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Learning about computers

Daniel Clayton Jones

LEARNING ABOUT COMPUTERS

A Project

Presented to the

Faculty of

California State University,

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In Partial Fulfillment

of the Requirements for the Degree

Master of Arts

in

Education: Instructional Technology

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ABSTRACT

Negative perceptions concerning the effectiveness of public education has forced government and administrators to quickly respond with programs and promises of change. Educational standards and goals have been re-written, class sizes drastically reduced and a great deal of money has been spent on technology in the classrooms. Incorporation of technology into the classroom includes new computers, software, hardware, peripherals and printers, and connections to the Internet.

The inclusion of technology in education quickly loses its value, however, if the teacher is not technologically trained and research indicates that this is exactly what has occurred. Most teachers do not feel comfortable enough with the technology to include it into their curriculum so while their rooms are wired with T-1 Internet connections and they have the latest educational software available to them, the computer only takes up a little more valuable space in the classroom. Many teachers have never even used a computer for personal use, so while the public's requests for changes may be temporarily satiated by physical presence of technology in the schools, the students will receive minimal benefits from the technology unless teacher training helps them to become technologically literate and efficient. Unfortunately, training teachers to use computers and other types of technology can be time intensive and we cannot afford to wait for a new generation of teachers who are technologically comfortable to take over.

This project explores the problem of technological illiteracy among teachers, discusses evidences of the value of technological inclusion from perspectives of the proponents who have tried it successfully, and offers a solution for becoming

technologically literate. This solution comes in the form of a multimedia application design which is a tutorial for new computer users to become more knowledgeable about the computer and how it works.

The multimedia tutorial allows the learner to approach the subject at their level of comfort, from the basics of computers to more advanced computer concepts. It combines information with interactivity so that the user is able to select the areas they are interested in learning about and offers them both visual and auditory reinforcements. Self-evaluations are accomplished by quizzes which cover each section. Feedback from each answer is given and an overall score assesses their comprehension of the information.

The program was piloted by three adult non-teachers who were completely unfamiliar with computers and one teacher who was computer literate. The results of the pilot indicated that while those persons who had an interest in learning about computers were able to learn a number of significant facts and procedures, those who had little interest to begin with were not motivated by this program and, consequently, for them the program was of marginal value. This result is, however, not surprising since the assumption is made that those teachers who have little initial motivation towards computers would most likely not be inclined to use this program anyway.

The successes of this program does imply that for those teachers who are interested in learning about computers, the computer itself may offer the most persuasive argument for the effectiveness of incorporating technology into education. If teachers can become comfortable with technology through the medium of technology, perhaps the value of including technology into their own curriculum will become obvious.

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CHAPTER ONE

Literature Review

The demand for change in public education is clearly here! The public wants results, and those results are expected to come in the form of higher test scores on standardized tests and more secondary students graduating into a college or university. Whether or not those measurements are accurate assessments of our public educational institutions is a matter of heated debate but one ignores the heated temperament of the public at their own peril. Change is upon us and we will change!

The response to this demand has most notably included an increase in the amount of technology in our classrooms. The public has apparently decided that the quickest solution to perceived notions of academic underachievement is to increase the sheer amount of technology in the classroom. Whether the teacher likes it or not, change will certainly include classroom evolution from film projectors and overheads to computers and LCD displays. Pressure to get the schools "wired" for the Internet and put computers into every classroom is increasing almost exponentially. Unfortunately, while budget allocations are moving at the speed of public demand, administration is often still scrambling to figure out how to get all of this technology incorporated into the curriculum.

It is ironic that at a time when budgets have swelled to provide technology, less attention is paid to the fact that teachers are uncomfortable with using the technology. Many educators view the technology changes as adding more to a schedule that is already packed full. So, powerful computers sit in a dusty corner of the room, occasionally

prodded and poked by "techy" students, but often to be discarded even by them because the software is outdated or otherwise uninteresting to them. According to Faison, (1996), (Baker, Hale, & Gifford, 1996), and others listed within this publication, many teachers do not even use the computer for basic presentations because they frankly do not know how to use them and their studies show that the majority of teachers are very uncomfortable with computers, particularly for educational use.

Christy L. Faison's article, *Modeling Instructional Technology Use in Teacher Preparation: Why We Can't Wait* " (Faison, 1996), says that "while many barriers to technology use exist, (i.e., resources, time), most disturbing is the fact that many practicing teachers feel that they have not had adequate training to help them use technology effectively."

Faison further states that "while many teachers see the value of technology, they feel ill-prepared to use these resources in the instructional setting". The real culprit, according to Faison, is that "current training programs are not technology oriented and educators must become technologically literate on their own". She goes on to say that vast resources are being spent on hardware and software, but since most institutions have traditionally viewed technology as a "supportive" necessity rather than an integral part the curriculum, teacher training in technology has not received adequate attention.

If education is to keep up with the demands for change, Faison believes that it must begin within the universities and colleges where our teachers are trained. Warren Baker, Thomas Hale, and Bernard R. Gifford parallel her opinions in their article, *Technology in the Classroom, From Theory to Practice* (Baker, Hale, & Gifford, 1996).

They state that "not even the National Research Council's periodic pleas for greater use of technology to meet the learning needs of an increasingly diverse student population have succeeded in reducing higher education's reliance upon conventional teaching methods." "Barriers to success" they believe is due to the colleges' and universities' "inability to afford to shoulder the financial risks of developing the enabling technologies necessary to support the development of instructionally effective CMI materials."

Nevertheless, the public's demand for technology is in full force. Teachers not only find themselves in need of training, but multi-cultural and multi-ethnic classrooms present even more challenges to using the technology. Caryl J. Sheffield, Professor of Elementary/Early Childhood Education at California University of Pennsylvania, says in her article, *Instructional Technology for Teachers: Preparation for Classroom Diversity* (Sheffield, 1997) that instructional technology must be appropriately modified for classroom diversity. She writes that "through the application of instructional technology... teachers will be able to [achieve expectations of] understanding the learner characteristics that children from different cultural backgrounds bring to the teaching/learning situation which may effect the quality of learning; and 2) create, select, and use appropriate instructional strategies pedagogical techniques, and materials to accommodate the learner characteristics". She says that since children have different learning styles, it would be a mistake to try to apply single instructional methodologies. She says that teachers cannot simply learn how the technology works, but must also learn how to appropriately apply the technology to various groups of students.

There are many examples of how technology has already been successfully used in the classroom. One example comes from Christman, Lucking, and Badgett in their article, *The Effectiveness of Computer-Assisted Instruction on the Academic Achievement of Secondary Students: A Meta-Analytic Comparison Between Urban, Suburban,and Rural Educational Settings (*Christman, Lucking & Badgett , 1997).

This article concerns a meta-analysis of 28 previous studies conducted to demonstrate the effectiveness of computer aided education and specifically, this study was undertaken with the purpose of determining whether statistically significant differences might exist between comparative groups within urban, suburban and rural areas. The results in all three categories indicated that while the differences may not have been statistically different, (as defined by $p < .01$), differences were observed in all three categories. Each group that had received CAI performed better then their counterparts who did not, regardless of demography. Secondly, urban groups showed greater differences than suburban groups which demonstrated greater differences than the rural groups.

A meta-analysis is a study based on the research data accumulated by previous studies. The authors of this article waded through 1000 studies to find studies which would meet their four criteria: 1) they were conducted in secondary schools 2) provided quantitative results for academic achievement 3) used experimental, quasi-experimental, or correlational approaches 4) minimum of 20 students in both the experimental and control groups. A total of 28 articles were chosen which met these criteria.

In each group, urban, suburban, and rural, two sub-groups were studied. The control group was instructed with traditional lecture methods and the experimental group utilized CAI. The results demonstrated that the urban experimental students moved from 50th to 65.1st percentiles as compared to their counterparts. The suburban experimental group moved from 50th to 55.5th percentiles and the rural experimental group moved from 50th to 53rd percentile.

Clearly, differences were observed between each group and the study does indicate that usage of CIA may improve students learning overall. However, the reason for this increase is not surmised by the authors other than to imply that it may be due to the obvious unique differences in the respective learning environments and environmental settings and to suggest that these differences may not appear in the next study. The important aspect of this study is to recognize that CAI seems to work regardless of demographics!

Another example has been demonstrated by Richard Riding and Phillip Chambers, Assessment Research Unit, University of Birmingham, UK in their article,. *Cd-rom versus textbook: a comparison of the use of two learning media by higher education students* (Riding, & Chambers,1992).

Determining what works best in instructional techniques requires direct comparisons between two models. Comparing and reporting results is obviously a major goal of research. Claims for a better system should be able to be substantiated and that is precisely what Riding and Chambers have done. Technology is being touted as a viable solution to lack of motivation in the classroom, as well as providing environments

whereby the student can explore answers to his or her curiosities develop new curiosities and consequently increase learning dramatically.

Forty college students were tested on the development of the third world after receiving instruction from a conventional textbook or from an interactive CD-ROM. The CD-Rom had search facilities and hyperlinks so that the student could explore the text material that became of interest. The gender breakdown was an even 20 female and 20 male and all were chosen randomly from one of five disciplines: English, History, Geography, Art and Music.

The textbook, *Development in the Third World,* was used by 20 students and the same text on a CD-ROM was used by the other 20 students. Evaluations took the form of factual information such as: "Describe the climate of a tropical rain forest"; interpretive information like "how might the collection of water affect the natural environment?", comparative analysis such as "compare the availability and usage of water in the developed world" and finally, deductive reasoning questions. An example of the latter question was to " describe some of the possible causes of drought and suggest solutions which emerge from the factors and considerations."

The results showed that the students who used the CD-ROM to cover the same textual material as the student who used the textbook received superior grades in all questions except for comparisons. The authors suggest that this may have been caused from the lack of diagrams and illustrations in the electronic mode, which were omitted due to technical considerations.

Clearly the implications of this study warrant further research in this area. These results also provide further evidence that incorporating technology into education is quite beneficial.

Utilizing technology as an instructional aid seems to work regardless of the learning ranges in which they are found. Work with students who have mild learning disabilities by McGregor, Drossner, and Axelrod have demonstrated success using technology in their article: *Increasing Instructional Efficiency: A Comparison of Voice Plus Text vs. Text Alone on the Error Rate of Students with Mild Disabilities During CAI* (McGregor, Drossner, & Axelrod,1990).

The purpose of this study was to determine whether or not utilizing simulated voice along with text was an effective aid in helping students learn subject matter. Critics of voice plus text suggested that adding voice would be too distracting and that language barriers would be enhanced by utilizing poor quality voice synthesizers. This investigation was to find out if adding voice to the text would be more beneficial to the student.

The group that was studied consisted of 12 kindergarten students and particular emphasis was placed on two of these students: Michael, age 7, and Christine, age 6. Both students were classified as students with learning difficulties. Hardware included an Apple IIgs and an Echo II+ Speech Synthesizer. Instructional programs were developed by a team of special educators and computer programmers at John Hopkins University which were designed in such a manner that the teacher could develop lessons utilizing the program. The lessons designed were to include an instructional sequence of matching

letters to pictures, pictures to letters, pictures to words, words to picture, word to number, and number to word. The rate of error was tabulated and recorded graphically. A total of 6 lessons were developed using voice and without voice. These lessons were presented to the students and the responses were noted with particular emphasis on errors.

The results indicated that in both cases, the error rate decreased significantly as the voice + text lessons were utilized. In Michael's case, the error rate ranged from 0-42% with text only and dropped to 0-28% when voice was added. In Christine's case, the error rate dropped from 0-19% to 0-17% when voice was added. The authors were quick to point out that given the small number of students studied, no definitive conclusions could be drawn, but they did feel that this test demonstrated that adding the voice did not distract from learning as some previously thought.

David W. Brooks demonstrates how technology can be integrated with curriculum in his work with computer classrooms in Chemistry. His article *Lecturing multimedia classrooms,* (Brooks,1997) addresses his approach towards combining lecture with experience and using technology to accomplish this in large classrooms.

David W. Brooks lectures the required introductory Chemistry classes at the University of Nebraska-Lincoln for science students. But Brook's lectures are not the typical Chemistry lectures most of us are familiar with. He incorporates multimedia presentations in almost every facet of his lectures, with the exception of question and answer periods prior to testing. The purpose of his article was to advocate multimedia presentations to other teachers and to encourage them to build web presentations of their lessons which could be accessed at the student's convenience.

Brook's multimedia presentations began with movies from the *Chem Study* series and progressed with the use of television and synchronized slide show presentations, He says that while the courses were difficult to organize, they were rather simple to execute. The lectures were accompanied by class notes that students used to augment and reinforce the presentations. Videotapes soon became part of the presentation package. With six 25-inch television screens placed overhead throughout the lecture hall, demonstrations that were inherently small such as experiments utilizing a penny could be broadcast all over the room with an image large enough for everyone to clearly see.

Brooks attributed the success and popularity of his course to several factors. First, each class member had the opportunity to check out the lecture in a video format from the resource room whenever they wanted. If a student missed important concepts during a stoiciometry lecture, the lecture could be reviewed with ease.

Secondly, all of the experiments were done live utilizing ingredients which would be highly aromatic or otherwise appeal to the senses. This allowed for the student to become more emotionally involved in the experiment, and utilize the learning techniques that multimedia could not capture.

Brook's classes currently make use of World Wide Web formats. All of the lecture material is converted to WWW formats utilizing hypertext links in key places. Video and other media effects are incorporated into the lessons including all live laboratory demonstrations which are still an integral part of his program. Brook believes that utilizing web technology is a relatively easy and powerful teaching tool which can be

utilized in almost any lecture course. It also makes the course much more interesting and popular, a goal that most teachers would see as worthwhile.

Dr. Aiken and Dr. Hawley from the University of Mississippi have modeled an electronic classroom design in the article, *Designing an Electronic Classroom for Large College Courses* (Aiken & Hawley,1995)

In 1992 they transformed one of their lecture rooms into what was to become the largest "electronic" classroom in the world. With $300,000, the lecture hall became a computer center with 55 PCs connected by an Ethernet local area network. The developers of this project recorded their endeavors and accomplishments in the above titled journal article.

As with most technological advances, the motivation was supplied by a perceived need. The authors believed there was a need of integrating computer and information technology into the many aspects of business. Other schools had computer laboratories, but this classroom was not destined to become another lab. The real purpose, according to the authors, was to "function as a regular teaching classroom that allowed the seamless integration of computer and multimedia technology into any class, regardless of its subject content". Plans were initiated in 1992 and construction and conversion was completed within the same year.

A total of 54 PCs were placed on desks that had been arranged theater style. The theater style arrangement had already been used for the lecture presentations before the computers were introduced so it was an easy proposition to place computers. The computers were 486SX 25 MHz with 4 MB of RAM and 40 MB of hard drive space.

The instructor's computer was a 486DX 66 MHz and a whopping (for then) 420 MB hard drive, CD- ROM, stereo amplifier and external speakers. All computers had color monitors and the instructor's computer had the capability of projecting the screen to a large screen via overhead.

A software system was developed by Aiken to allow short commentaries, ie. answers, discussions to be entered anonymously by any user which would then appear on all screens and stored for subsequent printouts. This software is called the "Group Decision Support System". According to the authors, studies have shown that classroom productivity was increased. No references were made as to who conducted the study nor the parameters of the study, so one can assume that the study may have been conducted by those who may have been a bit biased in favor of the technology.

Various classes were conducted utilizing this arrangement including Finance, Production and Operation Management, Management Information System, and Business Communications. In addition, the system had Internet capabilities, as well as access capabilities to bulletin boards and the communication network with the school's main databases such as the library and student records.

To offset the financial aspects of this program, the school rents out the facility to business for meetings and they also sell the Group Decision Support System previously mentioned to businesses. Predictably, the developers of this "electronic" classroom are touting it as a success and it may be. At the very least, it moves multimedia a huge step closer to meet the purposes of the developers: integration of education and technology in the classroom.

Of course, not all institutions have the necessary resources to install such a high tech environment. There have been some major accomplishments towards dealing with such a problem. One such effort is described by Klemm and Utsumi in the following article entitled: *Affordable and Accessible Distance Education: A Consortium Initiative* (Klemm & Utsumi,1997) .

As the WWW expands its tentacles into regions of the world where this cutting-edge technology has not been common in the past, a new problem arises: how can those students access this information with such a widespread lack of accessibility to electronic communication technology? A consortium has been developed and has met at the University of Tennessee to discuss this problem in 1995 and this article reports on some of the conclusions of the group.

There are three stated goals of CAADE. First is to provide "mass instruction with pre-packaged materials that coexist with and complement highly individualized instruction". Secondly, to "combine wireless and wire line technologies into an integrated system at a reasonable cost". Their third goal is to "promote experiential and collaborative learning" environments. The consortium is made up of educational institutions, national and international government and quasi-government agencies, foundations, and private profit and non-profit corporations.

The overall objective is to make distance learning affordable. Some of the target audiences will have access to only one P.C. Others will have access only to Television and other broadcast media. To accomplish this mission, the consortium feels that it is necessary to combine several technologies rather than traditional computer to computer

approaches. This is accomplished by using telephone lines, satellite signals, wireless communications, low to medium speed Internet communications. Depending upon the availability of technology, the instructor will be able to adjust his or her curriculum appropriately. Conference software might be used on one end combined with a video signal into television for the receiver. Telephone hook ups could be utilized for question and answer sessions.

Certainly it is wise to consider how information and learning can take place in areas that are technologically disadvantaged. This is no easy job. There can be no magic formulas because what works in one area may not work in another. It seems that the consortium has at least addressed the problem with vigor and is motivated to provide solutions. While some of them seem cumbersome such as Q&A via telephone, they will probably work. As technology increases in the advanced societies, it is easy to forget that not all societies can take advantage of these changes. If knowledge is a necessary component to move these under developed areas along, and it is, we as educators should be interested in how those individuals who are working on the problem are solving it.

Making technology available in our lesson plans requires that we as educators use the technology at a maximum of efficiency. Many hours can be lost if we do not develop strategies for putting technology to work. One of these strategies is called "advance organizers" and Kang introduces us to the concept and it's relevance to education in the article, *The Effect of Using an Advance Organizer on Students' Learning in a Computer Simulation Environment* (Kang ,1996) .

While a great deal of focus on Educational Technology is currently on the effectiveness of the "technology" part of education, some researchers are narrowing in their focus to the application techniques of using this technology. This article discusses how structurally organizing a computer-simulated condition may improve the outcome for the student over a non-structured environment, even though the ultimate simulation was the same. The term for this organization is "Advanced Organizer" and it was described at the end of the article. In summary, the difference between the two is that the Advanced Organizer offers not only the situation, but suggestions, helps and utilizes an overall positive tone. The non-structured approach is negative, offering no suggestions or helps other than to mention the impending doom if the right decisions are not made throughout the simulation. The result of the study showed that utilizing the Advanced Organizer approach had statistically significant results when compared to groups who were given the non-organizer approach.

It is important to reiterate that this study was not a comparative analysis of students who were utilizing computer simulation and those who were not. Both groups utilized the same simulation software. The study attempted to demonstrate that student's attitudes or predispositions could be manipulated by the software programming thus improving or hindering the effectiveness of the technological strategy employed. By providing the positive outlook from the beginning, along with the helps and hints, the attitude of the student approaching the objective was improved and the conclusions demonstrated that the student with the positive attitude did learn more than the those who were not given that approach.

A total of sixty-six students participated in the experiment, evenly distributed by grades 5, 6 and 7. The students were randomly assigned to their groups: the advanced organizer group and the non-organizer group. The teacher was available to each group equally for questions throughout the simulation. The simulation was a "Wilderness Survival" which utilized Hypercards developed by the author. Prior to engaging in the simulation, half of the students were given advanced organizers and the other half were given non-organizers. The results showed a statistically significant difference in the post test recall with those students receiving advanced organizers achieving higher scores.

In conclusion, not only does CAI seem to indicate a higher level of learning, but just as important is the writing of the software, especially as it relates to encouragement and developing positive attitudes in working with the program.

Teachers should also be aware of what motivates software writers in instructional technology and how innovation is diffused so that we can become a part of the creation process. Surry and Farquhar discuss this diffusion principle as well as many philosophies which are embedded within our software in the article, *Diffusion Theory and Instructional Technology* (Surry & Farquhar, 1997).

The purpose of this article was to discuss how the diffusion of innovative technology impacts Instructional Technology. The philosophy surrounding this topic is Diffusion Theory. As innovation comes before educators, there are theories of how to best advance that innovation in order to maximize its acceptance. This article first discusses General Diffusion Theory which the authors quickly point out is not a single, well-defined and comprehensive theory. The authors move on to discussing the theories

as they relate specifically to Instructional Technology. Incorporated within that component is an interesting discussion on the Philosophy of Technology.

The focus of this article is directed towards developers of innovative software who are marketing toward the instructional technology markets. The innovator often wonders why his or her great product just did not catch on! The rate at which innovation becomes diffused according to the authors is proportional to how well the five stages of diffusion are accepted. The stages are Knowledge, Persuasion, Decision, Implementation, and Confirmation. The authors say that potential adopters of innovation must learn about the innovation, be persuaded of its utility, decide to adopt, implement the innovation and confirm the decision to accept the innovation. He indicates that there are some individuals who are predisposed to accepting new technology and others who are inclined to rejection even before judging the merits of the innovation.

The discussion on the philosophy of Technology was an interesting overview of various positions on the advantages and disadvantages of our ever-expanding technological world. The idea here of course is to better understand some of the inmportant driving intellectual forces behind what is accepted and why. The article dealt with Utopian Determinism, Dystopian Determinism and Instrumentalism. Utopian Determinism sees technology as inevitable and good for humanity. Dystopian Determinism on the other hand describes technology as an inevitable, autonomous and will lead to the destruction of humanity. The premise of instrumentalism is that technology is neither good nor evil and is not autonomous. It is in the control of people and as the outcome is dependent upon human intervention.

While it is certainly beneficial to discuss why teachers should become technologically literate, and how to train teachers to integrate technology into the curriculum, we should also explore the effectiveness of going through all this trouble. Not everyone agrees that technology and education should be married.

Margaret Farrow, University of South Australia, reported the results of her study of 32 undergraduate students in their third year of Applied Science studies in the article, *Knowledge-Engineering Using HyperCard: A Learning Strategy for Tertiary Education,* (Farrow, 1993). Her goal was to measure the effectiveness of students using a HyperCard presentation in reporting their findings for a research project regarding a specific neurological condition. Farrow stated that while previous student tutorial presentations were a popular strategy for the staff, they were not popular for the students. Subsequent to the lecture, the student often had to work very hard at finding information on their own because note taking was ineffective and lecture content was inadequate or the presentations were "boring."

The students involved in the study had little or no experience using HyperCard but were enrolled in a computer course along with the science class. The majority of the students were female and ranged in age from 19 to 22 years. Each student was assigned a different neurological condition that they were required to research. A tutorial presentation to their peers would be accomplished through HyperCard stacks, which they created based upon their research. The stacks were to be designed so that appropriate treatments could be ascertained for specific symptoms by clicking on the appropriate hyperlink.

The results of her study indicated that while student motivation was very high, the amount of information learned through the process, which she called the quality of learning and measured it by a Spearman's rank Correlation, was less on average than the information learned from the previous tutorial method. According to Farrow, many of the students were excited to show their finished projects but the lecturers often found the projects to be primitive and of little subsequential value. Seventy-four percent of students felt that organizing the data into HyperCard stacks was a valuable learning strategy while only 6% felt that there was no value to the exercise.

Farrow attributed the lower quality of learning scores to two factors: first, none of the students had worked with HyperCard previously and secondly, the students may not have been able to adequately distinguish valuable information from superfluous information when presenting it via this method. It may be inferred form this study that obtaining information via hyperlinks as opposed to traditional methods may not always be the correct solution, but if designed or presented by someone who has a more sophisticated knowledge of the software and of learning theories, the value would likely increase. This is particularly important if it can also be shown that student interest and motivation continues to be higher when hyperlinks or hyper media is used.

A series of experiments by David H. Jonassen of the University of Colorado and Sherwood Wang from George Mason University as described in their article, *Acquiring Structural Knowledge from Semantically Structured Hypertext* (Jonassen & Wang, 1993) offered conclusions that maybe hypertext is not all that effective in the learning processes. As with other researchers in the field, Jonassen and Wang were attempting to

test the popular notion that hypertext or hyperlinking most closely represents the way we process information. They devised a series of three experiments based on the notion that information is stored within our minds in a semantic structure or semantic network which is similar to the way hypermedia works. We store information in packets or categories which are subdivided and linked together by relationships and can be accessed by utilizing these relationships. Hypermedia might then be expected to a reasonable method of learning new data.

The first experiment involved 98 pre-service teachers who were preparing to receive their credentials. The method involved using hypermedia to obtain information which they would later be assessed. The subject matter was the information in the book, Hypertext /Hypermedia (Jonassen, 1989) but given to the students in hypertext form. Specific information was given to the students such as relationship models. They were then assessed for recall and comprehension.

The second experiment involved 112 pre-service teachers and the same information, but the students were not given the relationship models. They would have to sort it all out for themselves to find what relationships existed and how they can be used. The third experiment used 48 students who were separated into two groups. One group was told that they would be expected to design a semantic network about Hypertext after studying the subject and the other group was told that they were simply to acquire knowledge about Hypertext during their study.

Jonassen and Wang concluded that using hypermedia to study Hypermedia was effective in only in the minority of cases. They attributed the lack of success to several

factors. Clearly learning information from hypermedia alone without any type of structure resulted in superficial knowledge. This was because the student did not know how to use hypermedia to study effectively. The suggestion was that if Hypermedia was to be effective, it would have to be structured so that logical progressions could be followed. Still, they were unconvinced that hypermedia models were the best choice for higher learning acquisition.

I believe that the authors were correct when they stated that the students did not know how to study hyper media or that hyper media by itself is insufficient to effective learning. Perhaps a different test might have been devised integrating hypermedia as an instructional tool rather than as the only mode of instruction. I suggest that this is where we will really see meaningful results.

One way that student can use hypermedia and take more responsibility for their learning is through peer assessments via hypermedia. A project was undertaken at the University of Liverpool by Christopher Rushton, Phillip Ramesy, and Roy Rada and described in the article *Peer Assessment in a Collaborative Hypermedia Environment: A Case Study,* (Rushton, Ramesy, & Rada 1993). They called the project, MUCH which stands for Multi User Collaborative Hypermedia and allows the authors to enter, store, and retrieve multimedia information. This is done using word processors and scores were entered on databases. The students would have access to each other's work and be able to critique them for mastery of lower level skills such as memorization.

The grades given were very similar to the marks that were awarded by the teacher demonstrating that peer assessment at these lower level skills might valuable for the

students doing the assessment, while retaining a reasonable level of confidence in the ultimate score of the students being graded.

The hypermedia model used in the assessment is one that might be employed in self-evaluations or periodical checks for comprehension by teachers regardless of the field of study. The student clicking the appropriate field graded various items with a score between 1 and 10. Areas tested involved Spelling, Grammar, Creativity, Clarity and Content. This approach could easily be used in Foreign language instruction, whether it involves peer assessment or not. The students studied overwhelmingly felt uncomfortable in having peer assessments done on them and we might consider how this attitude might ultimately effect the student's learning.

The advantages to increasing attitudes and motivation using computer assisted instruction were also discussed by Iris Geva-May and Orit Hazzan-Seger in their work on LOGO and their article, *Logo Studies and Their Effect on Learners' Attitudes Toward Computer Programming: An Evaluative Study* (Geva-May & Hazzan-Seger, 1993).

The purpose of this study was to evaluate the effectiveness of combining the teaching of a computer programming language called Logo with the introductory computer science course. The research was to measure both the effectiveness of combination and to measure students' attitudes toward computers and computer science after the course was complete. The course called "An Introduction to Computer Science via Logo" was developed by the Israeli Logo Center at Israel's Institute of Technology and was designed for high school students in the 10^{th} through 12^{th} grades.

Logo was designed to be a more user friendly computer language which incorporates simple language and metaphors and encourages intuitive interpretation by students who are at the early stages of learning computer language. It provides the student with feedback, error messages, and a non-threatening environment for the student to learn. The idea was to expose the student to a new computer language by utilizing a language they were already familiar with. The thought was that this approach would be effective in both teaching the new language and developing positive attitudes towards computer programming.

Two definitive groups were studied from two different socio-economic backgrounds. There were 58 tenth grade students in total. The first class comprising 40 students were chosen from a "low" socio-economic group and 18 students were chosen from a much higher socio-economic group. The evaluation tools were attitude questionnaires and observation forms utilized by the testers. The observation sessions occurred three times in each class during the six-month period.

The results of the study demonstrated that attitudes about computer programming generally were very high after going through the course regardless of socio-economic status. Percentages were not given but the authors did indicate that there was no statistical significant difference between the two groups for attitude. The more interesting result came from the observations especially as scores for language mastery was evaluated. The average score at the lower socio-economic level was 58.52% while the average score for the other group was 77.64%. Several factors attributed for this difference. In the first group, students needed to pair up because there were not enough

computers for everyone. This contributed to a general atmosphere of disorder according to the observers. The teacher needed to constantly help students with minor technical problems which left little time for helping the students with more complex difficulties. It was noted that the students in this group seemed to have little motivation for the course and preferred to ask the teacher for help rather than attempt to investigate the problem and try to solve it for themselves.

The latter group in contrast had enough computers for everyone and the group seemed to be highly motivated. As a result, their questions were much more complex. They almost never bothered the teacher with minor technical difficulties and the teacher was able to concentrate on observing the student. The atmosphere was "serious and constructive" according to the authors.

The authors believe that the main reason for this disparity was the lower socio-economic exposure to computers. This seems obvious, but the test did reinforce the idea. In determining whether or not Logo was indeed an effective tool for learning a computer language, it seemed that despite the differences, the authors felt that Logo did indeed prove itself. However, since there was no comparison between this method and another method in this test, it seemed that this conclusion might be a bit self-serving. After all, they did develop the Logo program.

One method generating a great deal of interest can be found in the educational philosophy of constructivism and is discussed in relation to teacher training in the article from Sharon F. Rallis called, *Creating Learner Centered Schools: Dreams and Practices* (Rallis, 1996). She says "the teacher's roles must go beyond traditional instruction.

Teachers must understand pedagogy and bring content knowledge, but they must also create the conditions that enable children to interpret and understand phenomena for themselves." Ms. Rallis, who is the Program Coordinator with the Regional Laboratory for Educational Improvement of the Northeast and Islands, believes that "learning is like breathing-all children do it."

For Ms Rallis, developing strategies for dealing with the new changes in technology then include training the teachers to be comfortable with the technology, as well as allowing the technology to change the role of the teacher from traditional information dissemination strategies to learner centered where "students make discoveries instead of following directions or memorizing facts".

Of course this leads to another problem... specifically one of computer availability. The ideal setting might be a computer on every desk but realistically, this ideal is not likely to be coming any time soon. So how can the teacher harness this technology if there is not enough hardware available? Single computer classrooms have been the answer in many science classes. Instructors have been able to develop programs which can be used on a single computer operated by the instructor only.

Tom Banaszewski in his article, *Strategies for the One Computer Classroom,* (Banaszewski, 1997) discusses ways of using the computer in a classroom for more than just lecture. He devised water testing experiments for students in the latter part of their primary education and allowed the computer to be used to record data and manipulate it for results.

His first suggestion is that the students who are already computer literate could play an important role as computer tutors for their peers. Obviously, this allows the instructor more time with individual problems and may assist students who are resistant to computer experience to gain confidence a little more quickly.

Another suggestion is using technology to aid in the lesson, not to completely teach the lesson. We have seen the importance of this suggestion several times already. Other suggestions are establishing scheduled times for computer users and holding students accountable through journals. The latter suggestion may counter the reservations that Jonassen and Wang (Jonassen & Wang,1993) expressed in the above article regarding their concern that the student did not know what to study when they used the Hypermedia. Once again, the implication here is that the instructor needs to take the active role in guiding the student but that student motivation is increased with computer involvement and because of the increased motivation, the student may be more successful at learning the objectives. Unfortunately, this article offers no quantitative comparisons between the test results of students using the computer vs. non-users, but the qualitative aspect of a teacher's experiences using such a method is quite beneficial.

We can draw several conclusions from these articles. First, Hypermedia is not meant as a stand-alone teaching tool. If it is used in this manner, the student is likely to lose focus and gain only superficial knowledge. Used in conjunction with good teaching methods from an instructor the combination can be used quite effectively.
Secondly, it seems obvious that student motivation is increased with the integration of technology into the classroom. Some may suggest that it is the novelty that generates the

excitement, but if it is indeed the novelty, then what better tool do we have for creating newer and newer ways of presentation? If, on the other hand, there is an intrinsic value in utilizing hypermedia as I suspect, then this technology should be utilized to a significant extent. Either way, there seems to be every reason for implementation.

Hypermedia can immerse a student into the language vicariously in many ways from story telling to reality simulations. There have been others who have tried it with success, and their success could become the impetus we need to encourage our own student's success.

Another option for teachers is to make use of the authoring programs now available. Authoring Systems are, according to Theodore W. Frick of Indiana University, "systems which are typically conceived as having a knowledge base, a set of pedagogical rules, a model of the student, and a natural language interface" *Artificial Tutoring Systems,* (Frick, 1997). Authoring systems allow for the instructor to become a programmer without learning the technical language of the computer program. Its advantage is that if the program is properly designed, it can stimulate motivation on behalf of the student and a desire to learn the content. In his article, *Designing Effective Senarios for Computer-Based Instructional Simulations: Classifications of Essential Features*, (Choi, 1997), Wook Choi attempted to define "properly" designed programs by stating that there are three major design aspects to effective programs. First is the scenario, which is the specific course of action and events occurring in the model. Second is the underlying model and finally the instructional overlay, which comprises

instructional content. Incorporating feedback towards the student's progress in these programs also becomes an important element.

An assessment of the importance of feedback in computer-assisted learning was reported by Roger Azevedo, Concordia University. In his article, *Assessing the effects of feedback in computer assisted learning* (Azevedo, 1995), Azevedo carried out a meta-analysis from 22 studies which included 14 immediate post-test studies and eight delayed post-test studies. "The importance of feedback as a critical component of instruction and learning is exemplified by the magnitude and direction of the mean size (.80) with the immediate post-test administration" Azevedo (1995). He concluded that feedback through immediate testing of learned information increases retention dramatically. The delayed testing, he says, "indicated a decrease in long-term retention".

Tamar Levine and Smadar Dontsa-Schmidt from Tel Aviv University School of Education proposed that prior experience with computer technology increased the degree of confidence that a student when approaching the computer to learn new applications or techniques. Their article, *Commitment to learning: Effects of computer experience, confidence and attitudes* (Levine & Schmidt,1997), reported on their findings after studying 309 students. Their hypothesis turned out to be wrong as the evidence demonstrated that even those with very little computer confidence approached learning the computer without great hesitation or intimidation. In fact, there was no significant correlation between prior level of computer experience and computer attitudes!

In conclusion, understanding the way we learn and molding our presentations around this understanding will prove to be invaluable to both the student and the

instructor. Utilizing technology in our instruction should a vehicle by which we can accomplish this objective. Perhaps this recombination of ideas along with training our teachers to use the technology now so readily available will enable our teachers to be more effective and encourage more students towards success.

CHAPTER TWO

Goals and Objectives

The research thus far presented has shown technology inclusion in education affects the motivational level of the student towards the subject at hand, and that technology has been used with some demonstrable success in classrooms. But for the person who is completely inexperienced with computers, the icon-covered screen can be a daunting venture. The challenge of becoming familiar with computer technology is made even more formidable to the uninitiated by a nebulas feeling of uncertainty and fear that if they touch a wrong button or hit a wrong key, the computer will do something unintelligible, or even worse, stop doing something, and it will be their fault! For them, the computer whirls to life almost as with a breath of its own and may as well even think for itself for as much as it can do, spitting out information and numbers, sounds and sights that must surely come from deep within a soul rather than a set of green plastic chips with wires all bound by plastic and metal.

This project, "LEARNING ABOUT COMPUTERS" is designed to help the new user understand that the directions in which computers move follows a reasonable logic which can be readily understood by almost anyone. Learning how to manipulate the computer, understanding how programs can be accessed and predicting the computer's responses provides a new user with enough confidence to move forward with their new-found knowledge, using the computer in the many areas of their life.

While most people learn how to use their computer from friends or family members, miscommunication or vague impressions often leave the new user to fend for

themselves. After much trial and error, the novice gains ground and with persistence becomes computer literate. Sometimes the new user is satisfied with learning one or two particular applications which they feel to be useful, but the rest of the computer still remains a mystery. This project is intended to remove the much of that mystery and miscommunication.

This project is expected to be an elementary primer for the new user. It covers the basics of computer operation like proper on/off procedures, operating systems, and dangers to the computer and moves on to more advanced information like increasing the computer's limitations, file extensions and hardware information to name a few. "LEARNING ABOUT COMPUTERS" will have accomplished its objective if the new user can become more knowledgeable about the computer, and consequently more confident about using the computer simply by going through the information presented within the software program.

Certainly, as the new computer user becomes familiar with these basics, the enigma of computers will begin to transform into a healthy respect for what they are capable of, and what they cannot do. If the mystery is replaced by knowledge, then the fear can be replaced by curiosity and the computer's true potential can be realized by the new user. The value of this project is that it can help the new user see the computer as a reliable assistant, and no longer as a daunting venture.

CHAPTER THREE

Implementation

Using technology in the classroom first requires that teachers and parents become familiar with the technology. As research in this study shows, technical familiarity on behalf of the teaching adults is still a major goal of educational leaders (Faison, 1996). This program was designed to help achieve that goal.

"Learning About Computers" is an interactive multimedia tutorial designed with a non-linear navigational system which has been augmented with a network of visual and auditory stimulus. The target audience is primarily adults who have had very little experience with computers in the past, but who are very interested in learning about it in terms that can be readily understood. This program was designed for users who have at least reached a high school reading level and also assumes that the user is comfortable with learning from text rather than "a talking head" or primarily from visual and auditory stimuli.

It was designed specifically in this manner because most adults who wish to learn computer skills have received most of their formal education through textual information in the form of textbooks and literature. Since these adults are the primary target audience, I chose to use a book as the background screen. This provides a level of association for the new adult computer user and should therefore also be an excellent tool for helping along the transition from learning by a book to learning with the technology of the computer. It is designed to help the student overcome a fear of the unknown computer territory by placing them within a more familiar context.

This is why this program may not work well for the younger individual. Much of their learning has been through audio and visual stimuli and such a "textbook" concept would not be as familiar to them. Some of the research previously cited indicates that younger students may be motivated by the bells and whistles of graphically intensive programs (McGregor, 1990), but such stimulus as a primary learning tool may not be necessary or advantages to the adult learner (Jonassen & Wang, 1993).

Most of the information in this program, therefore, is presented textually and will require the student to learn through reading this information. The program differs from the hard textbook in that sounds and pictures are used throughout to support learning and to encourage further exploration of the program. Secondly, the program is non-linear. The student controls what they wish to learn without the necessity of reading through all of the text. Lastly, a quiz is used to measure learning success, and immediate feedback helps the student to continue their learning as they take the quiz rather than only receiving a score at the end.

This project was created using Macromedia's Authorware 3.0. The book screen previously mentioned was taken from Hyperstudio, but all of the project's functions are derived specifically from Authorware. Authorware was used because of the program's versatility in providing me as the project designer with many options including the testing function which is a very important part of the program. The program opens with icons that slide into place with accompanying sound. This motion and sound provides visual and auditory clue as to where the user should navigate. As previously mentioned, the project rests upon a background of a book. The title of the program, "Learning About

Computers" appears on the top left page and the navigation buttons appear on the right page. Below the title, a media window appears. This media window is used for screen snapshots, other various supporting pictures and a feedback screen for the testing functions.

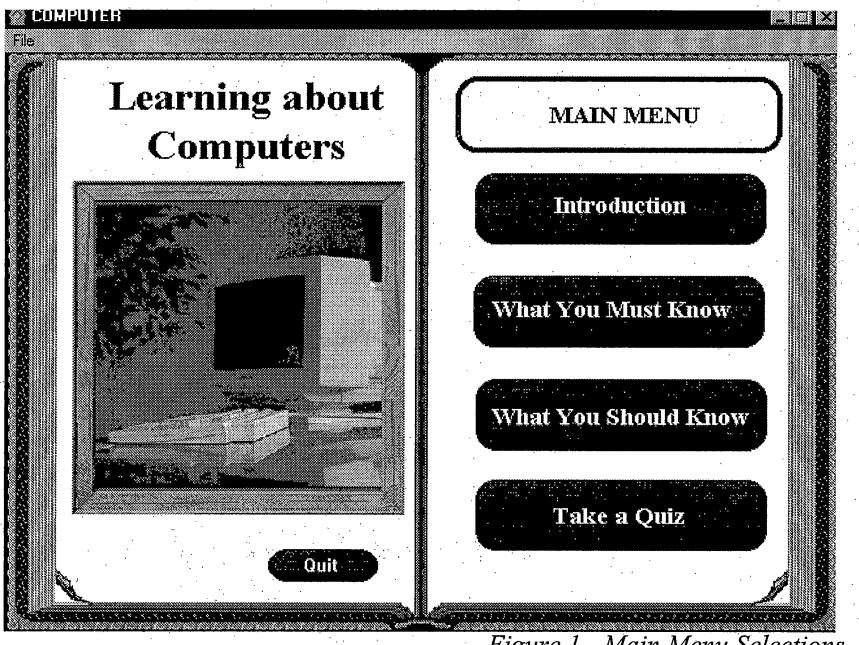

Figure 1 - Main Menu Selections

The program first runs through the main menu, which presents the user options as indicated in Figure 1 above. There are three major components of the program: 1) What You Must Know, 2) What You Should Know, and 3) A Quiz. Each section covers information about using computers in non-technical language as much as possible. When technical language is necessary, it is used in conjunction with definitions or in an obvious contextual setting that helps the user to understand the terminology. The idea is to provide basic information using non-technical language wherever possible. Figure 2 on the next page shows the general design of the program using the schematic from Authorware. At the first level, the user's options include an Introduction, What You Must

Know, What you Should Know, and a Quiz. The user also has the option of quitting the program which is maintained throughout the program.

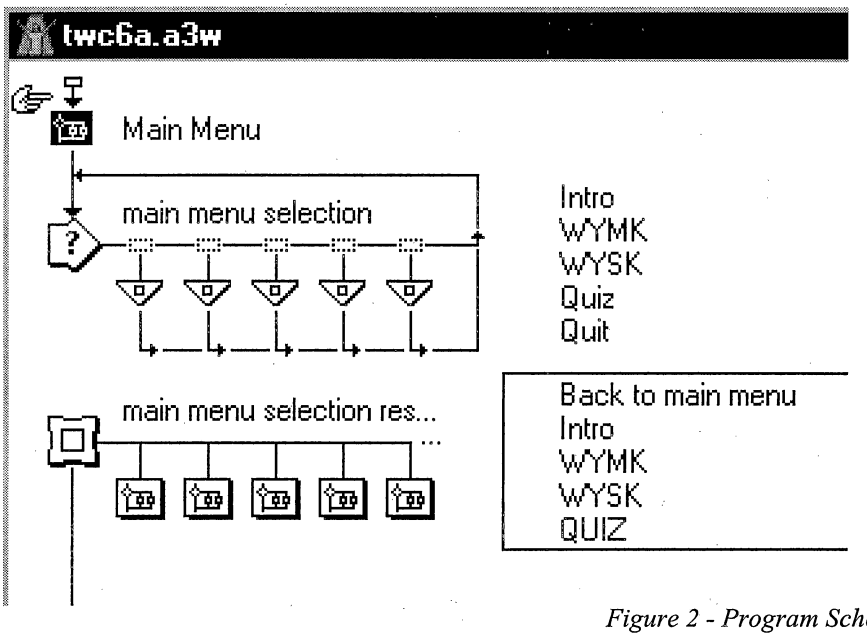

Figure 2 - Program Schematic

When the user selects one of the choices in the main menu, the program is directed to the second level. The first option is the introduction which is shown in Figure 3 on the next page. This section is designed to entice the user into the rest of the program and to make the user feel comfortable with using the computer for learning. A sound file (.wav) accompanies the change of the media screen to a picture depicting a NASA control center with many computers. The text convinces the user that because computer use is ubiquitous, the user should learn about computers. It describes the purpose of the program and specifically how to use the program and what to expect from it.

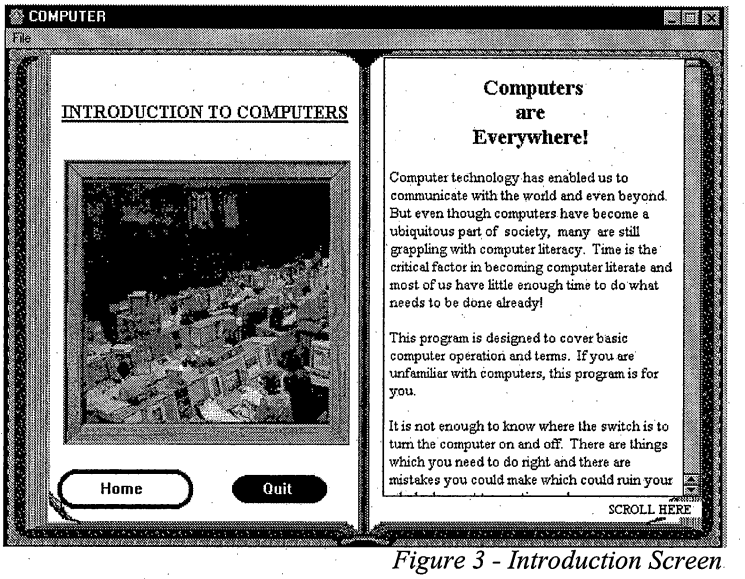

Figure 3 - Introduction Screen

Navigation to the rest of the program is straightforward. The Home button always takes the user back to the Main Menu and is available throughout the program as is the Quit button which serves the obvious function of ending the program.

When the user returns to the Main Menu, they are confronted with a choice to go to the three remaining major sections. Selecting the section called What You Must Know sends the user to a new level of the program. As the user makes selections depending on the subject in which they are interested in learning about, they move through the various program levels. Figure 4 on the next page shows the program schematic which will be used if the user selects "Proper On/Off Procedures" under the What You Must Know section and Figure 5 depicts the screen interface for the same selection.

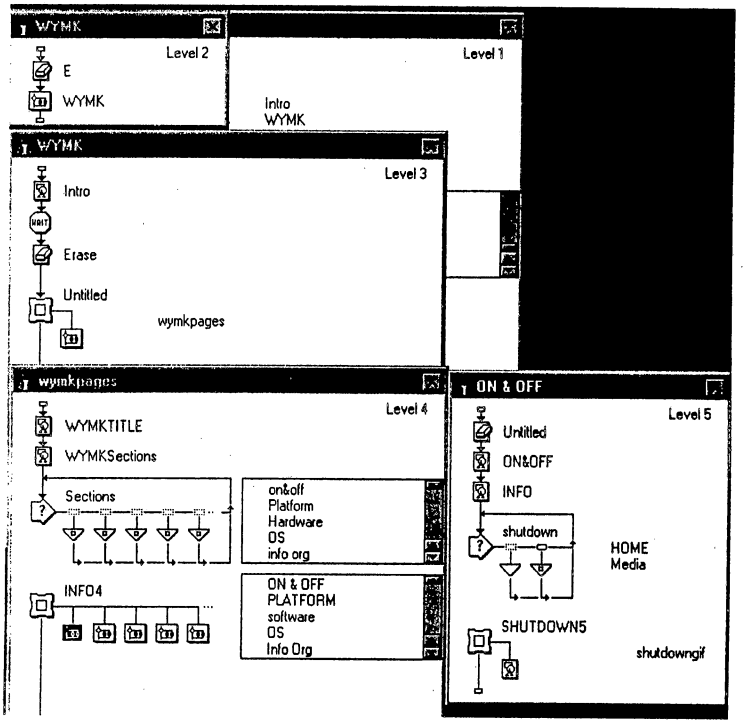

Figure 4- What You Must Know Schematic

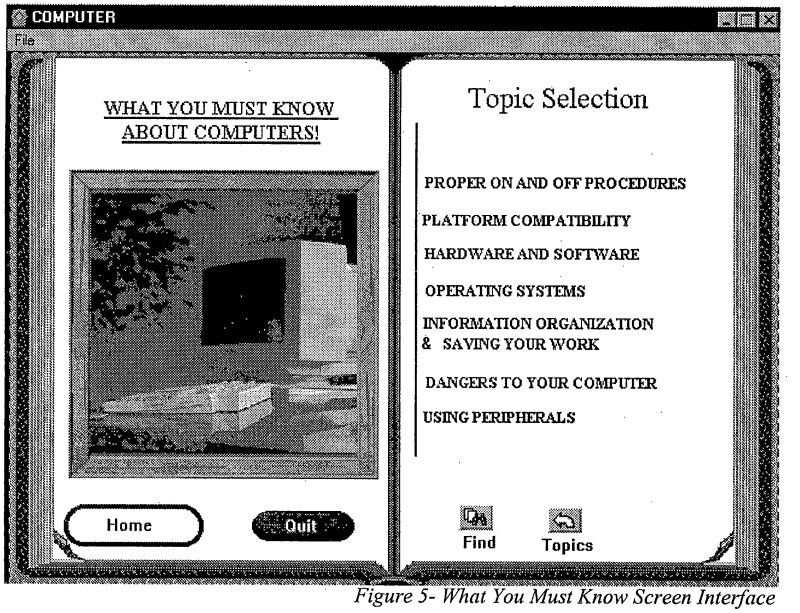

Figure 5- What You Must Know Screen Interface

What you must know covers seven basic ideas that everyone should know about computers.

1. Proper on and off procedures
2. Platform compatibility
3. Hardware and Software
4. Operating Systems
5. Information Organization
6. Dangers to Your computer
7. Using Peripherals

With the plethora of information available about computers, the new user should not become overwhelmed with too much information. A real attempt was made to select only the information which is necessary for a new computer user to know in order to safely operate and manage information in their computer. Similarly, the section What You Should Know, as shown in Figure 6, covers an additional six ideas about computers

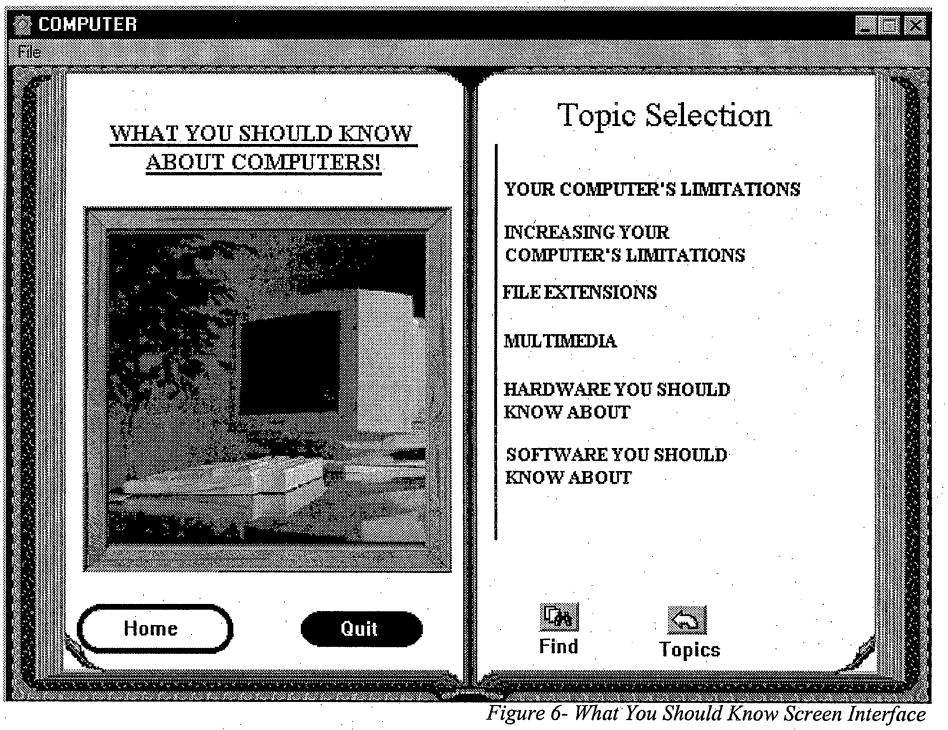

Figure 6- What You Should Know Screen Interface

that everyone should become familiar with, but are not necessary to know to operate a computer properly.

The final section, the Quiz, is sub-divided into two sections, one for each general section. Each quiz has 20 questions and there are three possible responses for each: Yes, No and I Don't Know. When the user answers a question, immediate feedback is registered on the multimedia screen. If the answer is correct, the response in the multimedia window is "You Are Correct!" If the answer is incorrect, the response gives the user an explanation of the correct answer, and then tells the user what the correct answer is.

When the user selects the "I Don't Know" button, the multimedia screen gives the explanation of the correct answer only. The correct answer is, of course, inferred in the explanation, but the correct answer is not specifically stated. This allows the user to feel as though they are reading about the question, but not receiving a response to a wrong answer.

At the end of the quiz, the user receives a score based on the number of correct responses. This score is represented by a percentage correct, as shown in Figure 7 on the next page. The user is then given the option of retaking the quiz, or going to the next section, or simply quitting the program.

This feedback is an essential part of the program and once a high score is achieved in both sections, the user should feel confident that they can understand the basic functions of the computer and feel confident in moving forward in exploring the

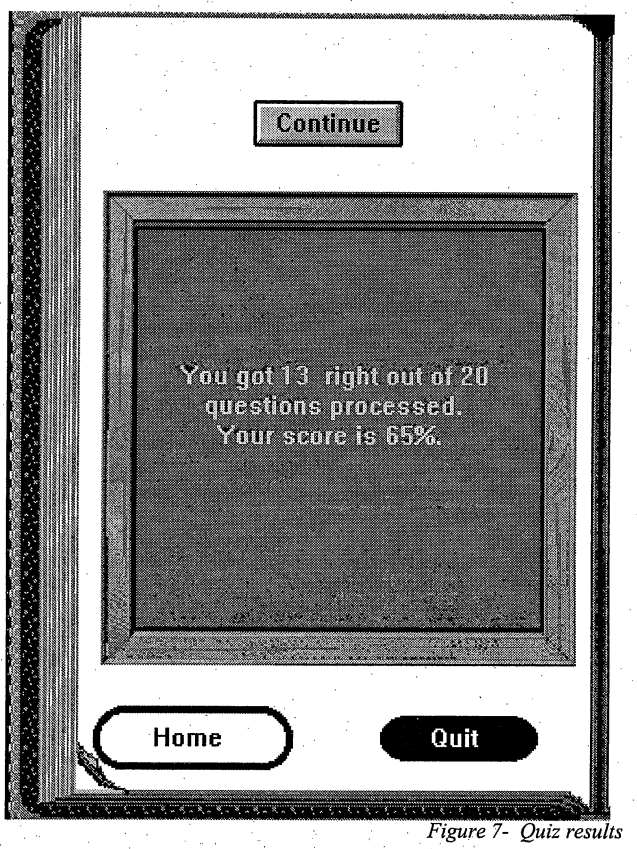

Figure 7- Quiz results

computer's potential.

It is most important that the user realizes that as long as they follow a few basic principles in computer use such as file organization and safety precautions, their experience with the computer should not be a frustrating one, but one of self-empowerment.

Three adult non-teachers who were completely unfamiliar with computers and one teacher who was computer literate piloted the program. The comments from the pilot were positive in that the program achieved its intended goal. They all felt that they had learned from the program and that the information in the program was valuable in helping the new user become well aquainted with their computer. Each of them stated that the

content covered many essential items without overwhelming the new user with too much information.

As a result of suggestions from the pilot, some information was deleted and replaced by other topics. For example, two users suggested that a section originally included in the program on video monitor types was unnecessary since they really did not care if they had a VGA or a SVGA monitor, as long as they could see the display and it was in color. I elected to delete this section as a result.

Navigation did not prove to be as intuitive as I had originally hoped for, but after a very brief trial and error period, navigation became quite easy. The greatest source of concern had to do with the "Topics" arrow found within the Topic Selection Page. The arrow appears on the initial page, but does not navigate to anything until subsequent topics are selected. This arrow is designed to be used as a return to additional topics after a topic has already been selected. In trying to redesign the placement of the arrow, I found that the design of Authorware itself would require a very significant re-modification of the entire program. This may be something to modified in the future, but since the users quickly realized that the button would not work on that one screen alone, it did not warrant an immediate change.

A bigger area of concern was that at least one user, who had little motivation to learn about computers anyway, felt that the program did nothing to motivate them further. This result is, however, not surprising since the assumption is made that those persons who have little initial motivation towards computers would most likely not be inclined to use this program anyway. Two other users, however, also indicated that using

the program reminded them too much of textbooks, and that alone was enough to turn them off of using it. Only one person, the experienced user stated that she liked the textbook idea and that they had no problem being motivated to learn the subject. She did admit however, that her motivation probably already existed and the program itself did not further motivate her.

I feel that the necessary elimination of the video clips played a role in this since the clips demonstrated the multimedia capability of the computer. I also am aware that often learning takes effort, and motivating one to learn is still quite a challenge. Future revisions of the program need to incorporate motivators such as more interactivity between the student and the computer, more multimedia clips including, perhaps, voice files which can be used to help with content delivery.

Despite these areas of concern, the program did prove to be a success. It proved to be another tool which can be used for learning, and with additional work, can become quite a valuable program for new computer users, specifically teachers. The computer itself may indeed be the best resource for demonstrating the value of integrating technology with the classroom and as teachers learn from it, they may realize the educational potential they have in that plastic, white, dust-covered box, which now often only takes up that isolated, undisturbed spot in the classroom.

APPENDIX A

Diskette: Learning About Computers

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