significant opportunities for visitors of all ages to explore a wide variety of issues and problems that impacted a prehistoric Native American culture known as the Anasazi culture. This culture developed in the American Southwest from about the time of Christ to approximately 1300 A.D. The use of interactive computer technology, such as those incorporated in the partnership's first product, provides opportunities for student users as well as visitors and interested individuals in distant locations who are not able to visit the Park, to explore the cultural and natural resources of the area with a degree of specificity often not available to traditional on-site visitors. Such interactive products are seen as very beneficial in helping the Park meet the needs and interests of many visitors including those who are physically challenged and unable to traverse the often steep terrain.

The special talents combined within the partnership provide opportunities for teacher educators and curriculum material developers to interact with graphic artists, dynamic media specialists, technology specialists and the Park's archeological and interpretative specialists. Kansas State's College of Education faculty bring effective teaching talents, related experiences in developing curriculum materials and talents in the use of instructional technology to the collaborative team. At the same time, since many cultural practices are difficult to recreate and many locations are extremely difficult to access, the involvement of the Kansas State University Department of Art is especially important. Graphic artists and dynamic media specialists have been asked to conceptualize and animate numerous concepts including working with members of The Avalon Group to develop the overall aesthetic quality of each product, thus enhancing the effectiveness of the product.

Initial conceptualization of a project involved representatives of the four participating groups developing the framework from which each group will contribute their expertise. The Avalon Group provides leadership for the development of a storyline and presentation approach employed within the product. Avalon Group staff members work with the Park Service to gain access to remote or restricted locations to develop many of the video and still image resources needed for the product. KSU teacher educators work with the Park staff to provide leadership for identifying the educationally significant aspects of various sites and the Anasazi culture in general as it evolved over time. Teacher educators then develop curriculum materials to be included in the teacher's manual and student guide. The Art Department is providing the leadership to develop the resource of "scrapbook" CD to be used by students as they develop their interpretation of the Anasazi culture. Finally, all members of the partnership interact with the Park Service staff to establish the authenticity of the product. Finally, The Museum Association is providing additional consultation on the look and feel of the product as well as input into the development of marketing strategies.

A Computer-based Interactive Physical Education Resource

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As class sizes are increasing, it is difficult for students to receive the amount of one on one instruction they desire and need. Normally, the teacher demonstrates a skill in front of a group of students and then gives instructions on how to practice it. As much of the instructors time is spent answering 'routine' questions, the teacher rarely has enough time to help individual students with skill analysis.

Sports Software

To overcome these difficulties, INSEGNA has developed an interactive multimedia sports program which contains all the skills, strategies and rules for a particular sport. Our programs are organized in such a way, that the learner is able to progress from skill to skill following the correct scope and sequence; or can choose to focus on a specific skill, rule or strategy.

Our programs feature the best of multimedia technology; animation, digitized video, and sound. These elements are used to instruct learners on correct skill technique as well as to test their knowledge of correct skill performance, game rules and game strategies. Complete, detailed instructions on correct skill technique and lists of performance cues are included. Both the performance cues and detailed instructions can be printed out and presented to students for study purposes once they leave the computer.

Other key features of our programs include a list of appropriate drills, and colour skill coding to differentiate beginner, intermediate and advanced skills.

The Advantages

INSEGNA's sports software is a valuable resource for students and teachers alike. It functions as a teaching tool, an instructional tool, a remedial tool and it allow for individualized learning. Students who have already mastered a skill can return to the program and receive additional instruction in new skill areas, as well as related drills, game strategies, and game rules. Whereas students who are having difficulty performing a skill correctly, can receive additional drills and reminders on correct technique. Our programs also free teachers so they are able to spend more time on skill analysis, error detection and error correction.

Finally, our sports software makes lesson planning much simpler, as all of the required resources are provided in our packages. Consequently, teachers with little sports related knowledge can provide instruction which is pedagogically correct, effective and relevant.

Implementing *Hyper on the Library*™: Computer-Assisted Library Instruction on HyperCard®

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Hypertext-based interactive computer-assisted instruction [CAI] programs increasingly are being utilized as alternatives to traditional instruction models. Whether they produce as high a level of conceptual learning as the traditional methods or are "a superior way to learn" (Bourne, 1990) is still an open-ended question. In any case, evaluation of their effectiveness is required to properly judge when, where and how they should be adopted.

One critical variable is whether the program is used as a supplement to or a stand-alone replacement for classroom instruction. Reported research results suggest that differences in post instruction performance may indeed be small. However, a combination of classroom and cost-effective hypermedia instruction may offer the best solution in terms of user performance (van-den-Berg & Watt, 1991).

Hyper on the Library™, CAI on HyperCard® (demonstrated at ED-MEDIA 93 at a pre-testing stage), was developed by the author for the University's expanded library competency curriculum. During the 1993-94 academic year, it was piloted in independent study and laboratory class settings and compared to traditional classroom instruction, in anticipation of its implementation as a course option in the Fall 1994 semester. Like another such program (Mackey, Dugan, Garrett, & Freeman, 1992), its content and basic structure parallels those of hard copy manuals employed in other course options. From observation, analysis of participating student evaluations and consultation with colleagues, the program's instructional design, whose importance cannot be underestimated (Grabinger, 1993; Okolo, Bahr & Rieth,1993), has been significantly revised, enhanced, simplified and improved. The program's positive reception by students with varied prior computer experience substantiates the advantages often attributed to hypermedia systems, in particular, HyperCard®: flexibility, user friendly interface, multimedia audio, visual, and now color capabilities, and nonlinear user discretion for content, time, place, and pace of instruction (Okolo, Bahr & Rieth, 1993).

However, the lack of any imposed structure also may be a disadvantage. The student can become disoriented within the nonlinear program, and can suffer from information or "cognitive" overload (Conklin, 1987). To avoid this pitfall, *Hyper on the Library*™ is divided into independent learning units or "conceptual neighborhoods" (Spoehr & Shapiro, 1991), corresponding to the Library's various departments. In addition, a set of preprinted worksheets are completed while navigating through the computer units. Answers to the questions, found in sequence on program screens, assist students in completing accompanying hands-on exercises in Library departments (common to all course options). Though certain nonlinear freedom is lost, using computer-based and print media within an imposed yet still flexible structure has been found to be beneficial both to the learning process and to program management, evaluation and revision.

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DEMON : A Distant Educational Monitoring Project

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Today in Ukraine there are enough number of computers which are connected to distributed networks. From five worldwide computer networks (BITNET, INTERNET, UUCP, FIDONET, OSI) two networks UUCP (RELCOM) and FIDONET are widespread supported in Ukraine. Last year we have obtained a direct connection to INTERNET. Mostly these networks use for supporting e-mail, for commercial and research applications. There are also several BBSs for software exchange. There are no applications for educational purposes but this kind of applications is the most prevailing in Western countries using INTERNET network (Krol, 1992). However we had some experience of educational networking in Ukraine because we have here about 150 schools which were chosen for participation in the IBM program "Pilot schools" for the USSR. These schools took part in HELLO and ACID RAINS projects which included exchange of letters and data by e-mail (through UUCP) between Soviet and American participants. At present a project for creating and providing the Educational System Integrated Computer Network is under development.

Last year at the Glushkov Institute for Cybernetics the DEMON (Distant Educational MONitoring) project was started for solving software and pedagogical aspects of the third problem. Since "monitoring" means a process for supporting something in stable state then "distant educational monitoring" means the process for supporting knowledge of educational administrators, teachers and students about current state of educational systems in Ukraine and other countries, teaching methods, curricula, learning materials on various media including computer tutoring systems, and etc. on the base of distributed computer networks. We consider the DEMON project has many goals in common with the HYPER-G (Kappe, F., Maurer, H., Sherbakov, N.,1993), and GOPHER and W^3 are the samples of successful design of user interfaces.

The main goals of the DEMON project are following:

- Creating software and courseware for distant learning.
- Developing structure of databases and teleconferences on teaching methods, curricula, learning materials, and etc. for various subjects and levels of education.
- Developing software for creating, modifying, and maintaining distributed educational databases.
- Developing the technology for creating computer-based tutoring systems.
- Developing techniques for using computer networks for distributed pedagogical experiments and expertise.

We consider educational administrators, teachers, and students as three categories of users. The administrators' activities using DEMON will include: searching and maintaining of relevant legal documents, rules and regulations; meeting organization and maintenance of minutes; room management and timetabling; maintenance of student records, budget reports, etc. The dominant teachers' activities will be: creating and distributing courseware and other learning materials; discussing questions of common interest through teleconferences; answering students' question by e-mail; taking part in distributed expertise of learning materials. The students' activities will be: searching for relevant learning materials; browsing through relevant documents; choosing, fetching and executing courseware; asking questions e-mail and teleconferences. In the future we consider to add other services such as the access to telephone directories (white and yellow pages), e-mail address directories, encyclopedia, specializes handbooks, and bi- and multilingual dictionaries.

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An Evaluation of Computer-assisted Learning Programs for Training General Dental Practitioners in Denture Design

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Computer-assisted learning (CAL) can combine all of the commonly used modes of presentation (concrete, symbolic and visual), it can promote deep, self-paced, active learning and can accommodate both a problem-solving holistic, and the more fact-oriented serialist, approaches to learning.(1) Dental practices in the UK are increasingly becoming computerised and it is the policy of the Dental Practice Board that the majority of practices will be computerised within the next few years. The Dept. of Health has made a grant available to cover part of the cost of installing computer systems and: as a result the availability of hardware which can support dental CAL is increasing steadily.

The objective of the present project was to evaluate CAL programs on aspects of denture design as a distance-learning package for dentists. Four CAL modules were developed from chapters in a textbook on the subject by one of the authors(2). The programs were developed using the Toolbook programming language for PCs using Windows version 3.0 with 2 MB of RAM, a 386 processor, a colour VGA screen and a mouse Particular emphasis is placed on rich forms of interaction creating a constant dialogue which includes the direct manipulation of on-screen graphics. Action by the user results in feedback to explain the basis for the correct answer. Three consecutive incorrect attempts bring up a help button which gives the correct answer if required. An index allows the user to navigate easily through the program. A glossary can be accessed by clicking on any dental term with the right button of the mouse. On completing the program the user is given a performance rating.

Sixty-five dentists were recruited as evaluators. Those with suitable computers were sent the programs for use at home, while the others used the programs at the dental school. All participants completed a questionnaire consisting of fixed and open questions with the former requiring answers on a scale of 1-5 where 1 was the most negative response and 5 the most positive. The costs of this evaluation were met by a grant from the Department of Health. The results indicated that modules took 10-45 minutes each to complete. The positive results of the survey were: 85% found the programs easy to use; 78% reported that the programs extended their knowledge of the subject; the programs were considered to be more useful than videos (66%), audio tapes (83%), journals (74%) and books (65%); 80% were interested in using other CAL programs; 64% would consider buying other CAL packages (35% @ £20, 47% @ £50, 18% @> £50). The commonest positive open comments related to the clear graphics and to the use of animation. Negative responses were that: only 43% considered that the programs extended their practical skills (however, this was not an objective of the programs); 30% were frustrated by invisible target zones being too precise; a few suggested that the clarity of some of the diagrams and text could be improved.

The programs were modified extensively in the light of these comments and 60 copies of the revised versions have now been purchased by the Department of Health and distributed, with appropriate hardware, to postgraduate centres throughout the UK.

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The Bell High School Video Portfolios CD ROM

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Overview

The Bell High School Video Portfolios CD ROM is an interactive electronic portfolio containing QuickTime™ versions of 28 videos produced by students in the Bell High School Television Production program. Each video is accompanied by an interview with a student producer, along with comments on the video by the television production teachers, Ed Murphy and Larry Stone. The videos represent the range of productions done by Bell students, including Public Service Announcements, Video Essays, Video Poems, and Music Videos.

This CD ROM is unique — it collects the work of students into a group portfolio, giving the reader/viewer an opportunity to learn about the award–winning Bell High School Television Production program by seeing videos, watching and listening as students describe their work, reading comments by their teachers, and seeing student work in the context of similar projects by other students. The interface provides a number of ways (genre, title, author, interviews, video index) to access the more than 1 hour and 50 minutes of Quicktime video on the disc.

Background

Bell High School has a very successful video production program, certainly the leader in the Los Angeles area and probably throughout California. Bell students won twenty-three different awards during the '92-'93 school year for their videos in local, state, and national competitions, and they've won about the same number of awards each of the previous two years.

The success of the students in Bell High School's television production program is even more noteworthy given the context in which they work. Their school has 4200 students and due to crowded conditions, has operated on a year-round schedule, with three tracks for the past 13 years. Many classes are over-enrolled, with more students than available chairs. Like many urban schools in California, Bell High has a 40% dropout rate, and is not far from gang and drug activity. The Bell video production facility has one editing set-up with an Amiga Video Toaster, three or four working camcorders, and four Apple IIc's for scriptwriting. Despite these conditions, Bell students continue to produce a range of high-quality videos that have brought themselves and their program considerable recognition.

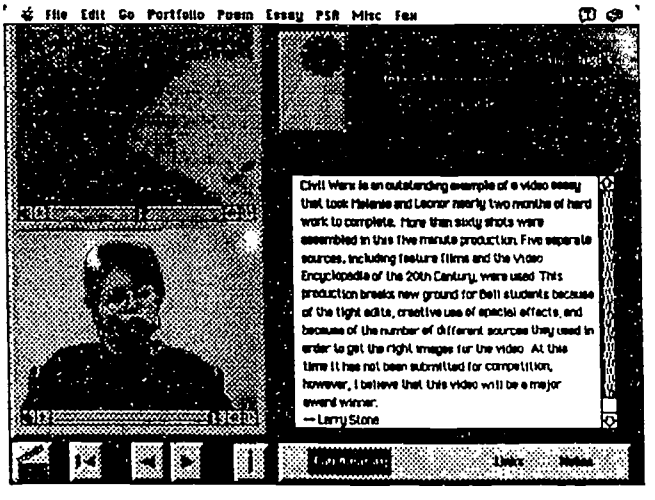

Figure 1 – Screen shot from Video Portfolios CD ROM showing entry for "Civil Wars," video essay by Melanie Alvarenga and Leonor Martinez.

Electronic Groups Communication via Satellite as New Distance Learning Environment

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The success of information technology utilization in the distance learning environment is strongly dependent on the communications media/platform. For the population of learners in the distance learning environment, there is a need for the development of communications networks upgrading them from leased or switched telephone lines to wireless, satellite based communications networks. Satellite networked communications platform and information bases are the tools for creating new independent, and open educational environment. Open learning environment has the idea that education is important not only because it contributes to one's career goals but also because of the value it adds to the general quality of one's life. Schools in distance learning environment develop networks that link any number of computer/desktops at learners' and teachers' sites, and let them share programs, files and messages. Educational institutions are acquiring networks for the same reasons business are - in increasing productivity and the quality. Interactive technology needed for computer supported collaborative work in distance learning environment can assist students inquiring on their own and that frees the teachers to work on specific teaching/learning problem. Many school libraries tap into on-line services, and provide access to thousands of university databases through Internet (through CarNet in Croatia specifically). When students can reach all that from their desks, the teacher's role changes from delivering information to helping students understand it. In the same time, computer and communications technology make the room for new methods of learning that replace detailed curricula with multidisciplinary projects and emphasize teamwork. This is why computer supported workgroup (electronic group) and communications networks are needed for today's learning environment.

It is available today for any type of digital communications network to be established in VSAT environment. The cost of satellite airtime and space segments as well as the cost for earth stations therefore depend entirely on the functionality of the network. In the same time, various data rate requirements and bandwidth options offer different cost-benefit performances, thus making a really trade-off between the cost of the earth stations, the total number of earth station/VSAT units envisaged in a network, and the recurring cost of the satellite airtime/space segment based on the degree of the providing satellite power (in spot or other means of beams) and bandwidth required to establish an operational network for dedicated distributed applications environment. The currently available 22/30 GHz frequencies range offers the opportunity to achieve relatively high bit rates with very compact ground signal status rearranging VSATs to be capable of transmitting and receiving information thus providing interactive medium. Given the identical antenna sizes of VSAT stations, the high frequencies result in higher antenna gains as compared with the 12/14 GHz frequency range mostly in use across Europe. This is attractive momentum that benefits applications in which learners and teachers are dominantly oriented toward interactive communications services at low costs. The implementation of an interactive VSAT system distribution network should be aimed to users' environment and should provide flexible and variable organization of distance learning; it must be open to various types of contexts in which it can be used. The organization of telecourses made by VSAT network opens up three main activities needed to create educational environment:

- creating of central lecturer function with adequate administrative and technical installations
- creating of central information (multimedia) base reachable by any point connected to VSAT network
- implementing minimal technical (software and hardware) and instructional elements

This is only general plan that is proposal for one year task schedule including the parallel activity considering the selection of the space segment operator (that will be EUTELSAT for the first stage), the selection of the Hub equipments and terminals (stand-alone earth stations/transceivers). All of them lay in the field of technical solutions that are known recently. The problem to be solved is to find right organizational form that accommodates both the existed formal school system and the acute requirements found in the informal education. VSAT systems improve the communications facilities only, so I found that organization of distance learning environment should be done prior any decision for startup VSATs for educational purposes

A Conceptual Framework for Building Hyperstories

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We present a modern view of producing multimedia software for learning. This study was developed to enhance thinking and learning through the use of hyperstories (Ref. 1). Stories are narratives of true or fiction events that intend to capturate and involve actively the learner. Based on the static metaphor of a typical iberoamerican neighbourhood ("el barrio"), representing a place were children live and develop socially and culturally, we have designed a dynamic metaphor we call hyperstories. "El barrio" is a metaphor where we can find houses, buildings, parks, schools, churches, cultural centers, etc. Interesting stories occur in "El barrio" involving and motivating the learner, as well as giving him/her control over the stories, tools and construction materials to build things and develop strategies to test hypotesis with the implicit idea of fostering the development of cognitive structures that determine tempo-spatial and laterality relationships among children ages 6-8. Hyperstories are, in some way, the electronic version of conventional literacy stories in the same way that hypertext is the electronic version of text. However, we push forward the metaphor in order to allow a "dynamic binding" between characters, the world in which they move and the objects they act on. This binding is performed by the learner thus allowing greater flexibility in the learning process. Thus, a hyperstory is the combination of a virtual world where the learner can "navigate", a set of objects on which the user can perform certain operations, and a set of characters that can be manipulated by the learner. Objects and characters may have their own behavior and act autonomously.

A conceptual model for hyperstories

Conventional hypermedia authoring tools does not provide an adequate set of facilities for building hyperstories. The static environments involved in a hyperstory (the virtual world) can be simulated easily, but several aspects such as dynamic objects behaviors and complex interactions between the main character and others exceed the conventional "nodes and links" model. By using a specially defined a conceptual model for hyperstories we can describe the virtual world as a nested context model (Ref. 2). The world can be enriched with objects and characters and thus "instantiating" a particular story. A virtual world is defined as a set of contexts. Each context contains an internal state, a set of contained contexts, a set of objects, and links to other contexts. Different relationships may be held between two different contexts. Different "real world" metaphors can be implemented easily with this simple model. Moreover, contexts may be reused in different virtual worlds.

The main difference between our model and traditional hypermedia models (Ref. 3) is that nodes (contexts) may be nested. However when we add objects, the world is enriched. State variables and a behavior describe the attributes of a certain object. The object's behavior is specified by using rule-based scripts. Each rule contains a pre-condition and a list of actions that must be performed when the pre-condition holds. Objects are further classified into statics and dynamics. A static objects always belong to the same context and dynamic objects may be carried from one context to another. Note that certain contexts, for instance books, can be also carried from one container context to other. We call them dynamic contexts.

In addition, objects can perform discrete or continuous activities. A door can be opened or closed (discrete) and a recipient may get full of water (continuous). Finally, one of the most interesting characteristics of certain objects is the capability to represent links between contexts. When manipulating characters the learner acts upon the world, navigates, performs actions on objects, carries objects from one context to another, etc.

Considering the aforementioned, a hyperstory is then the combination among contexts, objects, characters, and the interaction patterns performed by the learner. Events produced by the learner while interacting with the virtual world, the time sequences, and the interaction among objects determine how a particular "instantiation" of a hyperstory will look like.

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Creating CAL resources using PsyCLE: the Psychology Computer-based Learning Environment

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The PsyCLE Project is a three-year large consortium project involving over 30 Universities to develop computer-based material to support introductory University level teaching in Psychology. The project aims to deliver significant modules in 10 areas of the subject on both PC and Macintosh microcomputer platforms. The initial direction of the project involves the development of a suite of authoring tools and templates based in HyperCard on the Macintosh to support the 10 development teams. The current prototype PsyCLE development platform is focused upon a concept-mapping tool which allows the lecturer author and the student to construct node and link maps of information.

In August 1992, the UK Higher Education Funding Council announced a call for proposals for an ambitious plan to promote use of computer technology in higher education called the Teaching and Learning Technology Programme (TLTP). The ultimate object of this Programme "is a decisive extension in the use of technology in learning so that, where appropriate, it becomes an integral and established feature of the delivery of higher education". A major focus is on the efficiency of the educational process whilst nevertheless maintaining effectiveness through the potential benefits of improved quality of courseware and flexibility for students.

The Universities of York and Sheffield are the lead sites for the Psychology TLTP consortium. We are working on a courseware design and delivery platform known as the Psychology Computer-based Learning Environment. We have nine major sub-discipline development sites at Universities in the UK. Each is responsible for a particular sub-discipline based module. These ten modules are: Auditory Perception (Bristol), Visual Perception (Birmingham), Developmental (Warwick), Social (Kent), Statistics (De Montfort), Experimental Design (Reading), Psycholinguistics and Neuropsychology (Manchester), Collaborative Group Work Support (Nottingham), and Philosophical Roots (Middlesex). Each development site is matched with some of over 23 evaluation sites in the UK and 8 overseas sites in the USA, Australia, Denmark, Sweden, and New Zealand. We are developing core material plus additional topics in each of the modules, whilst also providing a means for instructors to modify content, sequencing and associated learning tasks to suit the needs of their particular courses. For instance, our evaluators teach a range of students from different colleges. They may not want to show the same material to nurses as to honours psychology classes.

Our emphasis is on interaction and engagement with multimedia materials rather than primarily on presenting textual and graphical information, as in many current CD-ROM and other multimedia products. We are concentrating in many cases on demonstrations and laboratory experiments which are hard to convey in conventional teaching and which can effectively exploit the power of the computer to make more informative and advanced experiments possible. For instance, the student can work with the experimental design module guiding them to run an experiment numerous times, but with different population samples to see the effect of sampling size and characteristics. In the developmental module, the students make predictions about children's behaviour according to various theories and then will be able to compare their predictions to video clips of children performing the tasks.

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Towards a multimedia and multimodal courseware architecture

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A multimedia courseware enables the manipulation of multimedia information (texts, sounds, graphics, bitmap or video images). A multimodal courseware enables the analysis and fusion of events from the keyboard, the mouse or the microphone devices. A multimedia architecture needs technics and tools to organize and browse through the multimedia information. Morever, the multimodal architecture needs a protocol to generate multimodal events from the simple input events but also to analyse them in the learning situation.

In the domain of interactive application design, searchers have already proposed and ratified several architectures [Kazman 93]. These architectures are absolutely transposable to C.A.I insofar as a courseware is also a high interactive application. The architecture that we propose relies on the integration of specific components such as the Intelligent Tutoring System (ITS) in the Seeheim architecture [Pfaff 85]. As the Seeheim model does our architecture distinguishes three layers :

- **application** is composed by a set of semantic functions which represents the courseware functionnal core. For example a courseware on Computer Assisted Design (CAD) concepts needs processing to manipulate curves and surfaces.
- **control** is based on two components i.e. the training adviser and the learning manager. The adviser task is to put the learner into the most suitable learning units. The learning manager controls the temporal execution of the learning units and captures the learner cognitive behaviour. The adviser analyses the behaviour parameters captured and generates a new learning situation.
- **presentation** distinguishes several components i.e. the presentation manager, the monomodal events managers and the multimodal generator. The presentation manager takes care of the restoration of the multimedia information on the output devices. It selects the information to present by browsing through the multimedia database. The monomodal events managers control the end user interactions. Each one generates a monomodal event and put it in the monomodal events queue. This queue is used by the multimodal generator to produce multimodal events. The generator continuously searches command events in the queue and merges all monomodal events which have relation with the command event. The fusion method uses the general model of interaction <Command-Name, Objects, Parameters>. The generator seeks the value of each parameter of the requested command. The multimodal event produced is directly sent to the learning manager which establishes an association between the event and a semantic function.

Our architecture distinguishes two kinds of components. The specific components of a courseware such as the learner profile, the learning units or the semantic functions units. The common components of all coursewares (the generic components) such as the learner manager, the training adviser, the presentation manager, the multimedia generator and the monomodal events managers components. These components can be implemented once and for all and reused to develop all the coursewares.

As an experimentation, we implemented two releases of the generic components. One is developped under the Ms-Windows system with the Turbo Pascal and the C++ programming languages. For the second we used the Macintosh Hypercard system.

We reuse the generic components implementations to build two coursewares : MATH-MAX and EAO-CAO. They are respectively dealing with the basic arithmetic learning and the CAD concepts. They respectively use the hypercard and the Ms-Windows releases.

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A Case Study of Hypermedia Assisted Learning in "Life Environment Studies" II

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From April 1992, new curriculums have come into practice in Japanese elementary school and "Life Environment Studies" took effect at the same time. Most important object of "Life Environment Studies" is to support the growth of children's independence. To realize of this object, teachers need to change their past typical teaching for all students in class. In "Life Environment Studies", students need to study with strong consciousness about the problem and to have their solution concerning of the problem. So the most necessary ability bringing up in "Life Environment Studies" is for children to investigate with their problems.

Meanwhile characteristics of hypermedia as Media are non-linear, non-continuance, non-structure and control by learner. Considering merits of hypermedia, it is very effective for children to study "Life Environment Studies" applying hypermedia.

In this paper ,we would discuss about hypermedia as one of the most effective materials to realize the object of "Life Environment Studies " and to lighten the burden imposed on teachers in the process of development of hypermedia materials.

Software development and practice in teaching

Computer Assisted Instruction(CAI) which was bound by text and teacher's guidance has strong historical roots in Japanese Education. But in the learning style of CAI, recently there is growing recognition of the need for changing to the children-focused learning environment . Hypermedia has been represented as new and powerful tools to help and support the transformation of Japanese classrooms. Children can study not by force but independently their own mental curiosity by applying hypermedia strategies. In "Life Environment Studies ", it's most important for children to interested in relationships between themselves and near society ,nature. So hypermedia materials is more useful than other materials to study for student's divergence of thinking.

We created stacks by HyperCard from the numerous computer files (text, graphics, audio, movies etc.). Each data of the card could linked other data of the appropriate cards in the stack. Clicking the "button" of the card by a mouse , children who use the stack easily enabled to dynamically search for their needful various type of information which is text, graphics, audio and movies. Movies are shown another TV monitor and they are easily controlled by HyperCard through the interface.

We used the development stacks in teaching 2nd grade class. After the lesson, we got to know that children were very excited and strongly motivated to study with the hypermedia System. Most of all children had the impressions that the lesson was very interesting and they wanted to go the place to get more information. The main findings are the following:

F1:We can create stacks more easily and shortly than developing traditional CAI system.

F2: It make children possible to study along their individual interest because of the structural flexibility and interactive operation of the stacks.

F3:The stacks are designed to hold various type of data. Children can study more independently by operating these data as they like.

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Reaching Students through Bilingual, Interactive Multimedia Books

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Interactive multimedia books, also known as CD-ROM storybooks, greatly appeal to educators who wish to stimulate the reading interests of beginning readers and reluctant readers. The sound effects, music, illustrations and speech associated with such electronic literature bring stories alive for the reader by presenting a dynamic retelling of well-known children's books. The multi-lingual options offer additional appeal to students who are learning a second language, for several of this genre of books present retellings in English and another language, most often Spanish.

Interactive multimedia books have been used successfully with elementary grade students who are native speakers of Spanish and with students who are learning Spanish as a second language. The student may elect to read and hear a Spanish or English version of the text. Likewise, he/she may select specific vocabulary from the text or from the illustrations to hear in both Spanish and English, thus allowing him/her to review pronunciation and to build vocabulary. For example, while reading Grandma and Me by Mercer Mayer (Brøderbund), the student may repeat any part of the text in order to hear Spanish or English pronunciations as well as definitions. In The Tale of Peter Rabbit by Beatrix Potter (Discis), the student may select text or significant parts of the illustrations to hear pronunciations in either language. The interactive nature of the reading allows the student to control the rate and the format of presentation and to repeat any part of the story as necessary.

These electronic books are ideal for students who have not yet discovered the joy of reading or who are learning a second language. Some criticism has accompanied the proliferation of such electronic storybooks, however. The genre is viewed by some as nothing more than excessive stimulation for the reader who engages in an MTV-like viewing of a story by passively listening and watching. These critics would suggest that the reader should be focusing simply on text and the imaginative images that it can induce. To the contrary, the dynamic interaction with text and images permits the reader to respond to the text by clicking on words, passages, or illustrations to make them come to life. Furthermore, the reader builds vocabulary and improves comprehension by monitoring his understanding of the passage easily and individually with no pressure from instructor or peers. In addition, several editions of these electronic books are accompanied by the books themselves so that the student may have the traditional reading experience as well, either before or after participating in the electronic version.

In order for bilingual, interactive multimedia books to be effective in developing students' understanding and appreciation of text, they must allow students to read independently and to explore stories interactively, controlling the pace of the program and choosing to read on their own. Furthermore, the best of this genre also encourage extension activities such as writing and oral discussion in response to the reading. Finally, for students who are learning a new language, many of these CD-ROM storybooks provide stimulating opportunities for independent language exploration which result in a non-threatening and thus natural acquisition of a new tongue.

"Physics by Pictures"
New Interactive Learning Environment for Physics Education

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Educational computer courseware "Physics by Pictures" is an integral base of knowledge in the field of physics which provides an interactive learning and teaching environment. "Physics by Pictures" includes a set of dynamic computer simulations of physical experiments and a reference book. The courseware includes various information and functions using simulation, multi-media, gaming, testing etc.,

"Physics by Pictures" is an educational computer courseware for both teachers and schoolchildren developed in Scientific Center PHYSICON (founded by Moscow Institute of Physics and Technology and Russian Physical Society).

"Physics by Pictures" consists of a reference books in physics and a set of computer programs. It includes colorful computer simulations from Mechanics, Thermodynamics and Molecular Physics, Electricity, Optics, Atomic Physics, as well as portraits and biographies of famous physicists, historical experiment examples, etc.

Some questions and various problems are included in the courseware with the possibility to enter and check the answers of schoolchildren. It is possible to choose all parameters of computer simulations. Some of the examples are designed as a flexible constructor, which allows one to develop different experimental schemes and to investigate them. There are also a calculator, lists of physics and mathematics formulas, and tables of physical constants. The hypertext is used to ease learning physics.

The "Physics by Pictures" courseware is intended for schoolchildren with different levels of physics knowledge. It can be used as a convenient reference book for the first level physics, and for deeper learning of physics at higher levels.

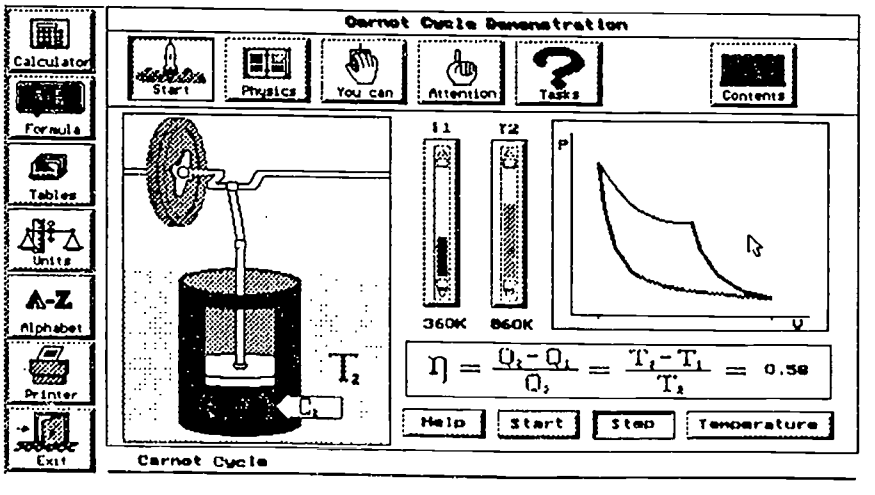
The distinguishable features of "Physics by Pictures" are:

a) the courseware includes various information and functions using simulation, multi-media, gaming, testing,

b) a friendly interactive graphics interface,

c) the courseware provides wide possibilities for more intensive teaching and attracts considerable interest of schoolchildren.

Hardware requirements for the courseware: IBM AT/286/386/486 compatibles, EGA or VGA graphic card, Microsoft compatible mouse, MS DOS 3.3 or higher. Now the new version of the software for Windows 3.1 is in progress.



Intelligent Performance Support for Courseware Authoring

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Courseware authoring (developing computer-mediated instructional materials) consists of a variety of tasks often performed by several individuals. Some of these tasks are repetitive and involve skills that are easily and quickly acquired (e.g., invoking a particular computer-based authoring environment to open and edit a file containing a particular lesson module). Other tasks are less mechanical and require years of practice to achieve mastery (e.g., specifying a particular instructional strategy for a given instructional purpose and setting). Still other tasks require collaboration in order to insure effectiveness of solution (e.g., planning the use of interactive media so as to engage learners) (Rowland, 1992).

Instructional design intelligence consists of expertise in one of more of the tasks involved in the courseware authoring process. This suggests that there are multiple instructional design intelligences and, therefore, multiple ways to represent courseware authoring intelligence in a computer program. An intelligent courseware authoring performance support system could be categorized and evaluated by the type of intelligence provided. At least these three types are possible: (1) intelligent tool set (e.g., brings the right tool set to the job arranged in likely order of use); (2) intelligent design advisor (e.g., offers one or more solutions elaborated for similar instructional problems); and (3) intelligent design problem-solver (e.g., presents the user, perhaps a novice designer, an executable framework for solving the user's design task) (Duchastel, 1990; Spector, Polson, & Muraida, 1993).

Evaluating Intelligent Instructional Design Support Systems

It is likely that different evaluation concerns arise with various types of courseware authoring support systems. For example, for those systems which purport to provide an intelligent set of tools, then it would be reasonable to examine some task analytic hypotheses (e.g., providing dynamic lesson plans which adjust to type of lesson objective will enhance productivity) as well as various human-factors hypotheses (e.g., providing drop-and-drag reusable objects in a particular window enhances productivity). Likewise, in evaluating an intelligent courseware design advisor it might be appropriate to examine various cognitive hypotheses (e.g., providing case-based, context-sensitive elaborations of specific instructional design guidelines enhances understanding of courseware design processes, with effects on improved instructional design performance). Evaluating an intelligent design problem-solver would include evaluation of products with regard to instructional effectiveness. Evaluating a collaborative courseware authoring performance support tool presents new and unsolved challenges.

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Multimedia Portfolios: Tool for Classroom Assessment

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As the use of technology in educational settings increases, traditional methods of assessment such as written tests and reports often prove to be unsatisfactory. Newer technologies appeal to a variety of learning styles, while the familiar methods of assessment do not necessarily address these differences. With the availability of low cost, relatively easy to learn multimedia authoring systems, traditional methods of assessment can be replaced by more innovative means of assessment. Multimedia portfolios that contain samples of student work and document student progress offer one alternative to the traditional assessment tools. The use of such portfolios poses several challenges for the teacher. These include questions of evaluation, and selection of activities for inclusion that do not simply duplicate traditional written forms of assessment.

This project focuses on the use of multimedia portfolios as assessment tools with two different populations. The first group consisted of first grade students from an inner city school. These students created multimedia math journals to illustrate concepts studied in their class. Journals included original artwork, clip art, buttons, text items, digitized pictures and verbal comments recorded by the students. Cards selected from individual journals were also combined into a class math journal. One unit included counting in other languages, and students were able to include in the journal recordings of themselves counting in these languages. An advantage of this type journal is the ability to record a student's spoken explanation of a math concept. Much of the artwork and writing could have been produced with paper and pencil. The ease of duplicating clip art made the students more willing to work with larger numbers in their examples, and the ability to resize clip art using the program reinforced the concept of relative sizes.

The second population consisted of preservice and inservice teachers in a college technology course. These students created multimedia portfolios that illustrated uses of technology in education. Students created simple stacks explaining, and when feasible, demonstrating output from a variety of technologies such as scanners, digitizers, video discs, CD-ROM, and MIDI music. Text items describing the use of these technologies in educational settings were included in the stacks Creation of a portfolio in this manner enabled the students to learn how to use a hypermedia authoring system as a tool. Inclusion of samples of the technology in the stacks required the students to demonstrate proficiency with each of the types of technology. Students enjoyed this approach and felt it demonstrated what they had learned more effectively than traditional written assignments would have demonstrated. At the end of the semester, students used their stacks to create videotapes on technology in education. This provided an alternative for those students without access to a computer after the course ended to continue to use the material.

Both groups used HyperStudio to create the portfolios. Samples of portfolios produced by both the first graders and the preservice and inservice teachers will be displayed.

Software: *HyperStudio*, Roger Wagner Publishing, Inc., El Cajon, California.

Authoring and Algorithmic Navigation in Large Hyperbases

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The problem of creation of large educational hyperbases and navigating them is especially vital for loosely-structured subjects, e.g. the humanitarian ones. The possibility of representing such a subject from various points of view is very significant. It is often difficult to define the limits of a material, or its "beginning" and "end". For these fields the hyperbase should not be organized as plain electronic textbook. The main intention of it is to provide for a student the possibility to perceive the material as it is, in multiple aspects, and to promote for self-learning and free navigation.

When a hyperbase is intended for the free navigation, linking of nodes in it is a very complicated and ambiguous problem. It is hardly possible to perform linking manually, not only because of the large quantity of nodes, but also because it is difficult to choose the unified criteria of linking. You never know in advance what will be the place of a particular node in various paths while in navigation. The pragmatic approach would be to link everything close by sense; in other words, each pair of nodes which *could* be joined with some linking expression or just could follow one another in a navigation path *should* be linked. The authoring system should provide facilities for automation of linking, performing search for nodes-candidates. The methods of information refining and powerful linguistic engines can certainly help in this matter.

The probability of getting lost in this hyperbase is very high. Of course, the "trail blazers" can do a lot of work, paving "good" paths in the base, but the ability of free navigation is also necessary.

On this stage, the automatic (algorithmic) navigation methods are suggested. The algorithms use only the structure of links in the hyperbase. They are based on the correspondence between topologic and semantic connectedness of nodes in a hypertext net. Speaking about topologic connectedness, we mean that every node has an unique position in the network (number of links, distances from other nodes, etc.). When the links are established by content, the topology of the network corresponds to the semantic interrelations of the nodes.

On each step of navigation the possibility exists to choose the next node upon criteria of high degree of its topologic connectedness with all the nodes previously included in the navigation path. The resulting navigation path forms a logical exposition of the theme set by the initial nodes.

The authoring and algorithmic navigation means are demonstrated on the IntelText system (Subbotin & Subbotin, 1993), which was developed basing on the abovenamed principles. IntelText works on the PC under DOS or Windows.

In IntelText, a hypertext node is a separate text fragment expressing one thought or idea or one small section of a textbook - in other words, a monosemantic unit. The links are bi-directional and go from a node to a node as a whole. Linking can be performed manually or automatically or in semi-automatic mode.

The navigation has three modes: manual, when the user traverses among nodes and can remember the navigation "path"; automatic, when the user sets the theme and the system automatically picks up the nodes and arranges them in a linear text according to the built-in criteria; and the combined mode, when the result of the automatic navigation is decompiled into a path which can be explored manually.

Thus, the learner has the following capabilities: traverse from one node to another, ask the system to automatically compile a path beginning at any particular node, walk along this path, look at the neighborhood of the nodes in it, leave the path for independent, manual navigation, return to the path, etc.

The author has additional capabilities of establishing and changing the links structure, remembering good paths, etc. He/she also can ask the system to construct paths automatically, consider the result and accordingly correct some links, thus improving the base.

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AlgoBlock: A tangible programming language for collaborative learning

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AlgoBlock as an conversational tool

In the belief that learning through discussion and cooperation is more effective than that in isolated environments, the authors intend to design a computer-aided learning environment in which primary and secondary students can improve their skills for planning and logical thinking through social interactions. The authors have designed AlgoBlock system (Suzuki et al. 1993) as a conversational tool that facilitates discussions among learners and activates collaborative programming. It is a set of tangible blocks that can be connected to each other manually to form a program. Each block corresponds to a command of a programming language. Learners can control a graphically displayed submarine on the CRT through Logo-like commands.

Collaboration on the tangible tool

With this tangible tool, learners can manipulate the programs manually and directly, and can share them on their collaborative work space. We believe that tangibility of AlgoBlock helps learners build programs through social interactions. To investigate the effect of the tool on learners' collaboration, we have had an observational session, in which three 12-year-old students were engaged in group programming works using AlgoBlock for 90 minutes. Results of the observation eloquently tell us that the tool is qualified as a communication facilitator. Following is a typical conversation in the session.

Subject1[01] " This " (Tried to insert Rotate-block between GoForward-block and GoRight-block [action-1])
Subject2[02] " No! We only have to change this (parameter) to 3 " (Stretched out his hand toward blocks [action-2], and removed Rotate-block that Subject1 connected [action-3]) "Be...Because this is....."

(1)**Easy operation:** Handling tangible blocks is so direct and easy for Subjects that they could manipulate programs immediately when they wanted to [action-1][action-3]. Easy operation promotes trial-and-error activities that encourage conversations among learners.

(2)**Social display of ideas:** In [01], Subject1's idea was socially displayed to the others by the obvious action [action-1] and physical changes in configuration of the tangible blocks that were placed on shared work space. Subject2 thus could understand the idea easily and intervene immediately [02]. Subject2's response here is also displayed to the others [action-3]. In this way, manipulating the tangible tool necessarily generates sequence of social display of ideas. AlgoBlock works as an open tool (Hutchins 1990) which enables users to monitor their cooperative activities mutually. This feature contributes to support collaboration.

(3)**Gesture based turn-taking control:** AlgoBlock also enables gesture based turn-taking control to access the tool because of its tangibility. In [02], Subject2 stretched out his hand toward the blocks [action-2] to express his idea. By the external gesture that was naturally generated in trying to manipulate the tangible tool, the turn-shifting was smoothly achieved and confirmed. The gesture based turn-taking control supports vigorous collaboration because the rules, which are the same as that in everyday activities, are so familiar to learners that they do not have to learn extra rules for the control.

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Multimedia and Teacher Training: A Videodisc Application For Exploring Conceptions of Effective Teaching Practices

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Teachers' (and students') conceptions of effective teaching practices play an important role in the teaching and learning process, but are typically given footnote status in teacher preparation programs. This lack of attention to conceptions of effective teaching may have particularly critical repercussions, as when teachers are trained and/or curricula designed with a particular sort of teacher-student interaction in mind, then injected into cultures in which teachers and students are accustomed to interacting in dramatically different ways. The purpose of an on-going project at the University at Albany is to develop materials that explore differences in perceptions of effective teaching practices and that stimulate preservice teachers to reflect on their preconceived notions of the same. Primary among these materials is a videodisc which presents loosely scripted interactions between a teacher and her students.

Teachers' perceptions of effective teaching are subjective. They are influenced not only by beliefs about the effectiveness of particular teaching strategies and styles (factors we are interested in exploring), but by expectations concerning classroom environments and what should be covered in particular disciplines, as well as by affective reactions to the personalities of differing teachers and students. These latter biases may be particularly troubling in cross-national studies. Although video is generally recognized as a useful tool for exploring teaching effectiveness, most of the video used for such purposes consists of tape made in actual classrooms, making it difficult to partial out differences in perceptions based on differences in teaching strategies and styles from differences in perceptions arising from other factors. Our approach, therefore, has been slightly different.

The video used in the work discussed here was designed to focus on particular teaching strategies and styles while holding other factors constant. It consists, therefore, of quasi-scripted vignettes of a teacher and her students exploring a non-traditional subject area, black history. The teacher and all her students are African-American. The segments were shot in a circular meeting area in a local community school. Two cameras were used to capture both teacher and student behaviors, edited into segments which vary by teaching strategy and style, then put on videodisc. The use of videodisc allows for the random presentation of these segments

We are currently using the videodisc in two ways. Firstly, it is being used in a cross-national study of conceptions of effective teaching practices. We are showing the vignettes to educators from a variety of different countries and asking them to rate the effectiveness of the teaching shown in each on a ten-point scale We are using comparisons of response patterns, in particular comparisons of the responses of educators in the United States with the responses of educators in African countries where we are working, to inform our international curricular work. In addition, we are comparing the responses of preservice and inservice teachers and teachers and students in this country. Because the vignettes are on videodisc, we can also explore the effect of presentation on responses.

Secondly, we are using the videodisc in our teaching methods classes as a prompt for discussions of teaching strategies, styles, and reflective practice. We are finding that the vignettes elicit a rich discourse around these topics, topics that have not traditionally been as well covered as we believe they should be in preservice training. The use of videodisc in these classes allows us to explore particular parts of each vignette in microcosm and to relate different vignettes to each other without struggling with videotape. Students' response to these discussions have been very positive, so much so that we are currently considering integrating our more conventional videotape examples into a similar structure for teaching purposes.

Interactive Multimedia for Preservice Elementary Teacher Education

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Six videodiscs were developed for use in a preservice elementary education science methods course. Each contains a twenty minute hands-on science lesson taught by an exemplary teacher, and a reservoir of thirty second episodes that also deal with the specific topic of the videodisc. The disc titles include: Process Skills I, Process Skills II, Interdisciplinary Science, Methods of Instruction, Classroom Management, and Questioning. Each disc contains four separate sound tracks: 1) the lesson as it happened, 2) the teacher's comments, 3) the childrens' comments, and 4) a science educator's comments.

This project was designed to facilitate instruction in science education. Current trends in education call for providing meaningful instruction. In science education this means hands-on activities that allow students to construct their own meanings. This series of videodiscs is an opportunity to bridge research into practice. It provides an opportunity to capture positive role modes implementing outstanding pedagogy in their practice.

Six elementary school teachers (grades 2-7) were identified as exemplary science teachers. This process began in the fall of 1992. After the teachers were recruited they met at Northern Illinois University where they were inserviced with regard to the project. Philosophy of the project, science methodology, process skill acquisition, questioning strategies, and videotaping details were discussed.

After the initial taping a rough edited version of the 1/2" betacam videotape was created. Upon completion the videotape was taken back to the school for the children to view. Their comments regarding what they remembered taking place were recorded.

The teachers were brought into the production studio at the university to record their comments. The science educator's comments were also recorded at the production studio. At this point two 3/4" parallel masters were produced for each lesson. One tape contained the video and the sound tracks for audio one and two. The second tape with identical timecodes contained the sound tracks for audio three and four.

The discs are currently being used in Level I applications while the software is being developed. Elementary science methods instructors are integrating selected video segments into lecture/discussion sessions. The two objectives are to provide role models for preservice teachers and to bridge the gap between theory and practice. Access is obtained through the use of a remote keypad.

Preservice teachers are provided with sets of barcodes that correlate with class discussions and textbook readings. Access is obtained through the use of a barcode reader. The videodiscs are located in the Science Education Laboratory and are available to students outside regular class time.

LinkWay Live is the software selected to develop the interactive multimedia component. When completed, preservice and inservice teachers alike will be able to interact with all six videodiscs in the following ways: 1) A lesson plan containing standard elements such as concept and process objectives, procedures, key questions, etc. serve as the primary shell for each featured science lesson. The viewer will be able to click on any icon found within the lesson plan and view the application of the plan and the resulting behaviors. 2) Assessment issues are another focus of the software. Opportunities to correlate with the Illinois State Goals for Learning, the American Association for the Advancement of Science document, Benchmarks, and common evaluation techniques will be provided. 3) Decision making opportunities allow the viewer to make choices about instructional alternatives that he/she might make during an activity.

Two additional videodiscs are currently in production on the topics of authentic assessment and technology. By the end of 1994, all eight videodiscs under the title: Capturing Excellence will be placed in the hands of the science educators involved in teacher preparation programs in the state of Illinois. Beginning in September, 1994, the project director will visit each Illinois public institution involved in teacher education to conduct staff development activities and disseminate the videodiscs.

Domain Analysis for CAI Design

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Educational software currently being produced suffers from severe design flaws which result in poor quality. For designers of Computer-Assisted Instruction to produce effective instruction, it is necessary to provide a set of procedures and guidelines that designers can follow, based on sound instructional design and learning principles.

A methodology known as GOMS can be used to assist designers during the first phase of the design model [Roblyer 88]. Determining what is learned is the Goal of the design. Lessons are designed to accomplish goals for specific learners. Having identified the instructional goal, it is necessary to determine the type of learning Outcomes required of the student. According to Gagne [92], learning outcomes can be placed into five categories. Each requires a different instructional method to accomplish it effectively. Since the underlying structure of the instructional content differs by domain, determining the domain of learning outcomes gives the CAI designer an initial idea about organising and sequencing instruction contents for teaching those outcomes.

Different Methods must be used to analyse subject matter in different domains because of different learning outcomes. There are four different methods that can be used for analysing different learning outcomes.

For educational software to be effective, what is needed is the incorporation of higher order learning Strategies within the courseware. Learning strategies include techniques that learners can be taught to use during instruction to support effective learning [Uden 93]. Good guidelines and design methodology can enable designers to achieve effective courseware production. The GOMS methodology offers such an approach.

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"Power Users" in Academe: Who are They?

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With respect to computing, the people who might be labelled "Power Users" are an important group in any organization. They often provide the necessary internal training (formal and informal) that an organization needs in order to respond adequately to rapid technological change. Moreover, they are often models for computing resource development within their organizations. In addition, by learning how to respond to the challenges of the new technology, they are typically pioneers who smooth the way for those that follow. Finally, they often occupy leadership roles in the decision-making processes regarding the integration of computing within their organizations. This paper suggests a set of criteria that can be used for the definition of "Power Users" in academic environments. It also describes the "Power Users" that were identified in a survey of the faculty at Western Michigan University, and discusses some of their attitudes about and perceptions of academic computing.

Toward a Definition of Academic Power Users

Based upon the literature, a number of criteria were identified that are central to the notion of "power users." These included: technical expertise, amount of time spent using a computer, the range of applications used, the expertise of use, and integration into a larger group of skilled computer users. Based on a 1989 survey of 500 faculty at Western Michigan University, six criteria were tentatively established as the initial definition of "power users:" 1) Total time working on a computer in excess of 15 hours per week; 2) Use of a word processor a few times a week or more; 3) Use of electronic mail; 4) Use of at least one application in addition to word processing; 5) Teaching or expecting to teach classes that require the use of computers by students; and 6) Purchase or acquisition of a computer for use at home or at the office.

To assess the relative importance of each of these criteria, we simply removed each of the six criteria in reverse order and observed the consequences. For example, when the sixth criterion "using one other application" was removed, exactly the same number of "power users" was produced (n=54). Since it makes no difference, clearly this factor is redundant to the definition. Also, since the fifth criterion "bought/acquired a pc" affects only one person, it is also redundant. Indeed, even the fourth criterion, "using a wordprocessor" affects only 4 individuals. In contrast, removing the third criterion "taught classes" increased the number of tentative "power users" to 72 (an increase of nearly 25 percent). Clearly, this criterion should be retained. Since the other two criteria accounted for the most Power Users, the final definition of "academic power users" among the faculty at Western Michigan University in 1989 should be based upon the first three criteria in the definition:

1) the use of electronic mail;
2) at least 15 hours of computer use per week;
3) teaching or expecting to teach classes that involve the use of a computer.

Although Power Users currently make up a small percentage of computer users (perhaps 10%), they are the prototypical faculty computer users of the future. What only the power users are doing with computers today will become commonplace among faculty in general within a few years.

Techniques for Converting Analog Interactive Videodisc Courseware into Digital CD-ROM Programs: Conversion of *The Anatomy Project*

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During the past decade, educators in the health sciences have effectively and widely used interactive videodisc technology for the delivery of instructional material. Many videodiscs have been produced that contain very high quality still and motion images of anatomy, physiology, and medical procedures. *The Anatomy Project* is a joint British and American effort to produce a series of high quality instructional programs that uses multimedia technologies to combine technical content in an artful format. Currently, a set of seven videodiscs and programs exist that are used in medical schools around the world. When completed, *The Anatomy Project* will contain 26 volumes of interactive videodisc courseware, covering all of clinically oriented human anatomy. Recent advances in CD-ROM and digital video technologies enable high quality digital adaptations of these interactive videodisc programs to be created and presented using personal computers.

A large number of critical decisions must be made before attempting to convert an interactive videodisc program into a digital format. One of the most important is the hardware requirements for using the program. Many medical schools have already invested heavily in a variety of computer equipment for instructional purposes. One goal during the conversion of *The Anatomy Project* was to redesign the program to take advantage as much as possible of existing installed bases of equipment. These decisions included designing for 14 inch monitors, requiring only 5 MB of RAM, and requiring no additional display or conversion hardware (i.e., software only decompression). In addition, it was decided to design for double speed CD-ROM drives since they have replaced single speed drives as the computer peripheral standard. The tools used in the conversion from analog videodisc to digital CD-ROM included a video capture and compression board (VideoVision Studio™), Adobe Premiere™ and VideoFusion™ video editing software, HyperCard™, QuickTime™ compression and playback, Adobe Photoshop™, and various graphics programs.

Obtaining good performance from digital programs stored on CD-ROM (i.e., smooth video playback with synchronized audio) requires the developer to carefully consider and manipulate a wide range of complex system and media factors. Some of these factors are: CD-ROM bandwidth; video frame rate and resolution processing; video decompression processing; video display processing; audio sampling rate and bit depth; audio playback processing, processing time for "de-interleaving" and scheduling video and sound; and flattening. A number of techniques have been developed to enhance movie playback. One of the most useful involves capturing a video frame as a still image, digitally enhancing the image, and then inserting copies of the still image in place of the original video segment. A second technique involves replacing full motion video with a montage of still images while maintaining the sound or narration.

Recombinant DNA Lab
An Interactive HyperCard Simulation

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Within the last decade biotechnology, the techniques and procedures used in genetic engineering, has become increasingly important and well known in universities and industry. However, this knowledge has not crossed over to the general public or even high school students moving towards a scientific career. The HyperCard stack described in this paper takes the theoretical concepts and experimental procedures of biotechnology and incorporates them into an interactive computer simulation of a basic biotechnology application. The student is given the task of producing human insulin using genetic engineering techniques.

The simulation takes place in a virtual laboratory where the student can move from room to room and work station to work station at the click of a button. The student starts the experiment by preparing the vector DNA to be spliced with the human gene. The student selects the bacterial culture which has the desired plasmid and uses enzymes to release the plasmids. From there the student isolates the plasmids using a centrifuge and then selects the appropriate restriction enzyme to cut the plasmid DNA at the desired DNA sequence.

The next task for the student is to prepare the insert DNA by first extracting mRNA from human pancreas and using reverse transcriptase to create the DNA sequence which produces insulin. The insulin gene is prepared for splicing by attaching the regulatory sequence to the gene. This will activate the gene and allow the host cell to produce human insulin. The final procedure after the insulin gene and plasmid are spliced is to introduce the hybrid vector into bacterial cells. The student then screens for bacterial cells which have accepted the hybrid vectors and will naturally produce insulin. These bacteria are then placed in a culture broth where human insulin is harvested.

Though the necessary steps are outlined in the protocol stack, the student interactively performs the tasks using equipment that would be found in a real laboratory. In the protocol stack there are links to supplementary stacks which further explain basic concepts to the student. For example, there is a linked stack which explores the use of vectors in genetic engineering. Both viral vectors and plasmid vectors are demonstrated.

At all the work stations the student can click on a virtual microscope which shows an animation sequence to help the student visualize the biological processes that are happening inside the test tubes. The graphical nature of the laboratory along with the animations of what is happening at the cellular and molecular level provide an insightful and entertaining introduction to genetic engineering. This virtual laboratory is an affordable alternative to having a fully stocked biotechnology lab at every high school.

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Partners in Education and the Distributed Interactive Simulation Instructional Animation Project

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The overwhelming ills faced by education today will never be cured by using outdated traditional processes for education. Worn-out lectures, tests and homework fall far short in challenging high school students to learn the skills they desperately need to face their rapidly changing future. The process is changing in Orange County, Florida. The Naval Air Warfare Center Training Systems Division (TSD) and Edgewater High School, supported by Apple Computer, Inc., have joined under the *Partners in Education Agreement* to provide a new learning paradigm in one classroom environment.

The Training Systems Division needed a method to explain the underlying concepts of Distributed Interactive Simulation (DIS) and Edgewater High School was looking for ways to utilize their computer animation lab. Edgewater and TSD jointly planned a learning venture for the students to produce the Distributed Interactive Simulation Instructional Animation. This project provided a "real-world" multi-media production that would enrich students' skills in visual arts, group dynamics, computer operation, and problem solving in a multi-disciplined team environment.

The primary objective was to make the entire project a creative product developed by students. The teacher and facilitating partners encouraged students to learn to structure a task from conception to completion, work in groups and independently, communicate ideas verbally and visually, manage time and set priorities. To provide the students with a non-traditional, highly effective learning environment, the organization of this student team was modeled after a real corporation complete with a customer, TSD.

The facts that the corporation had the capability to interview, hire, promote, or dismiss employees based on production needs and work performance, helped motivate all students to carry their share of the workload. The student and teacher held regular corporate meetings to make work assignments, prioritize time, delegate project responsibility, critique the animation, and evaluate progress. Student communication and organizational skills improved rapidly as they assumed their full corporate responsibilities.

With this type of partnership project, the teacher becomes a resource person, facilitator, and stage manager, creating a cooperative learning environment. The students develop effective working skills as traditional classroom assignments are minimized and more of the students' effort is directed by self-initiated tasks. The teacher serves as a resource manager, identifying and securing community people with specialized skills to enhance the learning production process.

Throughout the project's lifespan, subject matter experts assisted the students in the areas of engineering and DIS, computer technology, creative writing, theater, and visual arts. Parents volunteered clerical skills, transportation, food, technical skills, equipment, and family time. Their support was invaluable.

Students reported learning important skills from participation in this project such as: cooperation, drawing, color theory, organization, public speaking, advertising, brainstorming, animation, working with others, problem solving and business planning. This partnership effort allowed students to develop real world competencies such as imagination, flexibility, leadership, and responsibility. What started as a simple classroom project, evolved in into a revolutionary teaching and learning experience.

Application of the Russian Language Processor Russicon in Language Learning

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New electronic media now provides fast and easy access to the authoritative language information. Natural language processing as a part of Artificial Intelligence is seen by some as one of the most promising directions in computer based language learning. In Intelligent Language Tutoring Systems of various types, natural language processing is one of the most important components. There are many popular linguistic applications for Romance and Germanic languages that could be used for language learning. Unfortunately, we can't confirm the same about Russian language processing, in which good results were achieved for IBM 360 (Popov, 1986) and only first steps are made for personal computers.

We shall describe the design of, and the possible applications of Russian language processor RUSSICON capable of acting as an intelligent system for analyzing and synthesizing of Russian text.

Processor RUSSICON (Yablonsky, S.A., 1990; Belyaev, B.M., & Surcis, A.S.,& Yablonsky, S.A. 1993) includes six main blocks: 1) Set of machine dictionaries. Base machine Russian dictionary consists of 36611 word-building stems. One word-building stem generates from 1 up 80 word changing stems. Wordbuilding stems of the dictionary give birth to 84167 word-changing stems. Word-changing stems in there term give birth to 3600000 different words. 2) System for construction and support of computer dictionaries. 3) Morphological analyzer allows to define following grammatical characteristics of a word: part of speech, changeability, animation, case, number, gender, person, aspect, tense, transition, mood, form, reflexive (verb), length of word-building and word-changing stem. 4) Normalizer which modifies a given word to its normal grammatical form (lemma). 5) Syntactic analyzer. 6) Semantic analyzer. The processor is designed as C library (Borland C++) of mentioned functions.

Several applications are build on the base of the processor. Russicon Russian Spelling Corrector checks wrong spelling. Russicon Russian Electronic Thesaurus provides users with complete synonym information for words or phrases. Russicon Russian Language Expert System provides all functions of processor, allows to receive morphological information of the word and to build normal form for the word, shows paradigm for the word, constructs new words lexicon, constructs frequency lexicon, provides morphological information treatment of new words not in the base dictionary. Russicon's Russian Electronic Dictionary for any form of input Russian word outputs a) one or several lemmas (lexical homonims); b) one or several sets (the case of morphological homonyms) of such grammatical characteristics: part of speech, case, gender, number, tense, person, degree of comparision, voice, aspect, mood, form, type, transitiveness, reflexive, animation; c) the synonym row(s); d) the antonyms; e) the precise definitions; f) the explanatory comments; g) the examples of usage etc. All linguistic applications could be used as a seperate systems or inside of some Tutoring Systems.

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