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COMPUTER-AIDED LEARNING IN ELEMENTARY SCHOOLS

An Interactive Qualifying Project Report

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by

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Abstract

The goal of this project was to educate the teaching staff of Abington Center Elementary School in the various ways a computer can be used as a teaching tool that can expand the horizons of their students. This goal was attained through providing instruction on basic computer skills, ideas for incorporating computers into current curricula, and guidance in using application software to the teaching staff. Two workshops were held for the teaching staff. The first workshop centered on basic skill instruction. This workshop was designed around pre-workshop surveys sent home to the teaching staff during the summer. The second workshop allowed for specific software questions and instruction and was designed on the basis of the responses from a post-workshop survey distributed directly following the first workshop.

From the two workshops, the group feels confident that the teaching staff has a renewed interest in incorporating computers into their classrooms and professional lives. Many members of the staff now realize the potential of the computer lab. By providing examples of curriculum based computer exercises for students, and a step-by-step graphic intensive manual for the teaching staff, the group believes that the teaching staff of Abington Center Elementary will introduce new technological media to their students.

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1.0 PROBLEM STATEMENT

Six iMac desktop computers were purchased when the Abington Center Elementary School acquired a grant to be used in funding a computer lab for faculty and students. Abington Elementary hosts 300 students in grades three through six, with eight teachers instructing these three grades.

This project offers the school an opportunity to introduce computer-aided learning into the elementary classroom with the use of these iMacs. However, the mere possession of this equipment is not sufficient in creating an educationally sound program.

Since Abington Elementary now has this computer lab, it is important for the teachers, who will be using this lab as a learning tool for their pupils, to have a solid understanding of how a computer can be used, and how to teach these functions to their students. Currently the teaching staff responsible for grades three through six has mixed levels of computer literacy. These teachers will need to both learn new skills and refine the ones they already have in order to use the new computers as the valuable resource that they are.

Bringing a level of computer literacy and comfort with computers to the teachers will not be an easy task. Before the teachers can utilize the new computer lab effectively, they must attain a level of mastery with the machines themselves. As the teaching staff learns how the computers can aid them personally and professionally, it is hoped that they will then feel more comfortable in using the computers in their classrooms.

This mixed level of computer literacy is not the only constraint in this project; there are also additional challenges that face the school in utilizing these machines. For example, there is a limited amount of time in which the teachers are available for instruction. The school district has also allotted a limited budget of $1,000 for the purchase of application

based software. There are also a fixed number of computers within the lab and a limited amount of time within the school day for each student to have a chance to experience computer aided learning.

Since there are a limited number of computers for the students, it is important for teachers to develop an effective method to expose all students to the computers. As students begin understanding basic computer skills, teachers can apply the computer to all aspects of the curriculum to enhance learning.

The main goal of this project is to educate the teachers of Abington Center Elementary School in the various ways a computer can be used as a teaching tool that can expand the horizons of their students. Our group will attain this goal through giving instruction, ideas, and guidance to the teaching staff of Abington Center Elementary. Once the teachers are comfortable in front of a computer, they will be able to pass their newly acquired skills onto their pupils. As the students gain a level of understanding with the powerful resource that they have at their fingertips, it is hoped that their learning will flourish. As these intuitive, thoughtful, intelligent students mature, they will bring countless benefits into the world as adults.

1.1 Deliverables

The main focus of the project is to instruct the teachers of Abington Center Elementary School to use the iMacs that have been purchased and installed. The teacher training will be structured in the form of a workshop that takes place in the computer lab at the school. First, the teachers will need to learn many of the basic computer skills. These skills will include, but are not limited to:

- How to correctly turn on/ off the computer.
- Mouse skills, including: single click, double click, dragging an object, etc.
- How to open, close, minimize, maximize, restore, and scroll through windows.
- How to create a new document.
- How to create a new folder.
- How to save information to the hard disk, floppy disk, desktop, external drives.
- Understanding the difference between the 'Save' Command and the 'Save As" command.
- How to open and quit software applications.
- How to use the 'Find' command to search for and item.
- How to communicate to the computer via a keyboard. The emphasis will be on proper hand/wrist placement and key location, rather than speed.
- How to copy or transfer files from a floppy to the desktop and vice versa.
- How to print a document.

An instruction manual will be provided to the teachers as a guide to learn and remember these computer functions.

Once teachers understand the basic computer skills, this project will introduce innovative software programs that can be used in the classroom. One program in particular is Appleworks, a software application included with every iMac in the lab. Appleworks is equivalent to the more familiar software package, Microsoft Office. Appleworks allows the

user to create databases, spreadsheets, and text documents. This software can be used as an aid for a teacher preparing a lesson or for a student writing a report.

The project will present ways in which the Internet can be used as an asset to computer-aided learning. One demonstration within the workshop will take the teachers on a virtual field trip. This demonstration will show how computers and the Internet can be integrated into the curriculum. A teacher can take all the students on a field trip to a place they are studying without leaving the classroom.

The project will also show how a computer can be used with other technological media to enhance learning. For example, a LightPro projector connected to the computer will be used to present the workshop and will provide a demonstration of how a projector can be used in the classroom. The workshop presentation will be done in the Microsoft application, PowerPoint, to show how technology can be used for classroom lectures. The workshop will also show how to use a printer and scanner that is connected to the computers.

With these skills, the project group members believe that the teachers of Abington Center Elementary School will have the computer skills necessary to introduce effective computer-aided learning in their classrooms.

1.2 Connection to Society and Technology

The development of the modern computer has a long history. It begins with the Greek invention of the abacus, which is a crude device used to calculate numbers. In 1868, Christopher Sholes designed the first typewriter. The computer is a combination of a calculating machine and a typewriter. In the early 1900s, many basic forms of computers were invented. Howard Aiken introduced the first electromagnetic computer in 1944.

However, the modern computer was not developed until 1981, when International Business Machines (IBM) created the first personal computer, better known as the PC.[1]

Now computer use is growing at an exponential rate. Computer technology has infiltrated every aspect of life. In corporate world, computers are used daily to perform the basic operations of the company and keep things running smoothly and effectively. At home, the PC has allowed millions of users to connect to the Internet and use electronic mail to communicate with other users. In colleges, computers have allowed students to complete homework and projects in a more efficient manner. Computers have definitely become an integral part of modern society.

Elementary education is one area where there is room for improvement in computer technology. Most schools do not have enough computers to accommodate all of the students. Some computers are outdated or do not have the proper software necessary to be an effective educational tool. However, computers are expensive, and most school budgets do not leave room for this type of investment without taking away from other important programs. Many schools must obtain money for computers through government grants or must hope that someone will donate computers to the school.

Some experts believe that it is important to introduce computers to children as early as possible. Seymour Papert is one such expert who feels that computers greatly enhance a child's education. He and others feel that computer skills will help students do better throughout school and will eventually benefit their careers. However, there are also experts that feel computers do not need to be in the classroom. One expert, Clifford Stoll, believes that computers actually hinder a child's education in some ways. Stoll would rather see a

child interact with other children in the classroom instead of interacting with a computer program.

The Abington school district has decided that it is important to expose their children to computer technology. Through government funding, the Abington Center Elementary School has acquired 6 iMac computers for the students and faculty. The school feels that these computers will greatly improve the quality of their students' education by integrating the available technology into their curriculum.

2.0 LITERATURE REVIEW

2.1 Introduction

In order to solve the problem at Abington Center Elementary School, it was important to address many issues, including the following: Apple computers in the classroom, elementary school curriculum, theories of computer use in classrooms, and methods of instruction for teaching adults and teachers. However, the first topic that needs to be addressed is the controversy surrounding computers in the classroom. Do computers even belong in the classroom?

2.2 Why Computers Do Belong in the Classroom

It is important that the computer's role in education is clearly defined. Over the past four decades computers have helped users understand concepts, perform complex computations and make work more efficient. When introducing new technology, it is possible to forget some very basic skills. For example, without the assistance of a calculator, the only way to get the answer to a math problem such as 12*5 is to understand the fundamentals of multiplication and to do the work. With computers and calculators however, all the user needs to do is type in the numbers. Over time, basic math skills may become rusty and the user may become dependent on the technology in question. This is precisely why limits should be placed on the role of computers in classrooms.

Within these limits, there are several different methods of computer instruction. The work, "Computers in the Classroom – Mindtools for Critical Thinking" by David H. Jonassen provides a style of learning with its methods focused on young children. Jonassen states the

importance of learning *with* computers, not *from* them. Perhaps more importantly, he supports the view that computers are not an option in education, but a necessity.

A basic understanding of how a computer functions is important. The user must be familiar with the terminology for computer peripherals and components. This will come over time and has been found that it would not be beneficial to be taught this information in a repetitive manner. For this reason, Jonassen recommends to teachers that they place very little emphasis on computer vocabulary. Computer basics will come with time. This information must be presented to students, but drilling and quizzing would not prove to be productive. Jonassen states that, "Another common problem with computer literacy is the 'strong belief that vocabulary implies knowledge.' It is a mistake to believe that if students memorize the parts and functions of computers and software, then they will understand and be able to use them."[1]

Jonassen refers to computers as being the most effective Mindtools. He coined this phrase and states its meaning as "computer applications that require students to think in meaningful ways in order to use the applications to represent what they know. Learning with Mindtools depends on the mindful engagement of learners in the tasks afforded by these tools, which raises the possibility of qualitatively upgrading the performance of the joint system of learner plus technology."[1]

Jonassen believes that in most primary learning institutions, the teachers know very little about the use of computers. They may be very uncomfortable with the technology and use the machines as instruments for rote learning alone. The school can be provided with the newest systems available, however, until the teachers can adapt to learning with computers, the children will not be able to use the computers as

Mindtools. They will merely perform drill and practice lessons, thus limiting the usefulness of the computers. This is one of the most common problems found in technology education today, and the problem that this project intends to address.

A large challenge in convincing teachers to use computers is to prove that they will be of some benefit. So, why use these Mindtools? According to Jonassen they bring out constructive learning that is classified as:

- Active – Students take an active roll in their education by absorbing and retaining knowledge.
- Cumulative – learning is enhanced when it builds on previous knowledge.
- Integrative – students take their past understandings and apply them to the new information being introduced to improve their understanding.
- Reflective – students have an active awareness and understanding of what they know and still need to learn.
- Goal Directed and Intentional – students take an active part in furthering their education to attain some future goal.

There is a key difference between current teaching methods and those that can be applied by introducing Mindtools. In most educational systems, instructionism is used as the primary method of teaching. This theory assumes that the student is a passive body that absorbs knowledge directly provided by the teacher. In this method, students do not take an active role in comprehension. They take pieces of knowledge provided for them and piece them together. More productive than instructionism are constructio*n*ism and constructi*v*ism. As defined by Seymour Papert, a researcher from the Massachusetts Institute of Technology and noted scholar in the field of introducing computers into elementary classrooms, "The

word with a *v* expresses the theory that knowledge is built by the learner, not supplied by the teacher. The word with the *n* expresses the further idea that this happens especially felicitously when the learner is engaged in the construction of something external or at least sharable...a sand castle, a machine, a computer program, a book."[1]

Computers can open doors to many opportunities. Projects, which would have been previously impossible, are now feasible. With the use of computers, children are afforded with endless opportunities for hands on learning and creative outlets.

2.3 Why Computers Do Not Belong in the Classroom

While Jonassen admits that use of the computer in the classroom should be limited, he still is in favor of using the computer as a learning tool. However, there exist some educators and technical experts that do not support the use of the computer in the elementary classroom at all. This section presents the opinion of Clifford Stoll, a pioneer Internet user, on computer-aided learning.

Stoll states that "learning isn't about acquiring information, maximizing efficiency, or enjoyment. Learning is about developing human capacity."[2] To learn is not to memorize facts or to teach as much information as possible in a short-time frame. Learning is not fun; it takes work. Stoll observes that many teachers try to make learning fun. This deviates students from truly experiencing learning as a tool to develop their capacity.

One of the most popular ways that a teacher can make learning fun is through use of the computer. Teachers utilize educational software, also know as "edutainment," as a teaching method that allows students to have fun while learning. Most educational software programs feature cartoon animations and games that entice the student to sit and play. The

player receives a reward for obtaining the correct answer in the game. Stoll feels that this type of "fun learning" undermines the fact that learning takes work. "To turn learning into fun is to denigrate the two most important things we can do as humans: To teach. To learn."[2]

Fun learning shows students that learning is easy. For example, a student playing a computer game basically needs to learn the correct combination of mouse clicks necessary to advance the game to the next level. "Number Crunchers" is a math program that requires this type of skill. The object of each level is to make the number cruncher monster eat the equations that equal a certain given answer. The first level may ask the student to find all equations that equal 45. After a few trials, the student learns that equations like 9 x 5 and 40 + 5 equal 45.

It may seem at first that the student is indeed learning how to do math. But, Stoll argues that the student does not actually learn why or how these equations add up to 45. The student memorizes them so that a reward is won and the student can advance to the next level. "The program forces the child to do a math problem in order to be rewarded with two minutes of entertainment. Then the torture begins anew. What a great way to teach hatred of math."[2]

Stoll explains that this type of learning by memorization is not really learning. Although this student may remember that 9 x 5 is equal to 45, the student might not be able to show why the equation is equal to 45. The computer is not the first instrument to teach children how to take shortcuts in learning. The calculator succeeds in abolishing the need for students to learn basic math skills. As discussed previously in the section concerning elementary curriculum, it is around the first or second grade a student should become familiar math operations: addition, subtraction, multiplication and division. Teachers demonstrate how a calculator can allow students to check their answers. Once students learn that they can

automatically obtain the answer by punching in a few numbers, they may stop working out the problems. "Calculators and computers short-circuit the stepwise progression in learning."[2] Ultimately they may forget how to perform the basic math operations by hand and become dependent on the calculator.

The calculator and computer, along with most technology, take many shortcuts to simplify learning. These shortcuts often leave students short on information. Another popular software program that is used in the classroom is the Encarta Encyclopedia. A student can enter a keyword into the search engine of the encyclopedia and a summary will appear on the screen. The summary quickly describes the main points of the keyword. "These software encyclopedias, so rich with pictures, have no depth."[2] These short excerpts cannot possibly contain all the information needed for the student to gain more than a cursory knowledge of any given subject. Nevertheless, some educators proclaim that the computer can broaden a student's education by introducing concepts that are not available elsewhere.

Stoll agrees that programs like Encarta are useful and can expose students to new facts that may not be found in a textbook. However, he argues that many important concepts are eliminated from the summary in order to streamline the information, which makes it more appealing to the student. While this strategy attempts to make learning more efficient, it fails to efficiently educate students.

Despite the failure of computers to efficiently educate students, school districts spend millions of dollars every year to update technology in the classroom. Meanwhile, many other programs in the curriculum suffer. Funding for art and music programs across the country are declining, while grants are awarded to increase the amount of computers in schools. Instead

of learning how to play an instrument or paint with watercolors, students must simulate these activities on a computer program.

Besides eliminating important parts of the curriculum, computers also eliminate the need for students to interact with each other. Stoll states that in the primary grades, grades one through three, the most important skill these students learn involve social interaction. Students work together on math problems, read to each other, and play together. However, the computer is a classroom tool that only one person can use. Sometimes teachers will pair up students on the computer to play a game, but the computer is largely a one-on-one interaction between human and machine.

The computer is an addictive force because it is a new concept that everyone wants to explore. Some students that are especially attracted to the computer may skip recess to play with the machine. Outside the classroom, it is evident that more children would rather play with the computer than play outside with other children. In the early stages of social development this is damaging to a child because they never learn how to properly interact with other people. "Four and five year olds need to develop human skills... how to get along with others. They should be playing with things, not images."[2] It is obvious even in the adult world that many people chose to stay home to surf the Internet for hours instead of going out with other people.

Stoll feels that educators need to create a balance between human interaction and computer interaction within the classroom. Throughout the world computers succeed in eliminating the need for any human interaction. Electronic mail is rapidly replacing the need for postal services. Many people find it easier to send an email than to call a person. Instead of going to the library to research information, people stay home and search online for

information, sometimes from unreliable sources. All this eliminates the need for human interaction. Stoll believes that educators at the elementary level need to reverse this trend by balancing technological teaching methods with non-technological approaches to teaching. Teachers need to show students that technology should not run life; life should run technology.

Despite Stoll's argument against vigorous use of computers in the classroom, most educators feel that there is a need to provide children with exposure to this technology. Once administrators decide that there is a need for computers in their schools, another issue arises: which type of computer is the most beneficial in the classroom?

2.4 Macintosh vs. IBM: Education and Administration

A major technical hurdle in teaching young children how to use a computer lies in hardware compatibility. Macintosh hardware is the standard for most elementary schools. When you go to a child's home however, their parents have most likely invested in an IBM compatible machine.[3]

In today's business world, the industry standard is the personal computer (PC). PCs allow users several different platforms from which to work. These platforms allow the user to customize his or her machine to fit needs and personal preferences without disrupting network functionality. Security features are also prevalent and effective. The user can restrict access to machines, files and networks. Users can setup passwords to protect work and information that may be stored on their computer from other users.

A Macintosh on the other hand, limits the ability to customize individual machines. Users do not have access to higher-level machine codes and settings. The security features on a Macintosh machine do not compare to those discussed previously on a PC. These reasons, along with software available on PCs, are why corporations choose IBM.

There are two questions that remain. First, why do the vast majority of school districts choose Macintosh? Also, what prompts the decision to educate children on one platform, knowing that when these children enter the working world, they will be using an entirely different computing system?

Since its founding in 1978, Apple has had a consistent commitment to education. They have founded many organizations that help schools gain better technology through providing grants, instruction and guidance. An example of such a program is the online teachers training course, which is available for a fee at www.apple.com. They keep up to date on educational theories, progress and needs. As a company, one of Apple's primary goals is to provide children with the tools necessary to stay competitive in today's technological world.

For many schools with small technology budgets, this type of assistance and guidance is helpful in bringing computers into the classroom. Macintosh computers are designed around ease of use. It is often the case that a school will not need a professional LAN (Local Area Network) administrator to maintain their labs. Macintosh provides technical support and step-by-step instructions to help with everything from setting up a printer to sending e-mail.

Most educators today did not grow up in the "technology generation". Many may be intimidated by computers and hesitant to even give them a chance. Macintosh has aimed to relieve much of this fear. The systems are simple to use and difficult to break. For the first

time, there is evidence of a changing environment in the classrooms. More teachers and administrators are becoming engaged in the challenge of bringing computer technology into elementary classrooms. Like all change, however, it is slow moving. Currently "only 20% of teachers are comfortable integrating technology into classroom instruction."[1]

A direct quote from a congressional address given by Tony Lee, Senior Director of Worldwide Markets for Apple on March 8, 2000 shows that Macintosh recognizes the need for change:

> Mr. Chairman, because of technology, the world today is different and it will continue to change. Society is different. Information is different. Communication is different. Work is different. School is different. And because of this, kids need to be educated differently. According to a report published in 1999 by The CEO Forum, sixty percent of the new jobs created in this century will require skills currently held by only twenty percent of today's workforce. It is critical that our educational system produces kids ready for this different world. Therefore, it is critical that systemic change occurs more rapidly in our educational system. We believe that well trained teachers who can integrate technology into the curriculum will be a catalyst to drive that change.[4]

Macintosh has devoted millions of dollars to education related research. In 1987, Apple founded Apple Classrooms of Tomorrow (ACOT). This coalition studied how technology could impact learning and advances our teaching abilities. The results came as no surprise. ACOT found that "for technology to make an impact on student achievement it must be utilized as a tool to support thinking and for effective communication and collaboration."[4] Not only will the students benefit from new technological media in their classrooms, but their teachers will also gain the creative flexibility and power to do their jobs more effectively. ACOT also states that "the success of technology in America's classrooms depends upon the skills of the teacher and the support of school administrators."[4]

In an effort to help expedite the learning process, Apple offers both online and leader-led teacher training through the Apple Learning Professional Development program. This

program consists of a series of workshops that are aimed at changing some of the fears that the educator may associate with computer usage.

There are many traits that an Apple computer possesses that the company wants current and prospective users to know about. The computers are easy to assemble. Students do not have access to high-level configuration programs, and therefore, cannot "break" the computer. Computers are multimedia-ready, use plug and play for easy expansion and are easy to network and support. With these qualities in mind, it is easy to see why school systems choose Apple over IBM technology.

Once schools like Abington Center Elementary choose to implement computer technology into the classroom, they must decide how to use them within the curriculum to benefit the students. It is necessary that educators review their curriculum to determine where computers will prove to be most effective. This next section introduces many important concepts of curriculum: the philosophy of the educational curriculum, the development and implementation of curriculum, and how the evaluation of curriculum leads to alterations to suit the ever-changing needs of students and teachers.

2.5 Curriculum

Educational curriculum is an important concept because it encompasses two important ideas: what teachers teach and what students learn. Many curriculum theorists embrace the definition of curriculum in general as "a prescribed course of study, training." Robin Barrow, a professor of curriculum theory at Simon Fraser University, feels that this definition leaves open "the question of the manner in which content should be prescribed."[5] This allows for creativity within the context of creating the curriculum.

To define educational curriculum, the definition must be more specific. P.H. Hirst, another curriculum theorist, proposes that curriculum is a "program of activities (by teachers and pupils) designed so that pupils will attain so far as possible certain educational and other schooling ends or objectives."[5] This definition is also open-ended, leaving the particular design of the curriculum undefined.

2.5.1 Curriculum Design

Using the loose definition of curriculum, school districts must design a specific curriculum to suit the needs of the students and the educational objectives of the school system. There are many different patterns of curriculum design, such as the subject approach, the broad-fields approach, and the problems-of-living approach. These patterns fall within the extremes of two main approaches: the experience curriculum and the Grand Design.

The experience curriculum "emphasizes the immediate conditions surrounding the child and his concerns."[6] The teacher and group of children are the central focus of the educational planning. Other elements within the educational planning, such as learning materials, are secondary to the primary concern of the student's experience within the classroom. In other words, planning is not centered on resources available; it is centered on the students involved.

Sometimes the experience curriculum is referred to as the "unplanned" curriculum. This curriculum "does not permit any schematic arrangement of things to be accomplished or the development of a curriculum framework."[6] The school staff does not develop a scope and sequence based around the subjects that need to be taught. The scope of the curriculum is the child's experience, and it broadens as the child grows and learns.

The Grand Design takes the opposite approach. This type of curriculum is not grounded in the needs of the children. Instead, it lays down "detailed specifications of the general aims of schooling and the requirements of society, before proceeding to formulate precise schooling objectives."[5] The Grand Design creates a general outline of the curriculum, then adds specific objectives for each grade level. Some theorists describe the Grand Design as a "utopian blueprint for learning"[5] because it was adopted by many past educational thinkers, including Plato and Rousseau. Some critics believe that this design is too ideal and does not address problems that arise in particular situations. Most curricula are based on the ideas of the Grand Design. However, many also contain elements of the experience approach.

2.5.2 Curriculum Planning

The next step in creating an educational curriculum is planning the curriculum. Once educators decide around which design to structure their curriculum, they must outline the content of the curriculum. Two examples of curricula that derive from both the experience curriculum and the Grand Design are the Massachusetts Department of Education Curriculum Framework and the Abington Public School curriculum. The next two sections will outline the content of each of these curriculum frameworks.

2.5.3 Department of Education: Curriculum Framework

The Massachusetts Department of Education is constantly working to improve education for all school districts in the state. The Department creates a curriculum framework for each subject taught in grades one through twelve. Each framework contains a detailed

outline that specifies the philosophy, goals and principles of the curriculum for that particular subject. It also specifies the content of each subject to be taught. The Department of Education's curriculum framework is the basis on which school districts develop their own curriculums.

The most crucial part of the curriculum framework is the "guiding principles". These principles are the basis of the framework and apply to all grades from pre-kindergarten to twelfth. Following is the outline of guiding principles taken from the Massachusetts Department of Education Mathematics Curriculum Framework:

- **Exploring mathematical ideas**

  Students explore mathematical ideas in ways that maintain their enjoyment of and curiosity about mathematics, help them develop depth of understanding, and reflect real-world applications.

- **All students having access to high quality mathematics**

  All students have access to high quality mathematics programs.

- **Mathematics learning as a lifelong process**

  Mathematics learning is a lifelong process that begins and continues in the home and extends to school and community settings.

- **Mathematics instruction as connecting and integrating**

  Mathematics instruction both connects with other disciplines and moves toward integration of mathematical domains.

- **Enhancing mathematics learning through group work**

  Working together in teams and groups enhances mathematical learning, helps students communicate effectively, and develops social and mathematical skills.

- **Technology as an essential tool**

  Technology is an essential tool for effective mathematics education.

- **Assessment as a multi-faceted tool**

  Mathematics assessment is a multifaceted tool that monitors student performance, improves instruction, enhances learning, and encourages student self-reflection.[7]

While these guiding principles take into consideration the needs of the child and focus on the learning experience, they also create a basis for an outline of specific content; therefore, the Massachusetts Department of Education is based upon ideas from both the experience curriculum and the Grand Design.

2.5.4 Abington Public Schools: Curriculum Handbook

Using the guidelines set forth by the Massachusetts Department of Education, Abington's public school system has developed curriculum handbooks for each subject taught in the schools. Each book gives a detailed outline of the material to be taught within each grade of school. The format is similar to the outline of the Massachusetts Department of Education Curriculum Framework, and includes their philosophy, goals and guiding principles. Again, the Mathematics Curriculum for Abington Elementary Schools will be used as an example.

Each curriculum handbook begins with a foreword that explains the process behind the development of the curriculum. The mathematics curriculum was revised in 1994. The mission statement is entitled "Vision 2000 Mission Statement." It states the following: "Our mission is to provide a student-centered educational experience which develops skills, knowledge and principles necessary for individuals to attain their highest level of potential within a democracy and a changing global society."[8] This mission statement encompasses the educational vision for all students in grades pre-kindergarten through twelfth grade.

The mathematics curriculum continues with the "Goals of Mathematics Instruction." These goals are derived from the Massachusetts Curriculum Frameworks Guiding Principles of Mathematics Education. There are eight general goals that the mathematics curriculum hopes to accomplish for the students in pre K through 12:

- That they learn to value mathematics.
- That they become confident in their ability to do mathematics.
- That they become mathematical problem solvers.
- That they learn to communicate mathematically.
- That they learn to reason mathematically.
- That they realize that mathematics is an important part of many disciplines.
- That they realize the importance that technology plays in mathematics.
- That they appreciate, acknowledge, and understand that mathematics is an integral part of life and therefore should address societal needs and real world issues. [8]

The next section of the curriculum handbook contains the "scope and sequence." This section shows a detailed chart of the math concepts and at what grade they should be taught to students. In the curriculum guide for grades K - 6, the chart contains eight columns. The first column lists all the concepts and computation to learn. The other seven columns represent the grade levels. Each box contains either a T or an R, where T equals teach and R equals reinforce. For example, one math concept listed is "exponents." Reading across the chart, it shows that exponents are taught in grades 5 and 6. Another example is "whole numbers." According to the chart, whole number concepts are taught in grades K - 2 and reinforced in all the other grades.

The fourth section of the curriculum handbook is a correlation to the Massachusetts Department of Education Framework content outline, titled "Strands and Learning Standards." There are four areas in which students should be competent:

- Number Sense
- Patterns, Relations and Functions
- Geometry and Measurement
- Statistics and Probability[8]

The Abington curriculum breaks each of these areas into specific topics for each grade level.

The remaining sections of the handbook contain detailed information for each grade level. Each section of grades K - 6 uses the following format:

- Content Outline and Pacing Chart
- Competencies
- Methodologies
- Strategies for Assessment[8]

The Content Outline uses information from the Scope and Sequence section and the Curriculum Framework. This section shows how many days are devoted to teach each concept. The Competencies section reiterates the information contained in the Strands and Learning Standards of the Curriculum Framework. The Instructional Methodologies allows teachers to approach lessons with different methods. Some useful methodologies listed in this section include games, videos, technology, learning partners and small group instruction. The Assessment section outlines different ways that a teacher can measure a student's progress. Examples include presentations, written tests, and pop quizzes.

2.5.5 Implementing Curriculum

Abington revised its mathematics curriculum in 1994. The next step that the school district needed to take was to implement the curriculum into the schools. Implementing curriculum change is like selling a product. First, the school needs to analyze the curriculum

proposal to ensure that it is rational and fits the overall design. "Considerations of implementation should only be allowed to affect design when nothing is at stake in terms of the curriculum rationale."[5]

There are two main distinctions in the implementation of a curriculum: curriculum diffusion and curriculum dissemination. Curriculum diffusion refers to the "manner in which a curriculum comes to be taken up or adopted"[5] while curriculum dissemination refers to how best to present the curriculum to ensure that it is adopted. Diffusion is *how* the curriculum is implemented and dissemination is *why* it is adopted. The diffusion and dissemination of a curriculum works most effectively with a good plan. It is important for those involved to comprehend the new plan and understand why it is better than the old one. Some people are wary to changes, so the best way to sell a new curriculum is to "sell a well-thought-out plan to those with requisite understanding."[5] These are the ideas that Abington kept in mind as it implemented its new curriculum.

2.5.6 Evaluating Curriculum

Once a curriculum is implemented into a school system, it is necessary to evaluate the performance of the plan. There are two qualities in particular that must be addressed: the worth of the curriculum and the effectiveness of the curriculum. The worth of a curriculum often refers to the results of the curriculum. Worth "is a matter of it meeting desirable ends, and not necessarily intended ends."[5] A curriculum can be worthwhile without meeting specific goals so long as it is not a waste of time for the teacher or student.

However, the effectiveness of a curriculum does rely on meeting intended ends. An effective curriculum will meet all the requirements defined in the objectives of the

curriculum. When Abington Center Elementary revised its mathematics curriculum in 1994, the planners created a set of eight goals that they wanted the curriculum to accomplish. The evaluation determines whether these goals are being utilized to reach the desired and intended ends.

One of the goals that Abington's school system established states that students "realize the importance that technology plays in mathematics."[8] This objective of the curriculum derives from the Department of Education's guiding principles that state that technology is an essential tool for learning. To achieve the goal of helping the students realize the importance of technology in mathematics, Abington public schools should be utilizing technology such as computers in math classes. However, there is no definitive time within the school day that integrates mathematics and computers.

With the purchase of new computers, Abington Center Elementary has the ability to redefine the parts of the curriculum to include the use of technology as an integral part of the learning experience in mathematics, as well as other subject areas. Once computers have become part of the curriculum, the next step is for educators to decide the most beneficial ways that they can be used to educate students.

2.6 Two Main Theories of How a Computer Should be Used in the Classroom

Within the classroom there are two main schools of thought as to how a computer should be used. The first theory is that a computer can be used "as an interactive textbook in control of the user."[9] Simply put, this is where the student sits in front of the computer, with the computer asking questions or guiding studying, while the student responds to the stimuli

provided by the computer. An example of this method would be using a computer to guide rote learning.

The second main theory of how a computer should be used in the classroom is as an "expressive medium that is under the control of the user."[9] Here the student would be creating something original through commands to the computer. The computer would respond to the stimuli provided by the student and the output would be viewed on a monitor or from a printer. The theories discussed here are the basis for a wide range of research. Many individual theories on how computers should be used in the classroom have spawned from these two main schools of thought.

Alan Kay is a researcher who envisioned a type of personal computer that would allow its user to create learning environments, while also providing the tools to write and edit and even illustrate papers. He felt that the

> Protean nature of the computer is such that it can act like a machine or like a language to be shaped and exploited. It is a medium that can dynamically simulate the details of any other medium, including media that cannot exist physically. It is not a tool, although it can act like many tools. It is the first metamedium, and as such it has degrees of freedom for the representation and expression never before encountered and as yet barely investigated. Even more important, it is fun, and therefore intrinsically worth doing.[10]

This sentiment embodies the principles from both main theories of computer-aided learning. Kay reveals in this quote that he believes that computers can be used for many functions, from calculating equations to animating pictures, and that users will want to explore the computer's capabilities because the act of using a computer is enjoyable. Several of the theorists that will be discussed supported Kay's viewpoint, but each of them saw computer-aided learning as something distinct from Kay's idea. It is possible to see some aspect of Kay's sentiment in each of the four researchers, though none of them based their work around Kay's philosophy.

While there have been many research teams over the past four decades working on projects in this area, the next section of this paper will focus on the research of four main figures in this field. Some of these men are still conducting projects with computer-aided learning today. All four of these researchers fall into the two main theories of computer use in schools. The first two that will be discussed are Patrick Suppes and Robert Davis. The research of these two men, though independent of each other, stem from the first theory of computer use in classrooms, while the ideas and projects of the last two men, Tom Dwyer and Seymour Papert, fall under the second theory of computer use in the classroom.

It should be noted that the researchers discussed have strong backgrounds in mathematics and focus their ideas of computer use in the classroom solely to mathematics at times. The first researcher to be discussed is Suppes, whose ideas about computer-aided learning are the furthest removed from Kay's viewpoint.

2.6.1 Suppes: A Behavioristic Approach

Patrick Suppes is a professor at Stanford University. He has many areas of interest, and has appointments in the psychology and philosophy departments. In addition to this he is the director of the Institute for Mathematical Studies in the Social Sciences. Suppes practices a behavioristic theory of learning. This is a theory of learning where the student is guided each step of the way throughout the learning process. Suppes takes a very logic-based view of mathematics. He believes that this subject (or any subject for that matter) can be broken down into discrete individual facts. Then, these individual facts can be organized hierarchically. "One fact leads to another fact that exists higher in the logical structure."[9]

Computer use can fit well into Suppes vision of education. With a computer taking on the role of a teacher, students can practice areas where they feel they are weak. Suppes offers an arena for rote learning to be taught entirely by computer. The student sits at a computer, the computer produces an exercise, and the student responds to the stimuli with a response, an answer. If the answer is correct, the computer tells the student so, and moves onto another problem. If the student is wrong, the computer tells the student so, and re-presents the same exercise. When the student gets the answer correct, the computer displays a new problem that is increasingly harder, and further up the hierarchy. Once this process has been completed, and the student has moved hierarchically up through a set of problems, they will have learned a body of information that may assist them in the next set of problems.

Suppes finds computers to be a real advantage to this style of drill-and-practice learning for two main reasons. First, computers can produce exercises for different students in the same teaching style. This can be advantageous as students move from one grade to the next. The style in which they will have been taught would be consistent. This reduces the possibility that a mixture of students, for example entering the fifth grade, will be confused by the course material since their previous fourth grade teachers would have taught the skills they needed to acquire in a different fashion.

The second main reason that Suppes believes computers are a great vehicle for this type of learning is that they can be programmed to become more individualized to the particular student using them. The computer can select easier or harder problems based on the student's past performance. In a classroom a teacher would have to pick one level of problem to work on, aiming at the "middle" ability level of his or her classroom. With a computer, a student who is comfortable with the skills required can move onto a problem that

is more challenging. A student who is struggling with a certain aspect of the lesson can utilize the computer for remedial practice.

Suppes believes that this style of computer-aided learning is most beneficial for three main bodies of students. These three characteristics may at times overlap. The beneficiaries from this style would be large schools, where students may not be able to receive much individual attention from their teachers, for students who need remedial help or those who are performing below their grade level, and for students who are from low income families and towns. If the student lives in a low-income area, then the taxes collected are not contributing a large amount of money to the school, which results in a smaller budget for the school. This may mean that the school cannot afford to hire enough teachers or teaching assistants.

Suppes recommends the amount of time a student should spend on a computer for this method of learning to be ten minutes a day. There are two reasons fore the brevity of each session. First, Suppes does not want the student to find the exercise too routine and become bored. Second, there is a limited time within the school day and he feels that every student should have a turn. While Suppes does believe that there is a linear relationship between the amount of time spent on a computer and grade placement, he "would not expect to be able to find linear gains with indefinite increases in the amount of time spent at computer terminals."[11]

There are both positive and negative aspects to Suppes idea of computer-aided learning. His approach is "attractive to different people for different reasons. 'Theorists' like it because it has a clear intellectual structure and scientific pedigree. 'Hard-nosed empiricists' like it because the effects can be measured. 'Administrators' like it because the cost structure is clear. 'Teachers' like it because they are free to do other activities."[9] An additional reason

teachers may enjoy this style is because it is easy to evaluate. A teacher could get a print out of his or her students' performances over the course of a week or month and be able to determine quickly which of his or her students is excelling and which need some additional help.

The downside to this method of teaching mathematics is based on an argument of what, specifically, children should be learning in their math studies. While Suppes takes a reductionist stance in his view of elementary mathematics, he has reopened "the debate as to what minimal skills children must acquire and what other mathematical activities should take place in the classroom outside of the (computer-aided learning) environment."[9] Questions are raised with the idea that rote learning is sufficient. What if the teacher does not provide additional activities to reinforce what has been learned with the computer? How will the computer explain the logic behind the arithmetic skills the student is learning? If their context for using mathematics is within a computer-aided learning environment, will these students become good problem solvers in everyday life? These questions stem from the fact that the "basic skills" that elementary students should learn is still up for debate. As Davis, Dwyer, and Papert are discussed, we will see that not even the most learned scholars and researchers agree on what math skills elementary students should acquire.

2.6.2 Davis: The Child as a Mathematician

Robert Davis believes strongly in learning through discovery. He believes that young students can more easily fill the role of "mathematician" when using examples from everyday life. These examples give meaning to the basic math skills they are expected to learn. Davis' research is hosted mainly from the University of Illinois. His main project, the Madison

Project, places a great deal of emphasis on graphics and the visual representation of arithmetic functions.

Davis believes that teaching arithmetic is much more fulfilling and meaningful when it is related to algebra, geometry, and science. The idea behind Davis' work is that the student should be learning as a mathematician would be learning. Part of his philosophy is to "create activities in the classroom that children can do as mathematicians would."[9] To adhere to this philosophy, the student should be able to make discoveries and make generalizations. Davis feels that these two activities can take place within basic arithmetic functions and techniques. It is with these techniques that arithmetic should be put into the context of coordinate geometry, graphing, and algebra.

Davis has a concrete idea of the mathematics curriculum that is necessary for elementary school students to be successful. He feels that while math is complex, it also lends itself to creativity. With proper conditions, discovery learning can lead to a very high skill level for a student. If students are using everyday examples from their own lives to aid in their understanding of math, then they come into the classroom with a pattern of ideas. It is the teacher's job to encourage the student to build up this pattern of ideas, and then assist the student should they find themselves incorrectly relating their ideas together. It is the successful interrelation of ideas that will mark the skill level of the student.

With Davis' reform of "pre-Sputnik" mathematics curriculum (i.e. arithmetic functions taught in the context of coordinate geometry, graphing, and algebra), his goal was to leave the students with a few lasting impressions. First, he felt the student should be able to develop their ability to access abstract situations and discover patterns. He also hoped for students to make a habit of using discovery learning and exploratory behavior in other aspects

of their lives. Last, he envisioned each student acquiring mental symbols that would enable him or her to think creatively about mathematical situations, in or outside of the classroom.

Computers play an important role in Davis' vision. With children using everyday examples from life, they already have a mental image of what it is they are dealing with. For instance if a student is learning about fractions, they might imagine sharing a candy bar with their friends. Davis would use a computer to produce a high-resolution graphic display of a candy bar. The child would then decide how to divide the candy among themselves and their two friends. With the graphic display the student can more readily see the candy bar being split into three even pieces. With the picture in front of him or her, that student can grasp the logic of three one-third pieces because they have actually had to split a candy bar into three pieces before.

It is interesting to compare and contrast Suppes and Davis. The latter is quite often found criticizing the former. Both men found themselves reforming the current math curriculum, but their paths were different. Suppes "fell" into reform. He was displeased with the level and fashion with which his daughter was being instructed. This led him to a behaviorist stance. He didn't want to out-right eliminate teachers, but he felt their role could be drastically redefined. He saw computers as a way to lead students step by step though exercises and learning. Davis, on the other hand, specifically chose to become an elementary school reformist. As a professor of mathematics at the university level, he felt that in order for great mathematicians to emerge, children must be taught in an atmosphere where they will develop into mathematicians. "If you want to create thinkers, then you must create conditions that do not repress children's thinking."[9]

With respect to students, Davis adheres to a developmentalist theory. This is shown by his encouraging students to develop their own paths towards learning. However, in respect to the teacher's role, Davis is far more behavioristic. He envisions teachers as finely tuned actors. While the student is exposed to new ideas, these ideas are carefully chosen activities presented by teachers who are scripted. The teacher is building on what the student knows from everyday life, but the teacher is not ad-libbing their way through the class. Davis would want teachers to go through intensive training. The teachers would be allowed to provide spontaneous answers to questions from their students, but even these answers would be semi-rehearsed. Training would attempt to cover every conceivable circumstance.

Davis presents some very valid ideas, the interrelation of arithmetic to algebra and geometry, etc. and capitalizing on knowledge the students already have just from everyday life. However, it is easy to see where Davis' plan could fall short. Assuming that there are the resources for teachers to attend this extensive training, what happens when a teacher does not attend the workshop? Will teachers lose their ability to find and demonstrate the logic in the concepts they are presenting, if their knowledge of the subject matter is limited to a script?

Thus far, neither Suppes nor Davis has provided adequate theories. Compared with Suppes, Davis has a much looser approach towards learning and a broader model of the basic math skills elementary students should attain. Davis does, however, have a very definite idea of the classical "powerful" ideas to be learned and the method in which these ideas are taught is quite rigid. There may be a "happy medium" somewhere in combining them. From here the discussion will move towards more eclectic researchers. Both of them feel that learning with a computer comes from actually creating programs from scratch rather than using application software.

2.6.3 Dwyer: The Pilot Metaphor

Tom Dwyer also believes that the creation of an environment conducive to discovery will lead to effective learning. While there is this similarity to Davis, Dwyer differs from both Davis and Suppes in a significant fashion. Dwyer works in the computer science department at the University of Pittsburgh. Before joining the faculty there, he was a high school teacher. The paper will show later how this influenced his attitude towards the role of the teacher as compared with Suppes and Davis.

Dwyer's research and model for learning borrows from both of the main theories of computer use. He appreciates the use of simulations, where the computer is in control of the student. The computer simulation acts in a certain pre-programmed way, and the student must react. At the same time, Dwyer wants students to be taught how to program so that they can be in control of the computer.

Much of Dwyer's philosophy comes from his experience as a pilot. The metaphor is extremely pertinent to the situation of a student being taught to program. When becoming a pilot, the instructor teaches the student enough to enable him or her to "solo". When the student is on a solo flight, it is then that the student learns the most about flying. By teaching elementary students to program, it is then that they are able to truly control the computer and take their learning to new levels.

Dwyer has a very positive view of education. He feels education is a tool that "liberates human potential, and thus the person."[12] The role the teacher plays in this idea of education relates back to the pilot metaphor. In both instances there are times with "dual mode" and then "soloing". The student and the teacher must form a relationship. A positive relationship is a sign of good teaching. The role of the teacher is to transmit information and

bring the student to a level where they can receive the information effectively. Both the teacher and student need to be active participants. The teacher must recognize that the student must "appropriate" the knowledge for himself or herself. The teacher must also understand that it is not feasible for them to impose their exact structure on the student. Where the teacher can shine is by helping the student construct his or her own mental models. Throughout this process the students and teachers are working towards the same goal. They are both striving for the student to be able to engage their potential through education.

For Dwyer, the most effective use of computers, the method that will yield the most impact, is through programming them. Rather than using application software, Dwyer feels that the student would most benefit from designing and writing the programs that they would use. Dwyer is a man of action, and at the time when his theory was in its beginning stages, he picked the most accessible language for the time, BASIC. While others, like Seymour Papert (who will be discussed later) waited to develop languages of their own, Dwyer wanted to implement his system as quickly as possible. For this reason, he chose an "off the shelf" language. It was this move that may have been the biggest downfall to Dwyer's plan for the future of education.

There are several problems with implementing BASIC as such a major part of Dwyer's philosophy. First, it means that teachers must be fluent with it. This involves training in two areas: how to write in BASIC, and how to teach BASIC to students. The second problem is that BASIC has many limitations as a language. BASIC is not a procedural language. Lines of code cannot be debugged (checked for errors), named, and forgotten until a later time. Only conditional statements (for example: IF, THEN) can alter the flow of a program. On top of that, only one program can be in the workspace at a time. Adding new

features to BASIC is possible only for experienced programmers. Novice level students would have serious trouble with this type of language.

It seems that Dwyer was aware that the situations mentioned previously might arise. He goes so far as to warn others of the very fault for which he is guilty. "Attempting to innovate with supportive systems that don't begin to match the sophistication of the human learner should be viewed as a betrayal, not a consequence, of a humanistic approach to education."[13] It seems that Dwyer failed to take his own advice. By opting for the readily available BASIC, he undermines his vision of education.

As was mentioned before, Dwyer has a very different stance from Suppes and Davis in regards to the role of the teacher. It is thought that the differences stem from Dwyer's own experience as a high school teacher. Suppes does not want to outright eliminate the role of the teacher, but he certainly wants to limit it. Some may find this enticing. The teacher is left with more time for projects they feel are important, and their main role is to supervise and provide logic where the computer fails to explain a concept for the student sufficiently. Davis saw the teacher's role becoming an education "play" of sorts. The teacher would take cues from the students as to when to give information from well-scripted (previously learned) responses and lectures. Dwyer is the first to admit that his vision of education is actually more of a burden on the teacher than the student. The teacher is responsible for knowing the intricacies of a computer language. They must be fluent themselves, and have an effective method for teaching the language to their pupils. It is clear from this comparison that Dwyer is very optimistic about the ability of teachers. He does not seek to limit their role or replace them.

2.6.4 Papert: The "Mathland" Metaphor

Seymour Papert, a researcher from the Massachusetts Institute of Technology, also uses a metaphor throughout his work. While Dwyer relates learning to becoming a pilot, Papert uses the imagery of "Mathland". The Mathland metaphor is simple, yet manages to have tremendous impact.

There are many deeply ingrained assumptions that people have about human ability. The current mathematics curriculum suggests that early elementary school students are not capable of learning formal geometry or algebra. Using the Mathland metaphor, we can examine elementary school children's ability to learn to speak German. It is easy to observe how difficult it is for American students to learn to speak German in America. But any child that lived in Germany would have no problem learning to speak German. In a place called Mathland, students learn to communicate mathematically in a context of the computers that surround them. It is this environment that will be conducive to making Mathland a reality.

Papert created a computer language called Logo, which was designed specifically for elementary school students. These children learn to "speak to the computer" in Logo with ease. With Logo, students can build geometric shapes into houses, flowers, fish, birds, and the list goes on. The students can build these objects with ease, for the genius in Logo is its simplicity. Logo uses "Turtle Geometry", where a turtle is visible on the computer monitor (in the beginning there was a physical, turtle-like mechanism that would move about on the floor) that reacts to commands provided by the user. The user is free to create what they please. This is not to say that the teacher won't ask a student to draw a circle with Logo, but that the computer does not prompt the student to draw anything. The commands are quite simple. For example, to draw a square the student uses the following commands in TURTLE

TALK:

FORWARD 100
RIGHT 90
FORWARD 100
RIGHT 90
FORWARD 100
RIGHT 90
FORWARD 100
RIGHT 90[14]

Following a command to move forward, the user must designate a number to tell the Turtle how far to go. Following a command to move right, the user must designate a number to tell the Turtle how many degrees to turn. This type of programming can be extremely useful because the user can try the exercise physically themselves. To determine what direction to command the Turtle to move in, the user can stand up and see what direction they would have to walk in, in order to "draw a square" with their body.

There is a similarity between Papert and Davis and to some extent, Dwyer again. Papert also holds the belief that learning is most effective in a discovery type environment. Like Davis, Papert feels that students come into the classroom with knowledge from everyday life that should be utilized. For Papert, this is seen as "learning without being taught"[7]. He sees students as builders. In order to build something, one needs material. For Papert, these children already possess material, which they gather from the culture around them.

Papert feels the current classroom structure is entirely ineffective. He bases this feeling on the idea of children learning to talk effectively without organized teaching. Papert believes society created the classroom because there were shortfalls with informal environments being adequate for learning. However, the introduction of the computer is just what is needed to create an effective, informal environment for learning to take place.

Currently, traditional schools make learning a painful process, and they have limited success. Papert feels that if all learning can take place in the same context as learning to talk, organized institutions will have to either transform, or they will simply wither away. If teachers can find a way to evolve into the environment that Papert envisions, then he thinks that the computer will be as exciting for the teacher as it will be for the student. Since using a computer can be such a varied activity, it provides an experience that is "discovery rich". Because of this, on the first day or after the second year, when the student sits down in front of the computer, he or she will become capable of producing some output that is new and exciting to both the student and the teacher.

There is an argument that increased computer use will stunt social development. Papert thinks just the opposite. Since computer work is generally done alone, there is an increased desire for the child to want to communicate when they are done with their allotted time. With the computer the student can produce amusing or pleasing graphics. When the child prints out their work, they will want to share it with their friends and classmates. Part of the fun is sharing what they have created. Because all of Papert's ideal students are using the Logo language, they will have a common bond. They will have something similar that they will want to discuss. Papert designed Logo to make it easy to discuss.

It is interesting to compare all of our researchers at this point. The first immediate difference between Suppes, Davis, and Dwyer and Seymour Papert is that the first three all have a definite idea of what elementary mathematics should include:

$$\text{Math} = (\text{arithmetic} + \text{algebra} + \text{geometry})^{14}$$

They all agree that elementary students should be learning these three basics rather than just arithmetic without any context in which to use it. Papert wants to introduce new material; he

wants the computer to become synonymous with elementary mathematics. For Papert, students should use the mindset of a mathematician in the sense that they should "seek to make use of what they already know in solving new problems." [14]

It is apparent from this discussion that the road to computer-aided learning will involve committed teachers. These teachers will be the keys to bringing the effectiveness of the computer into the classroom. The teachers of Abington Center Elementary School will need training in the use of computers so that they will be able to implement computer-aided learning into their own classrooms. Once the teachers are comfortable using computers they can begin to utilize the technology. The computer lab can be used for research via the Internet, as well as mini-projects such as virtual fieldtrips. In order to educate the teachers on the functions and benefits the computers can add to their classrooms, it is first important to understand how adults learn.

2.7 Facilitating Adult Learning

The design of a lesson used in educating children differs from the design of a lesson intended for adults. Children develop their learning styles over time throughout the educational years. Adult learners have already developed their own learning style as a child. It is important to keep this concept in mind when teaching a lesson to adult. The teacher must utilize a method of instruction that "will compliment the adult learning transactional process."[15]

There are several highly rated methods for facilitating adult learning. The first method of effective adult learning is when a large group of people form smaller sub-groups. These smaller groups are known as *Inquiry Teams*. Each inquiry team consists of three to eight

members. There should be at least four inquiry teams for this method to be effective. The teams are responsible for addressing different topics assigned by the instructor and are required to provide an answer to all of the other inquiry teams. It is through this sharing that all of the teams gain a common knowledge. The teacher that supervises these teams is responsible for keeping the members of each group focused on the task.

This particular method offers some important benefits. Inquiry teams allow each individual in the class the opportunity to exchange information about their lives and what skills they can bring to the team. They also provide the individual students a chance to be part of a collective effort and to be evaluated as a team rather than as an individual. However, this method does have its limitations. In order to be most effective, there must be at least four groups with three to eight participants. Therefore, inquiry teams can be a very effective tool but they are designed for larger classes.

Mentoring is another positive method for adult instruction. Mentoring can be defined as a bond between a mentor and a protégé in which both the mentor and the mentored experience intellectual development and growth. The mentor in the relationship is the giver of knowledge. The protégé must take a risk from their common body of knowledge and be willing to grow intellectually. The knowledge that the mentor imparts on the protégé will only take hold if there is a trustworthy bond between the two. The mentored individual takes a risk by seeking help with a topic with which they have been struggling.

Adult learners can be more reluctant to change their ways of thinking and to seek guidance when they approach a task that they cannot easily accomplish themselves. Therefore, the mentor must show caring and understanding. If a level of trust and

understanding can exist between a mentor and a protégé, then effective learning and instruction can take place.

The mentoring method has clear benefits. The main benefit is that the mentored receives undivided attention with one-on-one instruction. However, mentoring is not an appropriate method for facilitating adult learning with a group when there is not a 1:1 ratio of instructors to students.

The final method of instructing adult learners is *Discussion*. "Discussion is perhaps the most widely preferred method. If properly implemented, it should result in a collaborative, challenging, reflective, transforming, and democratic process." [15] The purpose of discussion in this context is to share ideas, information, and fears with a group of peers. The discussion leader promotes a free-flowing exchange, encouraging everyone to speak without fear from group members. It may be hard for adult learners in an unfamiliar situation to openly express their reservations with learning something new. They do not want to seem ignorant in front of their peers or their instructors. It is the discussion leader's job to create a comfortable atmosphere without these inhibitors. It is also important for the instructor to be familiar with the participants' skill level with the topic at hand.

Researching these different methods of adult learning was useful in determining the method that should be used to train the teaching staff of Abington Center Elementary School. There are only ten participants in the computer training; therefore, it seems most useful to use the discussion method within the context of the workshop. While the workshop created for this project will entail some direct instruction through demonstration, the time spent with the teaching staff of Abington Elementary will be used to best help the staff. Should any skill in the workshop be perplexing to a participant, open discussion will be encouraged. As the

participants begin asking and answering their own questions within themselves as a group, they will begin to see how the topics being discussed can connect to their personal and professional lives.

2.8 Instructing Teachers in Computer Usage

The computer is a relatively new commodity in the elementary classroom. Many teachers, including those at Abington Center Elementary School, are unfamiliar with the functions of a computer and how it can be used as a teaching tool. The project will address this issue through an in-service workshop.

The purpose of a workshop is twofold. First, the workshop teaches the teachers the basic functions of the computer. These include:

- How to correctly turn on/ off the computer.
- Mouse skills, including: single click, double click, dragging an object, etc.
- How to open, close, minimize, maximize, restore, and scroll through windows.
- How to create a new document.
- How to create a new folder.
- How to save information to the hard disk, floppy disk, desktop, external drives.
- Understanding the difference between the 'Save' Command and the 'Save As" command.
- How to open and quit software applications.
- How to use the 'Find' command to search for and item.

- How to communicate to the computer via a keyboard. The emphasis will be on proper hand/wrist placement and key location, rather than speed.
- How to copy or transfer files from a floppy to the desktop and vice versa.
- How to print a document.

The teachers need a solid understanding of these basic skills before they can continue with the next part of the workshop. A strong comprehension of these skills will also help the teachers pass along this information to the students.

Next, the workshop introduces teachers to different types of programs and applications for the computer. This part of the workshop encourages teachers to work together as they explore programs included on the computer, as well as additional educational software. As with the first part of the workshop, a computer expert is present to answer questions. "The expert can help them with problems, suggest additional software, and point out similarities to other programs being run by other teachers in the same room."[16] However, the purpose of the workshop is to allow teachers to share their ideas and learn from each other. While the leader of the workshop may present ideas for computer-related projects for classroom use, teachers should develop their own project ideas that suit their teaching style.

The workshop supervisor must prepare for negative reactions to the use of the computer. Computers do not always function properly, which is frustrating even to an advanced user. It is important to show teachers how to fix hardware and software problems when they arise. This knowledge will give teachers a sense of control over the machines, especially if a malfunction occurs during classroom instruction. Familiarity with the entire machine reduces any fear that teachers may have with the computer.

Some teachers resist computers because they see the machine as a replacement for their position as instructor. It is important to remind teachers that the computer is just a teaching tool that helps to educate students more effectively, much like a textbook or a blackboard. A computer should not interfere with the interaction a teacher has with the students, and should not be seen as a replacement. The workshop should also "encourage continued use of effective, non-computerized techniques."[16] While the computer is a great learning tool, there are other tools that are also effective to educate students.

There is one important fact that teachers should keep in mind about using a computer for educational purposes. "Ninety-five percent of knowing how to teach with a computer is knowing how to teach."[16] Good computer skills will not make a bad teacher better at teaching. However, a good teacher can enhance the curriculum with a solid understanding of computers and technology. With this information in mind, the workshop in this project will attempt to present teachers with the option to use the computers within the classroom but will not force them to replace their own teaching styles in favor of computer-aided learning.

In order to determine exactly which skills the teachers at Abington Center Elementary School need to learn, they must fill out a survey detailing their computer proficiency skills. By understanding the skill level of the teachers, the project can tailor the workshop to meet the needs of the teachers.

2.9 Survey Design

When writing any type of survey, there are several things that must be kept in mind. The information gathered in this section is from www.infonet.com and from a Fidelity Investments survey manual, which was provided to the company by Gallup Polls. This

section is a comprehensive summary of information and suggestions from both companies. The first and most important is tone. People use words in many different contexts and it is important to get the message across to the audience. The questions must be short and to the point. The writer of the survey should word the questions in a manner that is easy to understand and interpret.

The length of the survey is just as important as the language. When sending a survey and collecting responses on a volunteer basis, if the survey is kept as short as possible, there is a larger chance that the sender will receive more responses. If the survey is long, the recipient might rush through the questions without pausing to apply some thought to their answer. When writing the survey it is important to make the distinction between what knowledge is essential, useful and unnecessary. Using this delegation, the writer can begin to eliminate questions and highlight the most important.

Using common language is important. The questions need to be easy to understand and to answer, to avoid ambiguity. The writer should avoid the use of acronyms, uncommon technology terms and large-scale wording. For example, rather than asking a question about VLSI computers, the writer should introduce the machines as Dell, Gateway, Compaq and similar computers. The two terms are interchangeable, and chances are that the general public is more familiar with the latter. Another step that is helpful is to use common grammar. Questions should be kept to the point, because the recipient could get lost in the meaning of a question that is too wordy. When trying to receive easy to interpret answers, the writer must design questions that are easy to answer.

Writing leading questions will make the survey results inaccurate. The writer should avoid asking questions that lend themselves to a particular answer. For example, rather than

asking, "Where would you like to go out to dinner?" A better question would be, "Would you like to go out to dinner?" Follow up with a second question that states, "If yes, then where would you like to go?" This allows the reader to determine if he or she even wants to go out.

Some questions require a metered response. If this is the case, make sure that the scale allows for both extreme ends of the answer spectrum. Questions that require that the reader select an answer from a list are often integral parts of surveys. Just be sure that the list of possible answers is not confusingly long.

Using open-ended questions is helpful when analyzing responses, but again, the number of these questions should be limited. The more that respondents are required to write, the less focused they will be when giving their answers.

The finished survey should flow naturally from one question to the next. The questions should progress in a logical order. Just as leading questions can alter survey responses, one question can change a person's view of another question.

A cover letter should always be included when mailing a survey. A letter of intent is often helpful in getting responses. If a recipient of the survey knows that the results will benefit them in some way, they may be more eager to reply. The cover letter should include:

- The purpose of the survey
- Why it is important to get responses
- What action will result from the survey
- The method for returning the survey (often a self addressed, postage paid envelope)
- A contact person or group to answer questions regarding the survey

- A reasonable due date for survey responses

In addition to determining the skill level of the participants in the workshop, it is also necessary to assess their desire to implement and use computer-aided learning in the classroom. Understanding the interest level of the teachers is just as important as understanding their skill level. Without the full enthusiasm of the teachers at Abington Center Elementary School, it will be impossible to have a successful project.

2.10 Conclusion

Bringing a level of computer literacy to a group of elementary school teachers and staff requires an understanding of an array of topics. This literature review has demonstrated the research needed for the group to design the structure of the workshop that will be provided, as well as the recommendations that should be given to the workshop participants as they begin to introduce computers into their classrooms. It is the opinion of the group that, based upon our research, the workshop should be structured in a way to encourage free-flowing discussion. While the first workshop will be primarily centered on instructing a set of skills, it is clear from the research that the interchange of questions and answers between the group and the workshop participants must take place in an environment where the participants won't feel uncomfortable.

The workshops will include basic instruction as well as future recommendations. While some of the participants might not be at the necessary skill level to incorporate computers in their classrooms, they should be aware of the possibilities that computers in education hold. Our recommendations to the staff for their use of computers in the classroom will draw from Suppes, Davis, Dwyer, and Papert. For basic remedial help, where a student

requires some practice in a "flashcard-like" fashion, Suppes' ideas for rote learning are applicable. Davis' use of visualization and drawing from everyday experiences can be implemented in all areas of the curriculum. Dwyer's ideas for "solo learning" are important for teachers and students to see that learning does not have to be limited to the classroom. The workshop discussions and recommendations will also include Papert's idea that students can use computers as a means of expression.

The workshop will also address the ideas of Jonassen and Stoll, that computer use should be limited. Teachers will be encouraged to continue non-computerized methods of teaching that incorporate human interaction. Using both methods, the students of Abington Center Elementary will have the advantages of technology and the social interaction necessary to become well-rounded individuals.

3.0 METHODOLOGY

The main goal of this project was to instruct the teachers of Abington Center Elementary School so that they would achieve a level of skill and comfort with the recently acquired computers in the school's computer lab. By bringing this skill level and comfort to the teachers, their students are likely to benefit in the future. As the teachers feel confident with computers, they will be more apt to utilize the computers as the valuable learning tool that they are. There were many steps that were taken to assure that we, as a group, could offer the best program possible to the teaching staff of Abington Center Elementary.

Given the nature of the project, the team determined that surveys provided the most beneficial method of data collection. The plan was to provide instruction to users with a wide range of experience and skill. The survey distribution was needed in order to become familiar with the skill and comfort levels with which we worked.

Using information from Gallop and infonet.com, the team wrote two surveys (See Appendices A and C) that were distributed to the faculty of Abington Elementary School. The first survey was mailed to the teaching staff over the summer, and the second survey was distributed after the initial workshop. The teaching staff was the target audience of the instructional session and therefore, their preliminary thoughts and final opinions were central to the project. The first survey was also sent to the principal of the school. He was once a member of the teaching faculty and was very excited about the prospect of the project. He had shown himself to be quite eager to learn more about computers and their role in the classroom as the students are using them as a learning tool.

The questions asked in the first survey ranged from basic skills to more advanced usage such as financial records and e-mail. In addition to determining skill level, a series of open-ended questions were included as an aid in determining the interest of the teaching staff in using computer-aided learning in their classrooms. It was our intention to use this assessment as a guideline to plan our instructional workshop.

The second survey was designed to evaluate the usefulness of the initial workshop. There were two sections to this survey. The first asked teachers to gauge their level of skill improvement following the workshop. The second section was open-ended, allowing for specific answers as to whether the time spent in the workshop was worthwhile, and what the participants would like to learn in the future. For example, the survey asked if teachers would be more willing to utilize computer technology in the classroom following the workshop. They were then asked to explain why or why not. These results were important to evaluate the success of the workshop and to construct the follow-up workshop.

Upon drafting a letter of introduction and composing the pre-workshop survey, the next step was to send the letter and survey to all eight teachers. A copy of the letter and survey is attached (See Appendix A).

After evaluating the survey responses, the workshop was tailored to most effectively help the teachers. Since there was a limited amount of time in which to instruct the teaching staff, it was crucial that the time be used effectively and that the group avoid spending time on skills that the teachers were already confident with. The goal of the first workshop was to demonstrate and teach a number of skills. The group members collaborated with Principal Gauley to compile the following list of skills to be taught:

- How to correctly turn on/ off the computer.

- The proper use of equipment and the legality concerning copyright laws.
- Mouse skills, including: single click, double click, dragging an object, etc.
- How to open, close, minimize, maximize, restore, and scroll through windows.
- How to create a new document.
- How to create a new folder.
- How to save information to the hard disk, floppy disk, desktop, external drives.
- Understanding the difference between the 'Save' Command and the 'Save As" command.
- How to open and quit software applications.
- How to organize files on the desktop, within folders, and within drives.
- How to use the 'Find' command to search for and item.
- How to communicate to the computer via a keyboard. The emphasis will be on proper hand/ wrist placement and key location, rather than speed.
- How to create and edit a word processing document, including how to: select a format, select a font, select a font size, use the shift and tab keys, choose an alignment, choose spacing, use capitals, use proper spacing after punctuation, insert and delete words, highlight text, use the 'Cut' and 'Copy' and 'Paste' functions and their keyboard shortcuts.
- How to copy or transfer files from a floppy to the desktop and vice versa.
- How to print a document.
- How to change the page layout.

Within time constraints, there were also various advanced skills that were demonstrated. It should be noted here that the instructional demonstration of skills by the group was done in conjunction with the teachers who practiced these skills throughout the workshop.

Learning the skills listed above takes time and experience. It would be improbable that anyone could learn these skills well enough to teach them the next day, so the group also provided a manual that demonstrated how to complete all of the skills listed above correctly (through use of step-by-step directions and pictures). A copy of the manual provided for the teaching staff is attached (See Appendix B). In addition to the directions provided in the manual, ideas for future projects that the students can complete with their teachers were included, such as virtual fieldtrips, and using the word processing capabilities of Appleworks to write and edit reports.

A second and final survey following the instructional session was distributed to all workshop participants (See Appendix C). This survey was aimed at determining the overall success of the project. Success was determined through survey questions geared towards self-evaluation by each of the participants. This follow-up survey consisted of primarily opened-ended questions that allowed the teachers a chance to explain to the group how they viewed the instructional session. The survey also presented a forum in which the teachers could evaluate themselves, with questions rating level of improvement with skill and/ or comfort. It was the hope of the group that the teachers would gain a basic understanding of computers and that they would become excited about the possibilities that computers open up in an elementary learning environment.

To be prepared for the workshop, the group became familiar with the technology at hand. The computer lab at Abington Center Elementary School hosts six iMac computers.

Each computer comes equipped with a 350MHz PowerPC G3 Processor, a 6-Gigabyte hard drive and 64MB of random access memory (RAM). Each monitor has a 15-inch display, a built-in CD-ROM drive and an external SuperDisk drive. The iMacs also come with a mouse and keyboard. All six computers connect to a shared printer and a scanner.

The workshop was held in this computer lab. The workshop required a LightPro projector to make a presentation using MS PowerPoint. MS PowerPoint was also necessary to create the manual that was given to the teachers at the end of the workshop.

The undertaking of this project required an organized schedule for the completion of the sub-tasks mentioned in the opening of this section. Table 1, on the following page, outlines this schedule.

DAY	June	July	August	September	October
1	• Beginning of E Term • Draft problem statement • Start literature research	• Begin writing literature review and methodology section	• Write data and analysis section		• Submit draft of final paper for review
7			• Develop instruction manual		
12				• First teacher workshop at Abington Center Elementary	• Make final revisions to paper
13	• Meet with Principal Gauley				
15	• Create teacher survey	• Receive completed surveys	• Develop teacher workshops • Prepare formal presentation		
18		• Begin survey analysis			
19				• Second teacher workshop • Distribute and collect second teacher survey	• End of A term • Hand in final paper
20		• End of E Term • Finish literature review and methodology section		• Begin analysis of second survey	
22	• Mail teacher survey				
25		• Submit Project Proposal section for review		• Write conclusions and abstract	
28			• Formal Project Presentation		
30	• Finish literature research				
31			• Beginning of A term		

Table 1

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4.0 DATA COLLECTION AND ANALYSIS I

Midway through the summer, a letter and survey (see Appendix A) was sent to each teacher from Abington Center Elementary. The letter introduced the group members and the concept of the Interactive Qualifying Project. The letter also included a summary of the goals for the project. The purpose of the survey was to assess the computer literacy of the teachers as well as their comfort levels with computers. The survey also assessed teacher interest in implementing computers as part of classroom learning. The surveys were sent to the nine teachers of Abington Center Elementary via the school secretary, and returned via mail to the school's office. The school secretary removed the names of the return addressees from the envelopes to preserve anonymity. The surveys were then retrieved and analyzed. The surveys yielded a 66% return rate. The results (see Appendix D) of the survey, tabulated from six responses, are as follows:

4.1 Survey Analysis I

1. Do you own a personal computer? (If no, please skip to question 4)
    a. PC
    b. Macintosh

100% of teachers surveyed own a PC in their home.

2. How often do you use your computer?
    a. Every day
    b. Every week
    c. Every month
    d. Rarely

33% of teachers use their computer every day, while 50% use their computer every week. The remaining 17% of teachers surveyed use their computer every month.

3. What is the primary use of your computer?
    a. Internet
    b. E-mail
    c. Financials
    d. Word processing
    e. Other (please specify)_____

100% of the teachers surveyed use the computer for word processing, while 67% use the computer for both e-mail and the Internet.

4. Do you know how to:

a.	Use a mouse	Yes	No
b.	Use a printer	Yes	No
c.	Use a scanner	Yes	No
d.	Save a file	Yes	No
e.	Use a Floppy Disk	Yes	No

100% of the teachers surveyed know how to use both a mouse and a printer with their PC. 83% of teachers understand how to save a file. 67% of teachers also know how to use a floppy disk. Only 33% of teachers know how to use a scanner.

5. How would you rate your over all experience with and understanding of computers?
    a. excellent
    b. above average
    c. average
    d. below average
    e. minimal experience
    f. no experience

50% of teachers feel that their overall experience with a computer is average, while the remaining 50% feel that their skill is below average.

6. If given instruction and guidance, do you feel you would use computer technology to assist you in teaching your students?
    a. yes
    b. no

87% of the teachers surveyed believe that they would use computer technology in the classroom if given instruction and guidance. Teachers would like specific guidance on programs that would be useful in the classroom. They would also like instruction on Internet usage. However, some teachers show concern regarding space and time restrictions. The computer lab is small and does not accommodate an entire classroom of students. There is also not enough time in the curriculum to take classes down to the computer lab.

7. Do you feel that computers could be an asset to your work?
    a. yes
    b. no

All of the respondents feel that computers could be an asset to their work. Many of them also appreciate the computers as a way to enhance the students' learning experience. Teachers also believe that the computers will be helpful for planning lessons and sharing ideas with teachers over the web. The biggest problem that teachers stressed is that their home computers are incompatible with the school computers. Therefore, teachers would only be able to do school work on either their home PCs or the school iMacs.

8. Are you currently utilizing available computer technology to assist students in learning? If so, please explain usage time, software and method:

Most teachers responded that they are required to use a program called Successmaker as part of the reading curriculum. Each student is exposed to this software for 15 minutes a day. Mario Teaches Typing is another computer program that is used to teach keyboarding skills. The teachers in the survey mentioned that they found these programs to be very limiting. One teacher also mentioned that the computer in the classroom does not function properly, which discourages this teacher from using the software available.

9. How satisfied are you with your school's current technology policy and usage guidelines? Do you feel as though you have adequate guidance in implementing technology in the classroom?

All of the teachers in the survey are pleased with the progress that Abington has been making in providing the schools with better computer technology. However, there are not enough computers for all the students. Time is also an important factor, and many teachers find it difficult to find the time to bring their students to the computer lab.

10. Do you feel as though you have adequate guidance in implementing technology in the classroom?

Some teachers feel somewhat comfortable using the computer in the classroom while others have reservations about their skill levels. All teachers agree that they could always use more instruction to become a better computer user, though none were specific as to the level of instruction they would benefit from.

11. What reservations or concerns, if any, do you have about using computer technology in the elementary school classroom? Please explain.

The biggest concern that teachers have about using the computers with their students is the time constraint. There are only 6 iMacs in the computer lab, but there are more than 25 students per classroom. Teachers would like to know of ways that they can use the computer effectively with the limited time available. Teachers are also concerned about monitoring the use of the computer with respect to the Internet.

12. What would you like to gain from our training program and manual- i.e. specific device instruction, basic computer skills, advanced instruction on specific software titles

In general, teachers would like to learn and understand the functions of the computer better. Specifically, teachers would like to be introduced to programs for students that will teach the basics of typing and essay writing. Teachers would also like to learn programs that will aid in presenting material to students, such as PowerPoint for presentations or a graphics program to display information with charts.

4.2 Analysis and Recommendations I

The results of this survey were used in shaping the scope of the first workshop. Because the teachers unanimously answered to the first question that they all own PCs in their home, the group knew that the teachers were unfamiliar with the Macintosh system. The workshop would therefore need to focus on the assets of a Macintosh operating system. The workshop would also need to illustrate the differences between a Macintosh and a PC.

From the answers to the second question, it was apparent that many teachers do not use their computer every day. In addition, all the teachers felt that their skills are at an average or below average level. They probably do not have the advanced skills that

result from continuous use on a computer. However, the results of the fourth question showed that most of the teachers understand the basic skills such as using a mouse, saving a file and using a printer. Therefore, the workshop would be designed to review basic skills and introduce more advanced skills like navigating through programs and organizing files.

The programs used in the workshop should reflect the area in which teachers would most likely be able to use the computer in the classroom. Most of the teachers explained in the survey that they would be willing to use the computers as an aid to learning if they knew the best methods of implementation. One area that is of particular interest to the teachers is the Internet. Many of them already use the Internet on their home PCs but would like instruction on how to implement Internet usage into classroom lessons. The workshop would need to provide examples of Internet sites that would be interesting to the students.

There are two main areas of concern that the teachers have with the use of the computers for classroom learning. The first concern involves time and space restrictions. Currently, students only have 15 minutes on a biweekly basis to use the computers in the lab. This is due to the number of students in each class and also the available supervision in the computer lab. There are 30 students per class, only 6 iMac computers, and no lab monitor. The only way that students are allowed in the lab is under the supervision of the teacher. This can only be accomplished when there is another person available to watch the students in the classroom.

The second problem concerns the curriculum. Currently, the Abington Public School system has specific guidelines regarding what needs to be taught in every grade for each subject. The teachers would like to use computers with certain aspects of the

curriculum, but do not see a feasible way to do this without disrupting other parts of the lesson plan. The workshop must deal with these concerns. First, the workshop would have to show how one computer could benefit a whole classroom of students. This could be done using a LightPro that projects the computer image onto a large screen.

Second, the workshop would need to show teachers how available computer resources could enhance current lesson plans. For example, the third grade math curriculum includes reviewing the basic math operations of addition and subtraction and learning the operations of multiplication and division. One way that students learn and memorize these operations is through the use of tables. Often tables for multiplication and division are included in the back of the math textbook. However, an innovative way to incorporate the computer into the math curriculum would be to have the students create their own tables using a computer program.

One software program that could create such tables is the Macintosh graphics program, Inspiration. By using a computer to create these tables, the students would learn many skills. First, the students would be practicing basic computer skills, like using a mouse and opening a program. Students would also learn more advanced computer skills, such as navigating through a software program. More importantly, students would learn curriculum-based material. By creating the table themselves, the students could see the emerging patterns of numbers in the equations. For example, in a multiplication table students would be able to see how 2 x 9 is the same as 9 x 2. The students would understand how *and* why the operations work. An example of a multiplication table made with Inspiration is included in Appendix E.

The teachers in general seemed very excited about implementing computer-aided learning into the classroom. Therefore, the workshop would need to review basic skills

for the teachers, but also introduce them to advanced functions of the computer that would enable them to successfully utilize the computer with the students. A complete outline of the workshop is included in Appendix F.

4.3 Workshop I

The workshop was held on the afternoon of September 12, 2000. There were twelve participants, including the entire teaching staff, several paraprofessionals (teaching assistants), and the principal of the school. The workshop lasted for approximately one hour, with an additional thirty minutes after the surveys had been completed for last minute questions.

The workshop began with an introduction of the group members by the principal of the school. The group then explained the Interactive Qualifying Project as defined by the WPI Undergraduate Catalog. A brief discussion of curriculum design was led, followed by a discussion of ways that computers can be utilized in the classroom while following curriculum guidelines. The consensus between the group and the workshop participants was that computers could be especially useful in writing and researching papers, as well in creating teaching aides such as diagrams and flow charts.

The group then introduced a couple of the main theories in computer use, derived from the literature review. The workshop participants understood the difference between the user being *in control* of the computer, as opposed to the computer being *in control* of the user. There was little interaction between the group and the participants at this point, so the group vocalized the idea of free-flowing questions and answers. The group encouraged the participants to ask questions as soon as any confusion arose, which prompted more active interaction between the participants and the group.

The basic skills section of the workshop began with an introduction to turning the computer on and off. The group showed the workshop participants how to turn the computer on by using the keyboard button located on the upper right side of the keyboard. The group explained that this button could also be used to shut down the computer.

Next, the workshop explored mouse skills, including hand placement, pointing and clicking. The group showed the participants of the workshop how to drag the mouse pointer across the screen. There was some confusion among the participants about what to do when they ran out of space on the mouse pad to drag the mouse. The group explained that this problem could be solved by picking up the mouse while still holding down the button and moving to another place on the mouse pad. The workshop participants also found that holding an iMac mouse was very uncomfortable in comparison to a PC mouse. The group suggested that the iMac mouse was more suited for a student's hand. A picture of an iMac mouse can be found in the Manual (See Appendix B).

The workshop continued with an intense exploration of the Macintosh application, Appleworks. The group began by having the workshop participants opening the Appleworks program using their mouse skills. Next the workshop participants opened a new word processing document. The group members showed them how to maximize and minimize the document screen and also how to scroll up and down through the document. Next, the group led the workshop participants through a quick example of how to type and edit text within the word document. They learned how to change the font size and style. The workshop participants also learned how to use the editing functions of cut, copy and paste.

Using the newly formed word document, the group demonstrated how to save the document onto the desktop. The workshop participants also learned how to save a copy of their document into a folder on the desktop. The group portrayed a physical demonstration of this by using tangible manila folders that represented the folders on a computer, and sheets of paper to represent files on a computer. Once the workshop participants finished saving files to the desktop and to the folder, the group showed them how to find the files using the Find function. After the workshop participants found their files with the Find function, they were taught the importance of saving files to a floppy disk. The group explained that a floppy disk is useful in moving files and working from different computers.

This ended the basic skills section of the workshop. With the remaining time, the group introduced some other applications to the workshop participants. A PowerPoint presentation was projected onto the wall using a LightPro. The presentation demonstrated a "virtual filed trip" to the New England Aquarium. It featured pictures of different exhibits currently at the aquarium. The workshop participants enjoyed the presentation and commented that it was a great way to present material to students.

The next software application that the group introduced was Inspiration. Inspiration is a graphics program on Macintosh computer systems that creates flow charts. The Inspiration example was an extension of the New England Aquarium presentation and showed a food web of aquatic life. The teachers were impressed with the graphic capabilities of Inspiration and discussed different ways that it could be applied within their curriculum, like creating a family tree.

The group concluded the workshop by announcing that there would be a second workshop on September 28. The group explained that the applications such as

PowerPoint and Inspiration would be explored more thoroughly at the second workshop. The workshop would be an open forum to the questions and concerns of the workshop participants. The group thanked the workshop participants for attending the workshop and left an evaluation survey (see Appendix C) for them to complete.

5.0 DATA COLLECTION AND ANALYSIS II

At the close of the workshop, the post-workshop survey was distributed to the workshop participants. The group then left the computer lab, to ensure an unbiased response. The completed surveys were handed in face down in a manila envelope. Once the surveys were completed the group re-entered the computer lab and addressed any last minute questions. The results (see Appendix G) of the post-workshop survey, tabulated from eleven responses, are as follows:

5.1 Survey Analysis II

The first area for response in the post-workshop survey included a list of skills and a choice of three levels of improvement; Negligible Improvement, Moderate Improvement, and Considerate Improvement. Respondents filled in skills that they already were comfortable with as Not Applicable (N/A).

1) Please rate your level of improvement with the following skills by marking the appropriate space with a check mark:

	Negligible Improvement	Moderate Improvement	Considerable Improvement	Not Applicable
Mouse skills		18%	18%	64%
Opening a program		18%	18%	64%
Exiting a program		9%	27%	64%
Opening an existing document		18%	18%	64%
Saving a file		18%	18%	64%
Saving a file to Floppy disk		27%	36%	36%
Using a printer	9%	9%	18%	64%

Creating a new document		9%	27%	64%
Closing a document		9%	18%	72%
Resizing a window	9%	9%	36%	45%
Creating a new folder		36%	45%	18%
Changing page layout		27%	27%	45%

2) Do you feel that the time spent in this workshop was worthwhile?

Yes _____ No _____

91% of the respondents felt the time spent in the workshop was worthwhile. 9% of the respondents did not answer the question. The general comments provided in addition to the yes/ no response centered on three points. First, there were many enthusiastic comments about how worthwhile the workshop was. Second, many felt the workshop was a good review of rusty basic computer skills, and third, it was useful for many respondents to see the differences and similarities between iMacs and PCs.

3) Do you feel that you would be more apt to implement some of the techniques learned today with your students after this workshop?

Yes _____ No _____

100% of the responses indicated a 'Yes' answer, with comments consisting of two topics. First, the faculty would like to have the school obtain the equipment that was used in conjunction with the workshop, such as a LightPro projector. This would allow them tp present the material on one computer in a large image to a full classroom. The second consistent response was that the manual provided was not only useful for the teachers, but possibly for their students as well. It was expressed that having the skills written

down in an easy to follow format was more helpful than trying to take notes or remember the skills when struggling to use the computer.

4) If a second workshop was offered, to demonstrate more advanced skills as well as field specific software questions, would you attend?

Yes _____ No _____

100% of responses indicated a 'Yes' response. Teachers would like to be able to demonstrate this software to their students, to be able to use this software for their own needs (i.e. record keeping, grade books). The skills the respondents were most interested in learning in the follow-up workshop include the following:

- Inspiration software – a flowchart design software
- PowerPoint software – presentation software
- Internet use – for research and communicating with other education professionals
- Graphics – to add into presentations and student worksheets
- Charts and graphs – to illustrate concepts and progress
- Spreadsheets – to calculate grades and maintain records

5.2 Analysis and Recommendations II

The first question on the post-workshop survey was aimed at assessing the level of improvement on some of the major skills taught in the workshop. From analyzing the survey responses, it seems that the focus of the workshop missed the median skill level of the participants. The workshop was based on the survey responses from the pre-workshop survey. The responses we received from that survey indicated extremely

limited skills with basic computer interactions. The responses on the first question from the post-workshop survey show that at least half of the participants were already comfortable with the basic skills the group was demonstrating and instructing. From the research conducted previously, one possible reason for the inconsistency in the skill level responses may have been from "peer pressure". The less skilled participants may have felt uncomfortable allowing their coworkers to see that they had little previous knowledge and experience using computers. Adult learning styles focus on limiting any one student from being singled out. In order to receive more honest responses, the group, in retrospect, should have separated the workshop participants to preserve the anonymity in their responses. Some responses may have been tainted by teachers fear that other participants were 'reading over their shoulder'. Another possible reason for the workshop missing the median skill level was the number of responses returned from the pre-workshop survey. The workshop was based on the returned surveys, so it is possible to assume that the workshop participants who found the level of the workshop too basic, were some of the same individuals who did not return the initial survey.

The responses on the second question indicated that regardless of whether the workshop was too basic in nature for some of the participants, the time spent was worthwhile. The participants who were already comfortable with the skills presented found the workshop to be a good refresher course. The participants who had little previous experience had an opportunity to be exposed to a set of basic and fundamental skills necessary for incorporating computers into their classrooms. Since all of the responses from the pre-workshop survey indicated that the participants were used to PCs, the workshop also gave several participants a chance to take a closer look at the differences and similarities between PCs and the iMacs in the computer lab.

The responses on the third question unanimously indicate a willingness on the participants' parts to try and incorporate computers within their classrooms. Research in the area of curriculum showed the group that the teachers of Abington Center Elementary, as well as teachers all throughout the state and country, have rather rigid guidelines they must follow in their classes. These guidelines limit the amount of time that students can spend on a computer. One way to utilize computers in the classroom is through projecting an image from a computer screen to a television screen or onto a projection screen. This maximizes the possible exposure of students to what is being displayed on the computer monitor.

The workshop included a demonstration of a virtual field trip slide show using a LightPro projector. Most of the respondents were very enthusiastic about the possibility of incorporating a piece of equipment like this into their classes. This enthusiasm may have been spawned by the possibility that they had never seen a LightPro used before. Since the participants of the workshop saw how a technological medium could be beneficial, this will hopefully lead them to be more inquisitive about other media that could also prove useful. In studying adult learning, it is a very good sign that the teachers of Abington Center Elementary are willing to try new methods for teaching. Many adults are reluctant to adhere to new and unfamiliar ideas, which is luckily not the case with the workshop participants.

The responses to the last question on the post-workshop survey were rather homogenous, which is helpful for the group. The topics the teachers are most interested in seeing presented in the follow-up workshop include:

- Inspiration software
- PowerPoint software

- Internet use
- Graphics
- Charts and graphs
- Spreadsheets

The software skills that the teachers are looking to gain indicate that they are willing to let computer technology replace some of the tasks they had previously done by hand. For example, when the group demonstrated Inspiration flowcharts, the teachers were excited at the prospect of having a computer construct their flowcharts for them rather than doing them by hand. With such homogenous responses from every respondent, the group can be more confident that the follow-up workshop will be pertinent to the majority of participants. Every returned survey indicated that the turnout for the follow-up workshop would be identical to the previous turnout.

It was determined from post-workshop survey analysis that the first instructional workshop left the staff with the desire to see certain software packages in further depth. The second workshop was designed to answer their questions and showcase more advanced skills. The specific software packages focused on were:

- Inspiration
- Appleworks:
    1. Spreadsheets
    2. Creating Charts
    3. Word Processing

Along with these applications, the group also assisted the Principal with the school's web page.

Given the diversity of the software being taught and teachers intended use for this software, the second workshop was developed into a very one-on-one intensive program. As described in the literature review, the one-on-one method used in adult learning can be very effective given that there are enough instructors per students.

5.3 Workshop II

The group arrived with prepared examples of how each software application could be used. These examples included displays of how a teacher might graph the results of a test, with the entire class' scores. Also displayed was an example of a multiplication table, where students could explore and become proficient with the Inspiration software, while incorporating curriculum material.

The workshop then became an open forum for participants to ask questions and to explore the software. The group provided one-on-one instruction and attention to each of the participants. The transcription of the follow-up workshop can be found in Appendix H.

The second workshop was held on the afternoon of September 28, 2000 and lasted for approximately one hour and thirty minutes. There were five participants including three paraprofessionals, one teacher, and the principal. The goal of the second workshop was to answer more in-depth questions and to instruct teachers on the use of specific software applications such as Inspiration and Appleworks.

The workshop began with a brief introduction explaining its intent as a help session for the participants. The floor was then open to questions. The first question was in regards to constructing bar graphs to represent student progress. When the team began to explain the process, it was discovered that two of the participants had never used a

spreadsheet program before. It was decided that instruction would be necessary on basic spreadsheet functionality. The teachers were individually provided with guidance and eventually were able to fill in cells of a spreadsheet, edit them, and change page layouts. Once there was a common ground of understanding, they were provided with several examples of how to construct different types of graphs based on their data.

Another area of spreadsheets that was explored was in relation to creating formulas. Participants were interested in learning how to use spreadsheets to calculate the grades of their students. Time was spent reviewing mathematical functions of spreadsheets. The main function that was explored was averaging a row of information.

The next area of focus was Inspiration. Only one participant remained by this time in the workshop. The group provided several examples of how Inspiration can be used with students as well as with teachers. The participant used one of these examples to create a basic Inspiration chart for multiplication tables. Having no more questions, the final participant thanked the team and left.

At this time, the team was asked to help the Principal with the school's web site. A newsletter file was on an IBM and needed to be converted to a file that the iMac could read. This conversion was accomplished by saving the file as a Rich Text Format (.rtf), and transferring the file to the iMac via a floppy disk. The second task that the team assisted the principal with was retrieving a picture file from a digital camera and converting it from an Adobe file to a bitmap image (.bmp). The camera was plugged into the computer and the data was accessed. The group copied the image from Adobe and pasted it into MS PaintShop. The file was then saved as a .bmp for use on the web site.

After meeting to discuss the success of the second workshop, the group felt that this workshop served as a great benefit to those who participated. While the number of

participants was small, it allowed for individual attention. Another benefit was that the participants began to work together in pairs. These pairs formed themselves quite well. The teachers possessed a similar skill level and desire to learn. Working together, they were able to combine their knowledge to solve problems. After overcoming a hurdle, they seemed more confident to tackle the next problem. It was also observed that they seemed to feed off of each other's excitement. A simple idea was suddenly developed into a more elaborate possibility, and the teachers became more and more excited about the computer's capabilities.

6.0 DATA COLLECTION AND ANALYSIS III

The second workshop took place on Thursday, September 28, 2000. As a means of data collection, throughout the 1.5-hour workshop, one member of the group recorded the questions from the participants, as well as the explanations provided by the group. The session transcription can be viewed in Appendix H.

6.1 Analysis and Recommendations III

Having now conducted extensive research on technology and education, and having spent significant time at the Abington Center Elementary School, this next section will focus on the group's recommendations for improving the usefulness and functionality of the school's current technology system. These recommendations are based on an analysis of the second workshop transcription and prior survey responses.

One major hurdle in current computer instruction at the school lies in operating system updates. Among the six iMac computers, two were found to have MacOS 9.0 and four were found to have MacOS 8.6. The appearance of the desktop and the functionality of system software such as the Find feature are different between these versions. In both workshops, it was apparent that a great deal of confusion came from features, such as the Find command varying from computer to computer. Because many of the users in the workshops were inexperienced, seeing their monitor display something different from the monitor to their left or right may have caused the user to believe they had done something incorrectly, which led to lack of confidence. In order for the workshop participants to introduce computer aided learning in their classrooms, they will have to feel confident in their skills. Since upgrading the computer lab so that each computer contains the same

OS is a relatively easy task, it is strongly recommended that this be done. Consistency within the computers will eliminate unnecessary lack of confidence.

Software versions also appear to be a problem. Because these computers are used in a lab setting and are intended to be instructional, it is important that they all have the same software. It is the group's recommendation that the school install the same version of AppleWorks on all of the computers. Two of the machines in the lab currently contain AppleWorks 6 which includes many Wizards (programs that take the user step-by-step through the creation of a new file). These Wizards are extremely useful, as well as easy to use. By following the displayed instructions, a relatively inexperienced user can create a number of items, such as business cards, certificates, calendars, and presentations. A full version of Inspiration should be installed on each machine, as the Demo version currently installed on five of the computers does not allow users to save their work.

The second workshop allowed the group to understand more specifically what the teaching staff of Abington Center School is interested in. At this stage in the teachers' experience, there is a lot of excitement over how the computer lab can become an asset to their professional lives. Once these teachers are more familiar with computers, it is the hope of the group that the teachers will take an initiative to introduce the computer lab as a staple of their students' curriculum. All of the participants in each workshop acknowledged the advantage of word processing software for writing and edit reports. In an effort to expand the horizons' of the teachers as far as computer aided learning for their students, the group found a way to incorporate an important section of the mathematics curriculum with the software Inspiration.

Beginning in the third grade, and extending into the fourth, students begin to learn multiplication. One way to expedite this process is through using multiplication tables. The student can look at a series of multiplied numbers and see the correlation between 1 x 9 and 9 x 1 for example. The Inspiration software is simple in nature and allows for students to gain familiarity with the application, and produce attractive multiplication tables at the same time. By installing the full version of Inspiration, students will be able to save their individual work to their own floppy disk, and therefore be able to repeatedly access it. The demo version of Inspiration does not allow users to access the Save function. It is this restriction within the demo version that prompts the group to strongly recommend installing the full Inspiration application software.

The next recommendation comes as a result of teacher responses on surveys. Teachers were very interested in the demonstration of a Virtual Field Trip using a LightPro that was borrowed from WPI's Instructional Media Center. This section of the workshop prompted the most conversation and questions. The group feels that if teachers had access to the proper resources, they would begin to use the technology demonstrated to teach their classes. The purchase of a LightPro or a VCR that is capable of hooking up to a USB port would be beneficial to students and teachers alike. By projecting the image from the computer, an entire classroom can be exposed to what only two or three people crowded around a monitor might be able to see. Along with this new technology, it is recommended that a Macintosh compatible version of PowerPoint be installed on each of the iMacs. This software is powerful yet easy to use, and was identified by many of the workshop participants as software of interest.

One problem that was found in the lab was a lack of mouse pads. When the team arrived, there were several complaints that the mice did not work properly. After some

investigation, it was found that the track balls and internal rollers were extremely dirty. While all mice get dirty over time, this lab is relatively new. The lack of mouse pads allowed debris to be picked up by the track ball. Time was spent cleaning the mice so that they would function again, but if they repeatedly gather debris, it will permanently affect their performance. In addition to recommending the purchase of new, full sized mouse pads (the lab currently has several mouse pads cut in half so that each computer has a mouse pad), the lab instructor should not allow any eating or drinking in the lab. The tabletop that supports the keyboards and mice should also be wiped down once a week to keep large amounts of dust and debris from building up.

The next recommendation is that the iMacs be networked. This would allow the sharing of printers, SuperDrives, scanners, and files. To accomplish this, the school will need to purchase a hub that will support six computers. Hubs are becoming less and less expensive now, and the benefits of networking the iMacs will far outweigh that small cost. Currently, to print a file, the users must save their work to a floppy disk, and wait for a turn to use the one computer that is currently hooked up to the lab printer. This in effect reduces the number of computers in the lab to five, since the sixth computer needs to be left available for users wanting to print their work. As the computer lab is already small, reducing the number of available computers even further is not an option for the school. Networking will eliminate this potential inconvenience.

Once the computers have been networked, it is recommended that the school acquire a DSL or Cable Modem Internet connection. The Internet is an invaluable tool. Teachers can use it for research, presentations, lessons, and to communicate with other education professionals. With the proper guidance, the Internet is an excellent tool for children as well. They can use it for research and to download and insert graphics when

writing papers. Because these computers are in an elementary school, the group would strongly recommend that if the iMacs are to be connected to the Internet, a version of security software is installed. There are several packages available that restrict access to sites with certain key words and ratings. With the proper monitoring, the Internet is safe, fun, and educational.

The final recommendation is again a result of conversations held with the teaching staff. It was made clear that the teachers would find the computers far more useful if they had a system in their classroom that was as powerful as those in the lab. The lab is a great resource and should not be broken up. The staff is correct, however, that it would be most beneficial if there were computers in the classroom for the teachers to use. Should additional grant money be awarded to the Abington Center Elementary School for technology, the group would encourage that the grant be used to purchase one new computer for each classroom.

7.0 CONCLUSIONS

Throughout the workshops, the focus of "computers in the classroom" was on the teachers. The project group showed the teachers and paraprofessionals of Abington Center Elementary the basic skills that are necessary to use a computer. The group also presented software programs to the workshop participants that will make teaching more efficient, such as the use of spreadsheets for grades. However, it is also important to look at the grander perspective of the role of computers in the elementary classroom. Now that the teachers understand how to use computers, it is necessary for them to integrate computer usage in their classrooms.

The research that was gathered in the literature review of this project poses two views on the role of computers in the elementary classroom. David H. Jonassen, author of the book "Computers in the Classroom – Mindtools for Critical Thinking" feels that the computer does play an important role in the elementary classroom. Jonassen believes that the computer is a "Mindtool" with which students learn. His beliefs are in sharp contrast to that of Clifford Stoll, who feels that the computer does not belong in the classroom. Stoll argues that the presence of a computer in an elementary classroom deters social interaction, which eventually hinders a child's social development.

The group took the stance that computers do play a role in elementary education. The group feels that computers are a necessary tool that students can learn *with*, but not *from*. Computers are not meant to serve as a replacement to a teacher; rather, computers are an additional resource with which students can learn. However, to determine how

students can learn with the computer, it was necessary to research specific learning methods involving computer technology.

Patrick Suppes, a professor at Stanford University, supports the use of the computer for rote learning. For example, in mathematics rote learning would be useful to practice and memorize the basic math operations of adding, subtracting, multiplying, and dividing. Using this method, the computer would replace the role of the teacher. The student would have one-on-one instruction, and the material would be suited to the student's skill level. Suppes feels that this drilling method is most effective if the student only uses the computer for ten minutes per day.

Robert Davis has a different view on computers in the classroom. Davis in general believes that learning is best achieved through discovery. He feels that students need the freedom to develop their own ideas and express them creatively. The computer fits well into his personal opinions of education and learning because the computer is a great tool for exploration and discovery. With the guidance of the teacher, the students would be able to be creative and learn at the same time with the technology of the computer.

Tom Dwyer is another computer expert that feels that the discovery method is an effective way to learn. However, Dwyer concludes that the best way that a computer can be integrated into a discovery environment is through programming them. There are many benefits of teaching students how to create their own programs. First, the student understands how the program works because they wrote it. Second, the student knows the design of the program and will be able to change it. Dwyer believes that this is more

effective than merely using available application software because it allows the student to have more complete control over the learning.

Seymour Papert, a researcher at MIT, also supports the use of programming in elementary student learning. He developed the programming language LOGO for elementary students. With LOGO, children learn to speak to the computer by typing in certain commands to build geometric objects. Papert maintains that this method of learning allows students to be creative and discover while also teaching them important mathematical concepts. Using LOGO, students will have a new experience every time they sit down at the computer.

In an ideal situation, the project group feels that the ideas of Dwyer and Papert are the most beneficial applications of a computer in the elementary classroom. Both scholars believe that incorporating programming languages as a staple of daily curriculum enhancement is the key for utilizing computers as tools for learning. The technological revolution of the past two decades has introduced many more useful functions for the computer, such as a wide variety of application software, but programming still lies at the fundamental basis of computing. By creating a program, a student watches as their work comes to life on the computer screen.

One concrete example of how a creating a program can benefit a student comes from Papert's "Mathland" metaphor. In the Logo computer language, a student learns "turtle geometry." After the teacher explains the basic concepts of geometry, such as shapes, to the students, the students turn to the computer. A cursor appears on the screen. The student "speaks" to the computer through a series of commands and instructs the turtle to draw a geometric shape, such as a square. For example, the student might tell

the turtle to move right 5 spaces, up 5 spaces, left 5 spaces and down 5 spaces. Through this exercise the student can see how a square is formed, and that a square has four equal sides. If the student is unsure of how to guide the turtle, the student can stand up and physically walk in the shape of a square to understand how a square is formed. The student gains a conceptual knowledge of geometry while also learning basic geometric facts. The group feels that it is this type of active learning between the computer and the student that should be the ideal use of computers as learning tools.

However, in many elementary schools, including Abington Center Elementary, the implementation of Dwyer and Papert's theories are not feasible. In order to ensure the maximum effectiveness of their theories, each student would require their own computer in the classroom. In most schools this is impossible due to the cost of computers as well as the amount of space in each classroom. In addition to this problem, many educators are blind to the value of teaching young students how to create their own programs. With the advent of numerous educational software programs, many administrators find it easier to buy and install these programs instead of allowing students to produce their own. While students can still "explore" these software packages, they are not gaining the maximum benefit from creating their own unique programs.

The ideas of Suppes and Davis are more easily implemented into an elementary school curriculum. Where the computer is the central focus of Dwyer and Papert's theories, Suppes and Davis view the computer as an additional resource to the teacher and the curriculum. Under Suppes and Davis' methods, students can learn mathematics operations in the classroom and then practice these operations at the computer with a software program such as Number Crunchers or Math Blaster. In their opinion, the

computer is a separate entity from the curriculum and is not implemented as a central part of learning but as an additional learning tool that can strengthen concepts contained within the curriculum.

It is the opinion of the project group that this use of the computer also plays an important role in the classroom. Rote learning in the form of "flash cards" has always been an effective method for memorization-style learning, even before the existence of the computer. This is beneficial to a student who is having trouble learning basic facts and concrete ideas. A student that is allowed to explore a software program is also learning and practicing the basic functions of using a computer, such as keyboard and mouse skills.

However, this is not the most effective way that a student can learn from a computer. There are so many aspects of the computer, beyond these educational software packages, from which a student can benefit and learn. Creating a program, such as the program that draws a square with Logo, allows the student to gain a more conceptual knowledge of the computer and the curriculum material. This use of the computer teaches the student more abstract ideas that cannot be introduced through a standard software program.

Overall, the group believes that the role of computers in the classroom should include the ideas of all four experts. Ideally, a student will gain maximum benefit through a one-on-one interaction with the computer, where the student controls the computer and creates programs that emphasize concepts from the curriculum. However, a student can also gain information and insight from a computer when it is used periodically for rote learning in addition to classroom work. Students can also gain some

benefit through the exploration of software programs. When a student is comfortable using several different software packages, such as Math Blaster, Inspiration, and AppleWorks, the short-term benefit is that the student has learned how to specifically use those applications. The long-term benefit is that the student will be able to sit down in front of any software, regardless if they have never used it before, and be able to navigate throughout the program.

In order to implement computers into the classroom, the first step that a school system must take is to purchase enough computers for all the students. If the school system is intent on introducing the students to computer programming, then it is necessary for each student to have a computer to work with throughout the day. The school system must also devise a way in which computers can be added to the curriculum without disrupting current materials. The research on curriculum shows that there is a long process involved with creating, implementing and evaluating a curriculum. The most effective way to bring about a positive change to a curriculum is to introduce the change slowly. One good way to introduce computer technology is to add the use of computers to one subject area and evaluate its effectiveness before changing the entire curriculum at once. For example, computers can be introduced to the mathematics curriculum first, with a module similar to Logo programming. Because this initial introduction with young students was the intent of Papert's design, this introductory integration should progress smoothly. If the students and teachers receive the new curriculum in a positive manner, then the school district can look at more ways that programming can be implemented into other parts of the curriculum.

One main obstacle that schools face with the idea of computers in the classroom is that many teachers do not know how to use computers. School systems can overcome this obstacle by introducing teachers to the computers before the technology is integrated into the curriculum. Research shows that an effective way to do this is by holding a computer workshop for the teachers. However, the manner in which the workshop is conducted depends on the type of computer learning that is being implemented into the curriculum. For example, if the school district wishes to add computer programming to the mathematics curriculum, it is necessary to ensure that the teachers are fluent in the programming language before it is introduced to the students. The best way to introduce a new program to teachers is to allow them to explore the language in the same way that the students would. If the computers are going to be implemented in the curriculum for rote learning methods or to teach students how to use a word processor, then the teachers will need to understand the basic skills and functions of the computer. They should be familiar with the software programs that the students will be using.

The structure of the workshop is dependent on the number of participants. In the literature review section of this paper it was determined that if the number of participants is over fifteen, the Inquiry team method should be utilized. Here the workshop participants form teams to work towards a common goal. This environment is conducive to adult instruction because there is less individual focus, and each team member has the opportunity to bring a unique skill to the group. If the number of workshop participants and instructors yields a 1:1 ratio, a mentoring method should be used in the workshop. Here the student is afforded undivided attention. If the number of workshop participants falls in between the number necessary for inquiry teams and mentoring, the discussion

method should be used. This method works well with medium sized groups and allows for open interaction. With teachers learning completely unfamiliar material, such as a programming language, the ebb and flow of questions and answers will prove necessary.

It is the opinion of the group that the most effective method for adult learning lies in inquiry teams. While the number of participants plays a large role in dictating the type of workshop given, ideally the workshop should be offered to enough prospective participants so that at least fifteen teachers would agree to come. This may mean that the workshop should be offered to several schools at once, rather than inviting only the teachers from the school hosting the workshop. Inquiry teams seem most ideal to the group because they offer the participants a unique opportunity to work as a team, which these teachers might not get a chance to do otherwise.

Teacher training is just one obstacle that administrators face when trying to implement computer technology in schools. Another obstacle that an educator faces integrates time constraints and resource availability. Most elementary classrooms contain between twenty and thirty students. However, most classrooms only have one computer. Some schools do not even place a computer in each classroom; instead, all the computers for the school are in one lab. Also, because the curriculum is already packed with material, it is hard for some teachers to make time for students to use the computers. When students are allowed to use the computers, it is for a short period of time and often students must share one computer per three or four students.

This is a difficult obstacle to overcome. Ideally the school should budget money for future purchases of additional computers. The research conducted in the literature review shows that students learn best through one-on-one interaction with the computer.

Furthermore, to effectively introduce programming to the students, each student must have their own computer. However, it is near impossible for many schools to come up with enough money to finance one computer per student. Even with federal grant money that is available to school districts, many schools can still only afford a few computers, as is the case with Abington Center Elementary.

One suggestion would be to assign each student 10 minutes per day to use the computer. Although this is not the most effective way to execute Papert or Dwyer's method, each student would still be allowed to use the computer alone to explore or create a program. Also, Suppes shows that this is an effective method for rote learning. If the situation is that there is one computer per classroom, then this is a viable solution, provided that the teacher can arrange daily classroom activities such that the student will not be missing important material. However, if the computers are all located in one room, a computer lab, there is an additional obstacle to overcome. Since students are not allowed to leave the classroom unsupervised, either a paraprofessional must be hired to supervise the students remaining in the classroom, or a lab instructor must be hired to supervise the students in the computer lab. Both of these avenues require the school to hire additional staff, which might not be feasible within budget constraints.

The best suggestion to overcome this obstacle is to design a way that one computer can benefit the entire classroom at the same time. One method through which this can be achieved is by projecting the computer image onto a larger screen. Using this method, the entire class can view the computer monitor at the same time. The teacher in this case can take students step by step though a task, or students can create presentations and display them to their classmates. An example of this might be a book report, or a

review of a fieldtrip the class has recently been on. This does not allow for one-on-one interaction; however, in many situations this is the only way to make efficient use of the computer as a teaching tool.

Despite the obstacles described here, it is necessary to look at the bigger picture. Computers are becoming an essential part of society. There are not many professional jobs that do not require computer knowledge. School systems must implement computers into the classroom in some fashion. Each school is different; therefore, each method of implementation will be different. It is important that children at an elementary level have some exposure to computers because their need for computer technology will increase as they move onto high school, college and beyond.

7.1 Group Member Aimee Kazlowski's Personal Learning Experience

Five months ago when this project began, I had no idea how complex it would be. At its completion, I look back and realize that I have learned far more than originally expected.

As a student, I had no concept of how complex curriculum design is. The state of Massachusetts has a rigid set of guidelines on what can be taught, how it can be taught and how much time must be spent on that topic. Teachers must plan down to the minute. The most important thing that I will take away from this project is a new respect for the work that elementary teachers do.

From a technology standpoint, I have gained a new respect for Apple computer systems. Originally, I disliked everything about their products - how they are designed, what software they run, and how their computers are marketed. This project forced me to

learn about Apple. In doing so, I have seen that they are excellent machines that are further advanced than PCs. Every device for an iMac uses USB technology – a feat that is years away for PCs. USB technology is faster and more efficient than serial and PCI devices. While I still prefer PC software, Apple does make excellent hardware.

One other thing that I have learned is the importance of communication. In working with the teachers, I noticed that when we were speaking, they listened and did what was asked. When we opened the forum to discussion however, the teachers began to work together and talk about different things that they would like to do on the computer. The most excitement and questions were generated when they were communicating with each other. Discussion allowed them to think 'outside the box' which I feel is necessary when using computers.

7.2 Group Member Ursa Scherer's Personal Learning Experience

This project afforded the group members, as well as myself an opportunity to learn on many different levels. From the outset the scope of this project was not an area of expertise for me. The IQP process was new, and proved itself to be quite a challenge. The literature review chapter of the project required diligent research and acceptance of the fact that the final, finished product was many drafts away.

The bigger learning experience for me took place not in the writing of the paper, but in the opportunity to travel to Abington Center Elementary School. Most college students are familiar with the process of writing a paper. Not all college students are given the opportunity to host workshops at a remote location.

The workshops showed me that hypothesizing about computer aided learning in the ideal situation won't solve the problems of typical school systems. Abington Elementary faces the challenges and obstacles that many elementary schools face. There is lack of skill on the teachers' part, lack of time within the school day to implement a new feature in current curricula, and lack of funding for adequate computer resources.

The workshops that we held proved themselves useful according to survey responses. This begins to overcome the problem of lack of skill within the teaching staff. The recommendation to the Abington Center School of using the computers to create multiplication tables while students are studying multiplication is an easy way to foster computer skills in students while still following current curriculum standards. This is a step forward in overcoming the lack of time in the school day for adding new material to the curriculum. The only regret that I take away with me from this project is that we, as a group, did not think to research how school systems could go about applying for technology grants. Abington Elementary School is similar to many schools in that there simply aren't enough computers available given the number of students. One-on-one interaction with computers will only be viable for a school like Abington Elementary if money can be allocated towards the purchase of additional computers.

7.3 Group Member Melissa St. Hilaire's Personal Learning Experience

There are so many lessons that can be learned from a project that extends over a six month period. The very first thing that I learned from this experience is that in order to invest half a year of work into a project, one must have a true regard for the project. Not

only must one want to receive a passing grade; one must also have a genuine concern for the people involved in the undertaking of the project and a defined willingness to achieve a particular goal.

This IQP project gave the group a unique opportunity to interact with people that we would not normally encounter in college life. At the preliminary design of this IQP, the group would be interacting with the students of Abington Center Elementary School. I was very excited at the prospect of working with elementary aged students because interaction with children is always a fulfilling learning experience. However, the scope of the project eventually changed to focus on the teachers. But, this also provided a good opportunity for interaction with adults and taught the group much about the differences between teaching to an adult group and a group of children.

While the literature research involved in the outline of this project was very interesting, I found the experiences at the school to be the most worthwhile. Having been out of elementary school for a long time, I realized how far education has come in the last 10 years. When I was in elementary school, we had access to computers; however, they were primitive machines compared to the technology available to schools today. I also went to a parochial school where most resources were privately funded. Realizing that public schools depend on the government for money towards computers and technology made me appreciate the quality of the education that I had received.

Entering into this project, I was skeptical that the teachers would respond to training from college students. I assumed that most teachers, especially the older ones, were already set in their curriculum and would be resistant to adopting computers into the classroom. However, I was pleased to find that the teachers were very enthusiastic about

the group's efforts to teach them how to use the computers and how to implement computer technology into their lessons.

My only disappointment with the results of the project is that I cannot foresee Abington Center Elementary ever achieving the ideal use of computers in the classroom. Unfortunately, I do not think that the role of computers in education is realistic. Time constraints and financial resources limit a school's ability to provide suitable resources for all the students. However, I think that the project group introduced the teachers of Abington Center Elementary to some effective methods that will integrate education and technology. Hopefully they will continue and expand their efforts to implement computer-aided learning in their classrooms.

Endnotes

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APPENDIX A

TO: Teaching Staff of grades 3-6 at Abington Center Elementary School

FROM: Worcester Polytechnic Institute IQP Group: Aimee Kazlowski
Ursa Scherer
Melissa St. Hilaire

DATE: 10/20/00

RE: Interactive Qualifying Project: "Computer Aided Learning in Elementary Schools"

Dear _____,

We are contacting you in regards to a project that we will be completing from June through October. This project will involve teacher participation in bringing computer-aided learning to the classrooms at Abington Center Elementary. This correspondence is threefold. First, we will introduce ourselves and explain what an Interactive Qualifying Project entails. Second, we will explain what role the teachers will play in our project. Lastly, enclosed is a brief questionnaire that we hope you will complete and return in the envelope provided.

Our group consists of three Worcester Polytechnic Institute students: Aimee Kazlowski, Ursa Scherer, and Melissa St. Hilaire. A faculty advisor, Michael Elmes, assists us and will ultimately grade the project. The Interactive Qualifying Project (IQP) is a requirement of all Worcester Polytechnic Institute (WPI) students. The project aims to involve both society and technology. The IQP consists of five chapters. First, there is a problem statement. This is where we assess the problem facing your school. Next, there is a literature review, where our group researches material that will aid us in solving the problem that we have defined in the problem statement. Next, we will write a section called Methodology, which will detail how we plan to collect data. For our IQP, the data collection will consist of the enclosed preliminary questionnaire, as well as a follow-up questionnaire, which you will receive near the conclusion of the project. The next part is an analysis section, where we assess the results of our project. A conclusion will integrate all parts of the IQP.

Currently we see the problem facing Abington Center Elementary as follows:

Abington Center Elementary has recently acquired a new computer lab. In addition to this lab (hosting six iMac computers), there is also a Macintosh computer in each classroom. These computers are a valuable resource. However, before you can use these computers for computer-aided learning, you must be comfortable yourself in front of a computer.

Our first goal is to assess the level of three things: computer literacy, comfort level with a computer, and interest in using computers to assist the learning of students. These levels will be determined with the questionnaire that is enclosed. Next, we will host a workshop where we will give instruction in several software applications. We will also prepare a

manual to guide you through basic computer functions. In addition to the manual, we will suggest projects that you can complete with your students. These projects will reinforce the skills you have acquired and allow you to pass these skills onto your pupils. After the workshop, we will distribute the follow-up survey.

We have covered the three main objectives planned for this letter. If you have any questions please do not hesitate to contact us.

Thank you for your time, and please fill out and return the questionnaire to us at your earliest convenience.

Sincerely,

Aimee Kazlowski

Ursa Scherer

Melissa St. Hilaire

We would like to thank you for taking the time to complete this survey. Your answers will greatly help us to direct our research.

1. Do you own a personal computer? (If no, please skip to question 4)
    a. PC
    b. Macintosh

2. How often do you use your computer?
    a. Every day
    b. Every week
    c. Every month
    d. Rarely

3. What is the primary use of your computer?
    a. Internet
    b. E-mail
    c. Financials
    d. Word processing
    e. Other (please specify)_____

4. Do you know how to use a:
    a. Mouse Yes No
    b. Printer Yes No
    c. Scanner Yes No
    d. Save a file Yes No
    e. Use a Floppy Disk Yes No

5. How would you rate your over all experience and understanding of computers?
    a. excellent
    b. above average
    c. average
    d. below average
    e. minimal experience
    f. no experience

6. How would you rate your overall typing and mouse skills?
    a. excellent
    b. above average
    c. average
    d. below average
    e. minimal experience
    f. no experience

7. If given instruction and guidance, do you feel you would use computer technology to assist you in teaching your students? Do you feel that computers could be an asset to your work?
    a. yes
    b. no

    Please explain:_____

8. Are you currently utilizing available technology to assist students in learning? If so, please explain usage time, software and method:

9. How satisfied are you with your school's current technology policy and usage guidelines? Do you feel as though you have adequate guidance in implementing technology in the classroom?

10. What would you like to gain from our project - i.e. specific device instruction, basic computer skills, advanced instruction on specific software titles

We would be glad to hear any suggestions or additional comments that you may have. If you would like to make suggestions about our training program, manual or to make requests for specific instruction, please feel free to do so. We will address your concerns to the best of our ability. You may attach an additional sheet to this survey and return it to us in the envelope provided. Again, thank you for your participation.

APPENDIX B

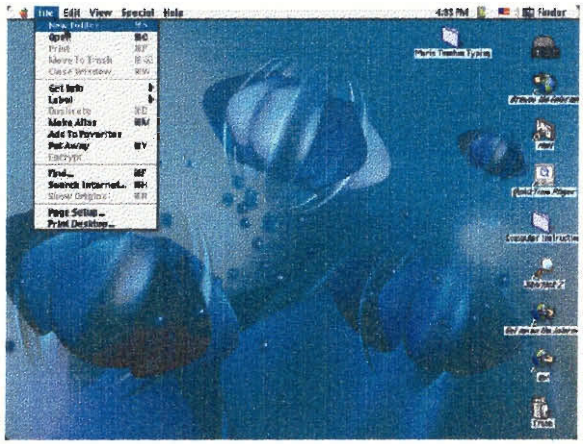
Computers In the Classroom

A Comprehensive Guide to Macintosh Computer Systems

Turning Your Computer On

- Your computer has two power buttons which can be used to turn your computer on and off.
- These buttons are located at the upper right hand corner of your keyboard, and in the lower right hand side of your monitor.

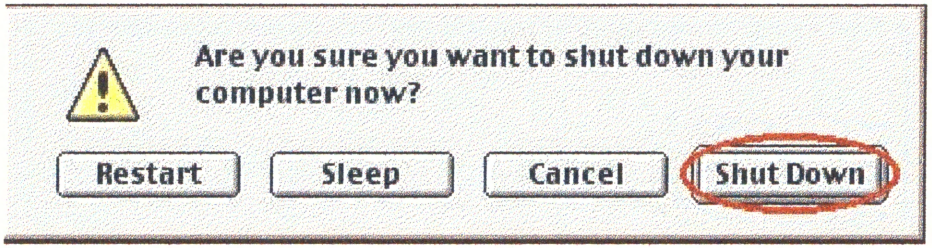
- To turn your computer on, simply press the power button on your keyboard. Your computer will now begin to "boot up." When your computer is booting up, it is running programs and getting itself ready for you to use it. This process will take between one and two minutes. When your computer stops working and is showing this screen:

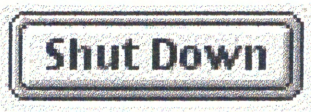


you are ready to begin using your computer.

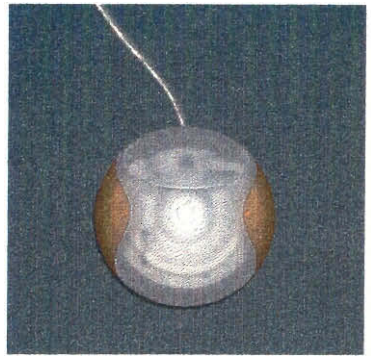
- This screen is called the ***Desktop***. The desktop is where you will find all programs, and all of your files and folders.

- To turn your computer off, press the power button on your keyboard. You will see the following screen:



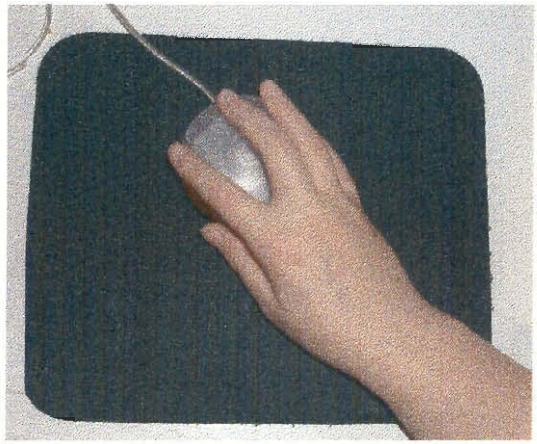
Click on the  button.

Mouse Skills



- How to hold your mouse:

  When holding your mouse, your index finger should rest comfortably on the button. This button will be used to select files and programs on your computer. We call this selecting 'clicking.'

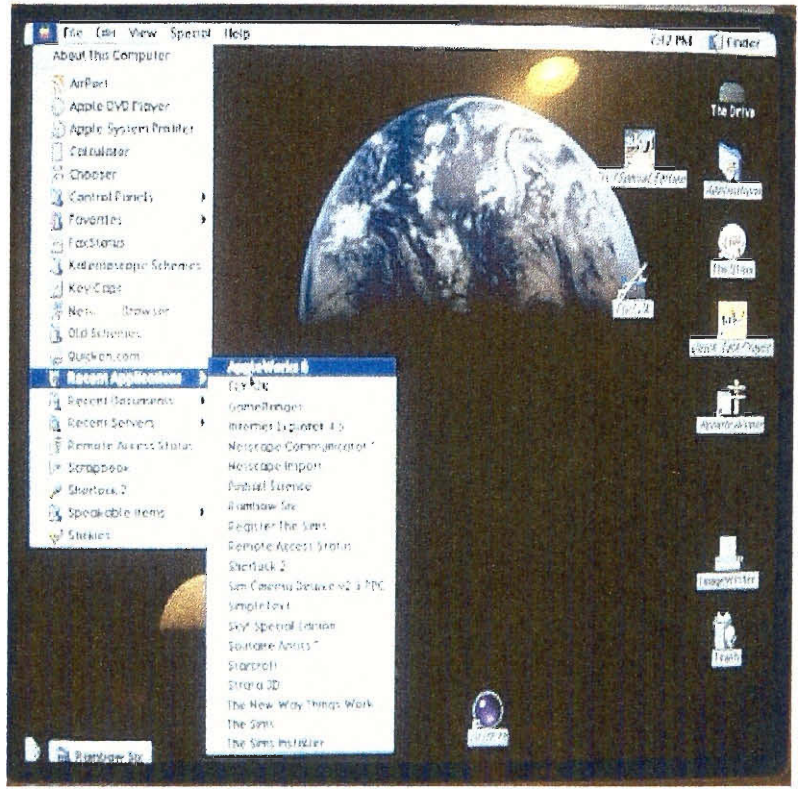


- As you move the mouse around, you will see that the arrow on your screen moves with the mouse.

- How to use your mouse:
  - ***Single Click*** – place the mouse over the selected object and press the mouse button once
  - ***Double Click*** – place the mouse over the object you wish to select and press the mouse button two times very quickly. Make sure that when you click the mouse, that you do not move the mouse off of the item you wish to select.
  - ***Press & Drag:*** allows you to move items on your desktop – place the mouse over the item to be moved. Click the button and hold it down. While holding the button down, move the cursor to where you would like your object moved to. Let the mouse button up – your object will move to the final spot.

Opening and Closing Programs

- Now, you are ready to begin using your computer. We will start by opening a word processing application.
- To open a program, place your mouse over the picture of the program you would like to open. Once there, double click on the picture.
  - Your screen should now look like this:



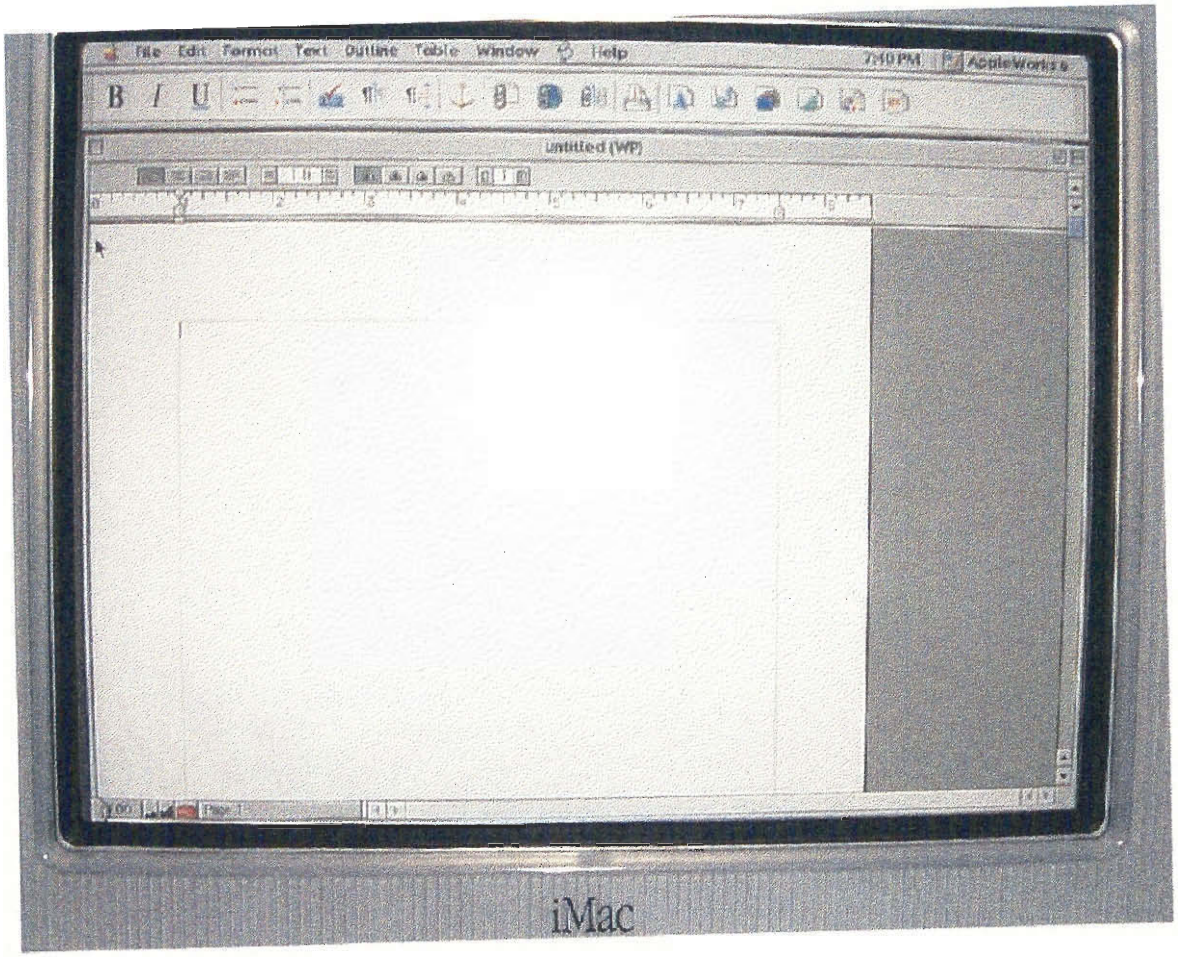
Resizing the Window

- In the upper right hand corner of your screen, you will see these pictures (or icons). These pictures allow you to change the size of your program window, and to close out of the program.
- To make the window larger, click the :
- To put the program aside so that you may work on something else, click the:
- To close your program when you are done working, you can click the box on the left corner of the window.

Appleworks

Appleworks provides the user with a variety of applications. There is an option for opening spreadsheets, drawings, paintings, databases, and word processing. This next section will explain using the word processing application, which will prove itself invaluable to students and teachers alike.

To open the Appleworks word processing application, single click on the left-most icon. This will open a new screen, with the cursor blinking in the upper left corner of this new screen. It is then possible to start typing. The material typed can be edited with ease.


File Edit Format Text Outline Table Window Help
7:10 PM
AppleWorks 6
Untitled (WP)
iMac

To edit text, there are four basic principles.

- Deleting text
- Cutting text
- Copying text
- Pasting text

To remove unwanted text, move the mouse to the space before the first letter of text to be removed. Hold the button on the mouse down, and drag the arrow across the text to be removed, all the while holding the button down. Then hit the delete key on the keyboard. This will remove the unwanted text.

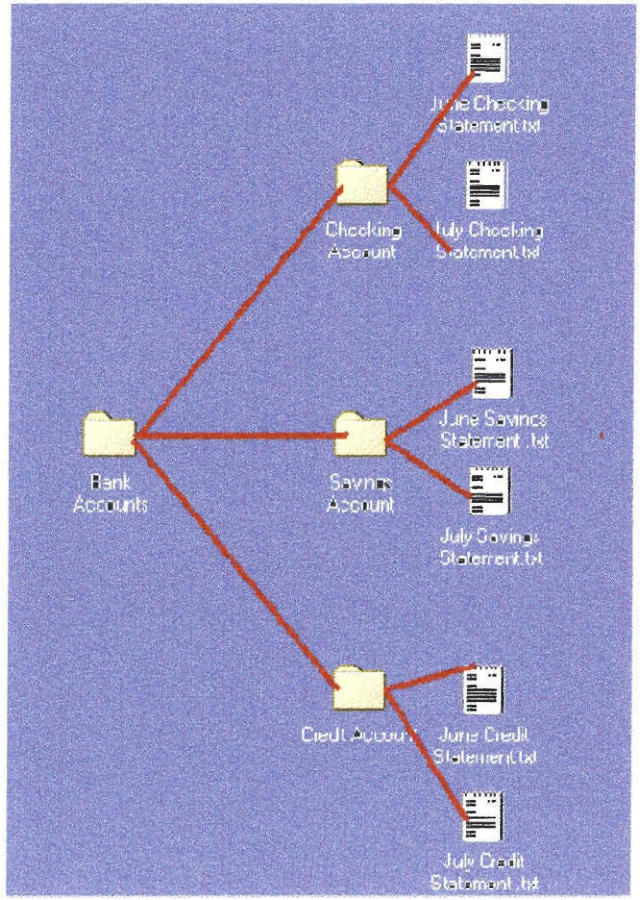
To move a selection of text from one place to another, highlight the text (as described previously) and select ‘Cut’ from the Edit menu. The text will disappear. Move the cursor to the place where the text should appear. Select ‘Paste’ from the Edit menu. The text will now appear in this new location.

To copy identical text from one place to another, while leaving the highlighted text in the original position as well, highlight the text that needs to be copied. Select ‘Copy’ from the Edit menu. Move the cursor to the selected spot and select ‘Paste’ from the edit menu. The text will now appear identically in both places.

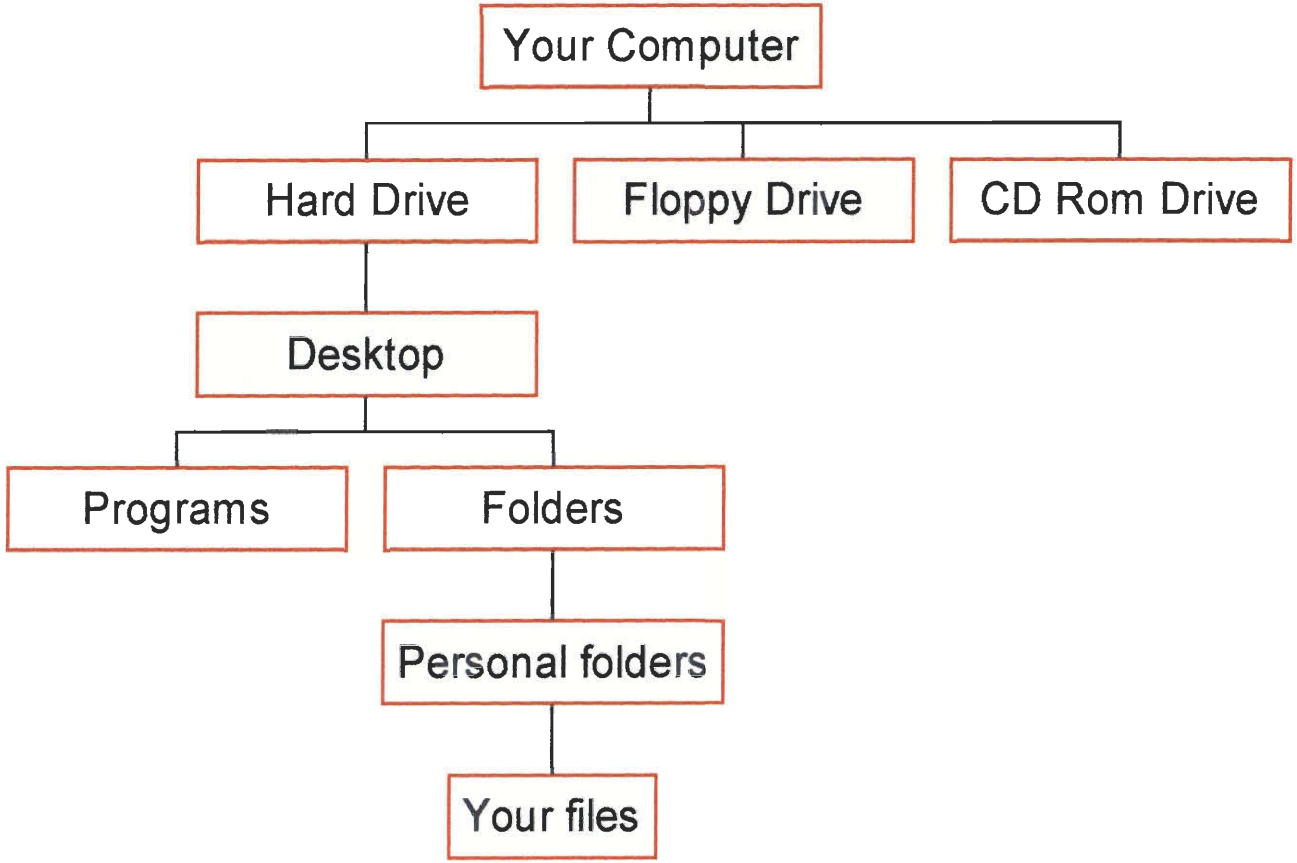
Navigating your Computer

Folders

- Folders on a computer work exactly like real manila folders.
- For example, you have a folder where you keep your bank statements. You get statements for a checking account, a savings account and a credit card account. To keep these accounts organized, you place three separate folders in your "Bank Statements" folder. Now, when you get new statements, you put them in the appropriate folder so that you can find them easier. b



Your Computer is organized in a very similar way as our "bank account." Each of these sections is represented as a folder on your computer..



- To Create a new folder where you can keep your files, follow these steps:

- Click on File, and then "New Folder"
- A new folder Icon will appear.

- Type in what you would like to name your new folder.

How to Search for Lost Files

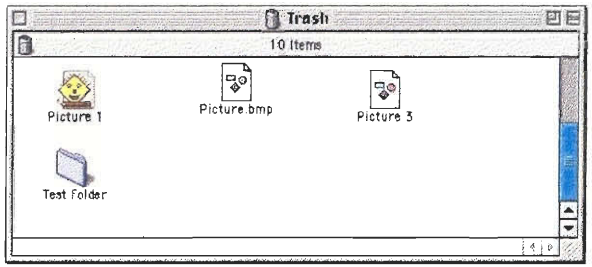
- If you should forget where you have placed a file, you can search for the file using an application called Sherlock.
- By striking the 'Apple' key at the same time as the 'F' key a window will appear in which you can enter your search query. By hitting 'Enter' the program will search the computer for the file in question.

Deleting Files

- To delete a file or folder, simply click on it once, and select delete from the window
- You do not have to be afraid to use the delete key. Your Imac will save a copy of files that you have deleted in the Trash Can

If you have deleted something accidentally, you can sill get a copy out of the trash can.

To check what files you have deleted, double click on the trash can. The following window will appear:



If you are sure that you do not need any of these files, click on the file menu and select "Empty Trash Can"

APPENDIX C

Thank you for attending this workshop, your participation was greatly appreciated. It is the group's hope that you have gained an understanding of the skills demonstrated and taught today. Please take the time to fill out this survey. When you are finished with the survey, place it in the basket provided in the front of the room.

1) Please rate your level of improvement with the following skills by marking the appropriate space with a check mark:

	Negligible Improvement	Moderate Improvement	Considerable Improvement
Mouse skills	_____	_____	_____
Opening a program	_____	_____	_____
Exiting a program	_____	_____	_____
Opening an existing document	_____	_____	_____
Saving a file	_____	_____	_____
Saving a file to Floppy disk	_____	_____	_____
Using a printer	_____	_____	_____
Creating a new document	_____	_____	_____
Closing a document	_____	_____	_____
Resizing a window	_____	_____	_____
Creating a new folder	_____	_____	_____
Changing page layout	_____	_____	_____

2) Do you feel that the time spent in this workshop was worthwhile?

Yes _____ No _____

Please explain:

_____

_____

_____

_____

_____

_____

_____

_____

3) Do you feel that you would be more apt to implement some of the techniques learned today with your students after this workshop?

Yes _____ No _____

Please explain:

_____

_____

_____

_____

_____

_____

4) If a second workshop was offered, to demonstrate more advanced skills as well as field specific software questions, would you attend?

Yes _____ No _____

If you answered Yes to Question #4, what would you be most interested in learning at the second workshop?

_____

_____

_____

_____

_____

_____

If you answered No to Question #4, what factors would influence your decision not to attend a follow-up workshop?

_____

_____

_____

_____

_____

_____

APPENDIX D

We would like to thank you for taking the time to complete this survey. Your answers will greatly help us to direct our research. If you would like to write more than the provided space allows, please feel free to attach additional sheets of paper.

1. Do you own a personal computer? (If no, please skip to question 4)
   a. PC
   b. Macintosh

2. How often do you use your computer?
   a. Every day
   b. Every week
   c. Every month
   d. Rarely

3. What is the primary use of your computer?
   a. Internet
   b. E-mail
   c. Financials
   d. Word processing
   e. Other (please specify)_____

4. Do you know how to use a:
   a. Mouse Yes No
   b. Printer Yes No
   c. Scanner Yes No
   d. Save a file Yes No
   e. Use a Floppy Disk Yes No } not really

5. How would you rate your over all experience with and understanding of computers?
   a. excellent
   b. above average
   c. average
   d. below average
   e. minimal experience
   f. no experience

6. If given instruction and guidance, do you feel you would use computer technology to assist you in teaching your students?
   a. yes
   b. no

   Please explain: Specific instruction i.e. - How to use the Internet to research info.

7. Do you feel that computers could be an asset to your work?
   (a) yes
   b. no

   Please explain: _____

   Re: access to lesson plans on the Web, sharing info & idea w/ other staff, allowing students access to word processor for writing projects

8. Are you currently utilizing available computer technology to assist students in learning? If so, please explain usage time, software and method:

   "Mario Teaches Typing" - for keyboarding skills
   Success Maker Software - 15 min. intervals per student in the area of Rdg. (daily) Games in the areas of Math & Rdg (Math Blaster, Number Maze, Word Munchers)

9. How satisfied are you with your school's current technology policy and usage guidelines?

   Due to limited # of computers, it has been difficult to allow all students equal access to computers.
   Also - not all staff have received the same training.

   Time is the biggest factor - Pressure to cover all areas of the curriculum, preparation for MCAS testing, etc... Any training that would be specific to curriculum areas, (i.e. the writing process: developing topics.) would be appreciated.

10. Do you feel as though you have adequate guidance in implementing technology in the classroom?

A lot I have done has been on my own (i.e - experimented w/ various programs & typing tutorials to see which would be the most beneficial). I feel I need more training on specific programs.

11. What reservations or concerns, if any, do you have about using computer technology in the elementary school classroom? Please explain.

- Monitoring students on the computer in terms of their ability to access/delete files, Internet monitoring, etc...

How to integrate computer tech. so it coincides w/ curriculum.

12. What would you like to gain from our training program and manual- i.e. specific device instruction, basic computer skills, advanced instruction on specific software titles

Powerpoint - any info.
How to design graphic organizers.
How to save files.
How to design bar graphs to plot info.
hist of best web sites for Teacher info (i.e. lessons, resources, etc...)
How to communicate w/ staff in other school districts.

We would be glad to hear any suggestions or additional comments that you may have. If you would like to make suggestions about our training program, manual or to make requests for specific instruction, please feel free to do so. We will do our best to address each of your concerns. You may attach an additional sheet to this survey and return it to us in the envelope provided. Again, thank you for your participation.

All your efforts are greatly appreciated!

We would like to thank you for taking the time to complete this survey. Your answers will greatly help us to direct our research. If you would like to write more than the provided space allows, please feel free to attach additional sheets of paper.

1. Do you own a personal computer? (If no, please skip to question 4)
   a. PC
   b. Macintosh

2. How often do you use your computer?
   a. Every day
   b. Every week
   c. Every month
   d. Rarely

3. What is the primary use of your computer?
   a. Internet
   b. E-mail
   c. Financials
   d. Word processing
   e. Other (please specify)_____

4. Do you know how to use a:
   a. Mouse Yes No
   b. Printer Yes No
   c. Scanner Yes No
   d. Save a file Yes No
   e. Use a Floppy Disk Yes No

5. How would you rate your over all experience with and understanding of computers?
   a. excellent
   b. above average
   c. average
   d. below average
   e. minimal experience
   f. no experience

6. If given instruction and guidance, do you feel you would use computer technology to assist you in teaching your students?
   a. yes
   b. no

   Please explain:_____

   _____

   _____

7. Do you feel that computers could be an asset to your work?
   a. yes
   b. no

   Please explain: _____

8. Are you currently utilizing available computer technology to assist students in learning? If so, please explain usage time, software and method:

   research
   word processing

9. How satisfied are you with your school's current technology policy and usage guidelines?

   technology program is building each year.

10. Do you feel as though you have adequate guidance in implementing technology in the classroom?

yes - through inservice
by S. McAuliffe
M. Williams

11. What reservations or concerns, if any, do you have about using computer technology in the elementary school classroom? Please explain.

too few children actually have access to computer at the same time.
scheduling use in the classroom is difficult

12. What would you like to gain from our training program and manual- i.e. specific device instruction, basic computer skills, advanced instruction on specific software titles

any and all help I can be given will improve my students' learning.

We would be glad to hear any suggestions or additional comments that you may have. If you would like to make suggestions about our training program, manual or to make requests for specific instruction, please feel free to do so. We will do our best to address each of your concerns. You may attach an additional sheet to this survey and return it to us in the envelope provided. Again, thank you for your participation.

Good luck with your project!

We would like to thank you for taking the time to complete this survey. Your answers will greatly help us to direct our research. If you would like to write more than the provided space allows, please feel free to attach additional sheets of paper.

Sorry it's so late! I was away!

1. Do you own a personal computer? (If no, please skip to question 4)
   a. PC
   b. Macintosh

2. How often do you use your computer?
   a. Every day
   b. Every week
   c. Every month
   d. Rarely

3. What is the primary use of your computer?
   a. Internet
   b. E-mail
   c. Financials (a bit)
   d. Word processing
   e. Other (please specify)_____

4. Do you know how to use a:
   a. Mouse Yes No
   b. Printer Yes No
   c. Scanner Yes No
   d. Save a file Yes No
   e. Use a Floppy Disk Yes No

5. How would you rate your over all experience with and understanding of computers?
   a. excellent
   b. above average
   c. average
   d. below average
   e. minimal experience
   f. no experience

> depends who our average is!

6. If given instruction and guidance, do you feel you would use computer technology to assist you in teaching your students?
   a. yes
   b. no

   Please explain: I have used computers in the past, I find the problem is the space in the rooms (i.e. - more computers there - I would be able to do more!). Hard to divide the class when there's only one of you! :)

7. Do you feel that computers could be an asset to your work?
   a. yes
   b. no

   Please explain: the children could learn a lot more on their own!

8. Are you currently utilizing available computer technology to assist students in learning? If so, please explain usage time, software and method:

   Not really - I use it to create things for them - they use it, but mostly for word processing!

9. How satisfied are you with your school's current technology policy and usage guidelines?

   I would like to do more daily work on the computers - but again - it would require more computers in my room! Can't let the children go down alone w/ no guidance!

10. Do you feel as though you have adequate guidance in implementing technology in the classroom?

yes - but I could always use more!

11. What reservations or concerns, if any, do you have about using computer technology in the elementary school classroom? Please explain.

None!

12. What would you like to gain from our training program and manual- i.e. specific device instruction, basic computer skills, advanced instruction on specific software titles

I'm not sure yet! I'll be thinking!

We would be glad to hear any suggestions or additional comments that you may have. If you would like to make suggestions about our training program, manual or to make requests for specific instruction, please feel free to do so. We will do our best to address each of your concerns. You may attach an additional sheet to this survey and return it to us in the envelope provided. Again, thank you for your participation.

Thank you again - sorry so late - I just got back!

Shanna McIntosh

We would like to thank you for taking the time to complete this survey. Your answers will greatly help us to direct our research. If you would like to write more than the provided space allows, please feel free to attach additional sheets of paper.

1. Do you own a personal computer? (If no, please skip to question 4)
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   b. Macintosh

2. How often do you use your computer?
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   b. Every week
   c. Every month
   d. Rarely

3. What is the primary use of your computer?
   a. Internet
   b. E-mail
   c. Financials
   d. Word processing
   e. Other (please specify)_____

4. Do you know how to use a:
   a. Mouse Yes No
   b. Printer Yes No
   c. Scanner Yes No
   d. Save a file Yes No
   e. Use a Floppy Disk Yes No

5. How would you rate your over all experience with and understanding of computers?
   a. excellent
   b. above average
   c. average
   d. below average
   e. minimal experience
   f. no experience

6. If given instruction and guidance, do you feel you would use computer technology to assist you in teaching your students?
   a. yes
   b. no

   Please explain: How best to explain how to use programs. At this point I still need to play with the programs to achieve what I want.

7. Do you feel that computers could be an asset to your work?
   a. yes
   b. no

   Please explain: If I use the computer for school work I tend to use home computer which is not compatible w/ school. More than one in the classroom is necessary to avail all students to use of computers

8. Are you currently utilizing available computer technology to assist students in learning? If so, please explain usage time, software and method:

   Computer in my classroom is not working properly. Mouse does not work. Not enough time with only one computer. Students do use in spare time. Success Maker also takes time

9. How satisfied are you with your school's current technology policy and usage guidelines?

   On paper it looks better than it actually works. It has helped to have the computer lab but time there is limited to every other week. Having only one computer limits time and usage for each student. In an ideal world a computer lab is needed with someone available there so students could use computers on a daily basis.

10. Do you feel as though you have adequate guidance in implementing technology in the classroom?

Not always. Many times programs are shown which we do not have. Courses are given on the internet, but is not available in the classroom. If you are having difficulty with a program, there is not always someone to help you.

11. What reservations or concerns, if any, do you have about using computer technology in the elementary school classroom? Please explain.

I would like my students to have more computer time to be able to be more familiar with its use. Drawbacks are amount of available computers and the availability of an instructor to guide students while using the computer.

12. What would you like to gain from our training program and manual- i.e. specific device instruction, basic computer skills, advanced instruction on specific software titles

Programs that would start children on the basics of being able to type an essay, report etc. The more advanced programs create problems for beginners on the computer.

We would be glad to hear any suggestions or additional comments that you may have. If you would like to make suggestions about our training program, manual or to make requests for specific instruction, please feel free to do so. We will do our best to address each of your concerns. You may attach an additional sheet to this survey and return it to us in the envelope provided. Again, thank you for your participation.

It might also be helpful to have two or three students in the classroom who are given instruction to help other students

We would like to thank you for taking the time to complete this survey. Your answers will greatly help us to direct our research. If you would like to write more than the provided space allows, please feel free to attach additional sheets of paper.

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   a. Every day
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   c. Every month
   d. Rarely

3. What is the primary use of your computer?
   a. Internet
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   d. Word processing
   e. Other (please specify)_____

4. Do you know how to use a:
   a. Mouse Yes No
   b. Printer Yes No
   c. Scanner Yes No
   d. Save a file Yes No
   e. Use a Floppy Disk Yes No

5. How would you rate your over all experience with and understanding of computers?
   a. excellent
   b. above average
   c. average
   d. below average
   e. minimal experience
   f. no experience

6. If given instruction and guidance, do you feel you would use computer technology to assist you in teaching your students?
   a. yes
   b. no

* Please explain: Only if time and resources were realistic

7. Do you feel that computers could be an asset to your work?
   a. yes
   b. no

Please explain: Computers could be an asset to student's learning experiences (directly) and teacher preparation.

8. Are you currently utilizing available computer technology to assist students in learning? If so, please explain usage time, software and method:

No, not really. I only use the required "Successmaker" in my classroom, which I find very limiting.

9. How satisfied are you with your school's current technology policy and usage guidelines?

Time and money appear to be 2 of the greatest obstacles to better use of technology in the schools.

10. Do you feel as though you have adequate guidance in implementing technology in the classroom?

I could certainly use more guidance, but I have a lot to learn - still!

11. What reservations or concerns, if any, do you have about using computer technology in the elementary school classroom? Please explain.

One concern I have is managing 25 students' time in a productive way relative to computer use. I'd be interested in seeing a few different models which could realistically be implemented in the classroom. It's essential to me that the computer software supports + enhances the classroom curriculum.

12. What would you like to gain from our training program and manual- i.e. specific device instruction, basic computer skills, advanced instruction on specific software titles

Anything I could learn would be helpful. For me, whatever I learn must be applied on a regular basis. ☺

We would be glad to hear any suggestions or additional comments that you may have. If you would like to make suggestions about our training program, manual or to make requests for specific instruction, please feel free to do so. We will do our best to address each of your concerns. You may attach an additional sheet to this survey and return it to us in the envelope provided. Again, thank you for your participation.

We would like to thank you for taking the time to complete this survey. Your answers will greatly help us to direct our research. If you would like to write more than the provided space allows, please feel free to attach additional sheets of paper.

1. Do you own a personal computer? (If no, please skip to question 4)
   a. PC
   b. Macintosh

2. How often do you use your computer?
   a. Every day
   b. Every week
   c. Every month
   d. Rarely

3. What is the primary use of your computer?
   a. Internet
   b. E-mail
   c. Financials
   d. Word processing
   e. Other (please specify)_____

4. Do you know how to use a:
   a. Mouse Yes No
   b. Printer Yes No
   c. Scanner Yes No
   d. Save a file Yes No
   e. Use a Floppy Disk Yes No

5. How would you rate your over all experience with and understanding of computers?
   a. excellent
   b. above average
   c. average
   d. below average
   e. minimal experience
   f. no experience

6. If given instruction and guidance, do you feel you would use computer technology to assist you in teaching your students?
   a. yes
   b. no

   Please explain:_____

   _____

   _____

7. Do you feel that computers could be an asset to your work?
   a. yes
   b. no

   Please explain: _____

8. Are you currently utilizing available computer technology to assist students in learning? If so, please explain usage time, software and method:

   Computer use by students (in the classroom) is almost exclusively success maker, which is basically a glorified worksheet.

9. How satisfied are you with your school's current technology policy and usage guidelines?

   I'm glad that we finally have a computer lab so that the kids can experience more than success maker. Limited time in the classroom and expectations for use of success maker are limiting.

10. Do you feel as though you have adequate guidance in implementing technology in the classroom?

Yes - based upon what we are now able to use the computer for in the classroom.

11. What reservations or concerns, if any, do you have about using computer technology in the elementary school classroom? Please explain.

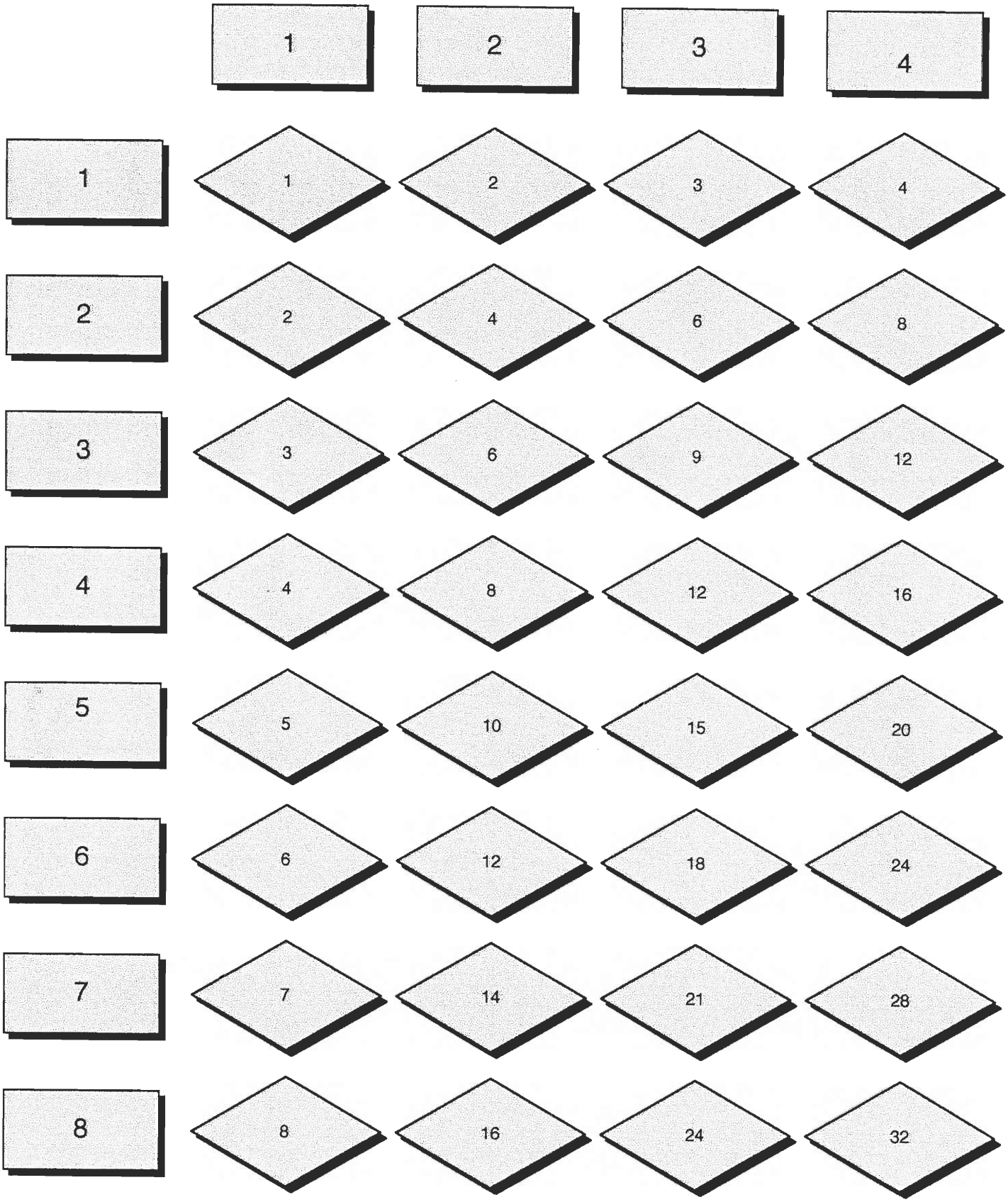
No reservations - limited by lack of time & equipment

12. What would you like to gain from our training program and manual- i.e. specific device instruction, basic computer skills, advanced instruction on specific software titles

Is it possible to gear your training + manual to the students? (a workshop for the kids and a manual they could use independently))

We would be glad to hear any suggestions or additional comments that you may have. If you would like to make suggestions about our training program, manual or to make requests for specific instruction, please feel free to do so. We will do our best to address each of your concerns. You may attach an additional sheet to this survey and return it to us in the envelope provided. Again, thank you for your participation.

APPENDIX E



APPENDIX F

Workshop I Outline

PART I

A. Introduction

1. What is the IQP?
2. Curriculum Design
   a. Implementation of Computers into the Classroom

3. Learning Methods
   a. Two Theories
   b. Computers in the Classroom

B. Basic Skills

1. Turning the Computer On/Off
2. Basic Mouse Skills
   a. Hand Placement
   b. Single Clicking
   c. Dragging Objects
   d. Double Clicking to Open Programs

C. Appleworks

1. Opening New Word Document
2. Resizing Windows
3. Scrolling Through a Document
4. Typing in a Word Document
   a. Highlighting a Selection
   b. Changing Font, Size, Style, Alignment
   c. Using Cut, Copy and Paste
   d. Editing a Sentence

5. Saving
   a. To the Desktop
   b. To a Folder
   c. Save versus Save As Commands

6. Closing a Program

D. Organization of Files

1. Creating a New Folder
2. Putting Files into a Folder
   a. Demonstration with Tangible Folders

3. Finding Files and Folders
   a. Using Sherlock

E. Using a Floppy Disk

1. Inserting Disk into Computer
2. Saving to Floppy Disk
3. Taking Disk out of Computer

PART II

A. Using the LightPro

1. Connecting to the Computer
2. Projecting Image onto Screen

B. PowerPoint Slide Show

1. Virtual Field Trip to the Aquarium
   a. Pictures from the Internet
   b. Information on Aquatic Life

C. Introduction to Inspiration Software

1. Example of Flow Chart
   a. Aquatic Life Food Web

APPENDIX G

Thank you for attending this workshop, your participation was greatly appreciated. It is the group's hope that you have gained an understanding of the skills demonstrated and taught today. Please take the time to fill out this survey. When you are finished with the survey, place it in the basket provided in the front of the room.

1) Please rate your level of improvement with the following skills by marking the appropriate space with a check mark:

	Negligible Improvement	Moderate Improvement	Considerable Improvement
Mouse skills		X	
Opening a program		X	
Exiting a program		X	
Opening an existing document		X	
Saving a file	N/A		
Saving a file to Floppy disk		X	
Using a printer			
Creating a new document	N/A		
Closing a document	↑		
Resizing a window	N/A		
Creating a new folder		X	
Changing page layout		X	

2) Do you feel that the time spent in this workshop was worthwhile?

Yes ✓ No _____

Please explain:

Yes I feel that the time spent was worthwhile. I own an IBM Aptiva, and I learned where certain items are found in the iMac, and what certain areas are for.

3) Do you feel that you would be more apt to implement some of the techniques learned today with your students after this workshop?

Yes ✓ No _____

Please explain:

These techniques are very basic and can be learned easily by all students.

4) If a second workshop was offered, to demonstrate more advanced skills as well as field specific software questions, would you attend?

Yes ✓ No _____

If you answered Yes to Question #4, what would you be most interested in learning at the second workshop?

If you answered No to Question #4, what factors would influence your decision not to attend a follow-up workshop?

Thank you for attending this workshop, your participation was greatly appreciated. It is the group's hope that you have gained an understanding of the skills demonstrated and taught today. Please take the time to fill out this survey. When you are finished with the survey, place it in the basket provided in the front of the room.

1) Please rate your level of improvement with the following skills by marking the appropriate space with a check mark:

	Negligible Improvement	Moderate Improvement	Considerable Improvement
Mouse skills		X	
Opening a program	N/A		
Exiting a program	N/A		
Opening an existing document	N/A		
Saving a file	N/A		
Saving a file to Floppy disk		X	
Using a printer	N/A		
Creating a new document	N/A		
Closing a document	N/A		
Resizing a window	N/A		
Creating a new folder		X	
Changing page layout		X	

2) Do you feel that the time spent in this workshop was worthwhile?

Yes X No _____

Please explain:

I am always looking for ways to improve my computer skills I'm particularly interested in learning Inspiration and Power Point

3) Do you feel that you would be more apt to implement some of the techniques learned today with your students after this workshop?

Yes Y No _____

Please explain:

Technology in the classroom is linked to all content areas so finding ways to coordinate both is helpful. Even creating timelines related to history, etc. would relate to class work.

4) If a second workshop was offered, to demonstrate more advanced skills as well as field specific software questions, would you attend?

Yes X No _____

If you answered Yes to Question #4, what would you be most interested in learning at the second workshop?

Power point

Inspiration

If you answered No to Question #4, what factors would influence your decision not to attend a follow-up workshop?

Thank you for attending this workshop, your participation was greatly appreciated. It is the group's hope that you have gained an understanding of the skills demonstrated and taught today. Please take the time to fill out this survey. When you are finished with the survey, place it in the basket provided in the front of the room.

1) Please rate your level of improvement with the following skills by marking the appropriate space with a check mark:

	Negligible Improvement	Moderate Improvement	Considerable Improvement
Mouse skills			
Opening a program		✓	
Exiting a program			✓
Opening an existing document		✓	
Saving a file		✓	
Saving a file to Floppy disk			✓
Using a printer		✓	
Creating a new document			✓
Closing a document		✓	
Resizing a window			✓
Creating a new folder		✓	
Changing page layout		✓	

2) Do you feel that the time spent in this workshop was worthwhile?

Yes ✓ No _____

Please explain:

Made things much simpler

3) Do you feel that you would be more apt to implement some of the techniques learned today with your students after this workshop?

Yes ✓ No _____

Please explain:

4) If a second workshop was offered, to demonstrate more advanced skills as well as field specific software questions, would you attend?

Yes ✓ No _____

If you answered Yes to Question #4, what would you be most interested in learning at the second workshop?

Power Point
Inspiration Software
Grids

If you answered No to Question #4, what factors would influence your decision not to attend a follow-up workshop?

Thank you for attending this workshop, your participation was greatly appreciated. It is the group's hope that you have gained an understanding of the skills demonstrated and taught today. Please take the time to fill out this survey. When you are finished with the survey, place it in the basket provided in the front of the room.

1) Please rate your level of improvement with the following skills by marking the appropriate space with a check mark:

	Negligible Improvement	Moderate Improvement	Considerable Improvement
Mouse skills NA	_____	_____	_____
Opening a program NA	_____	_____	_____
Exiting a program NA	_____	_____	_____
Opening an existing document NA	_____	_____	_____
Saving a file NA	_____	_____	_____
Saving a file to Floppy disk NA	_____	_____	_____
Using a printer NA	_____	_____	_____
Creating a new document NA	_____	_____	_____
Closing a document NA	_____	_____	_____
Resizing a window NA	_____	_____	_____
Creating a new folder NA	_____	_____	_____
Changing page layout NA	_____	_____	_____

2) Do you feel that the time spent in this workshop was worthwhile?

Yes ✓ No _____

Please explain:

It was nice to see where the teach how computer literate the teachers are

3) Do you feel that you would be more apt to implement some of the techniques learned today with your students after this workshop?

Yes X No _____

Please explain:

The Slide Show was very interesting and a neat way to work with the whole class

4) If a second workshop was offered, to demonstrate more advanced skills as well as field specific software questions, would you attend?

Yes ✓ No _____

If you answered Yes to Question #4, what would you be most interested in learning at the second workshop?

spread sheets
power point

If you answered No to Question #4, what factors would influence your decision not to attend a follow-up workshop?

Thank you for attending this workshop, your participation was greatly appreciated. It is the group's hope that you have gained an understanding of the skills demonstrated and taught today. Please take the time to fill out this survey. When you are finished with the survey, place it in the basket provided in the front of the room.

1) Please rate your level of improvement with the following skills by marking the appropriate space with a check mark:

	Negligible Improvement	Moderate Improvement	Considerable Improvement
Mouse skills		✓ N/A	
Opening a program		✓ N/A	
Exiting a program		✓ N/A	
Opening an existing document		✓ N/A	
Saving a file		✓ N/A	
Saving a file to Floppy disk		✓ N/A	
Using a printer	✓		
Creating a new document		✓ N/A	
Closing a document		✓ N/A	
Resizing a window		✓ N/A	
Creating a new folder		✓ N/A	
Changing page layout		✓ N/A	

2) Do you feel that the time spent in this workshop was worthwhile?

Yes ✓ No _____

Please explain:

A good review

3) Do you feel that you would be more apt to implement some of the techniques learned today with your students after this workshop?

Yes ✓ No _____

Please explain:

with the proper equipment

4) If a second workshop was offered, to demonstrate more advanced skills as well as field specific software questions, would you attend?

Yes ✓ No _____

If you answered Yes to Question #4, what would you be most interested in learning at the second workshop?

How to do presentations with the equipment we have.

If you answered No to Question #4, what factors would influence your decision not to attend a follow-up workshop?

Thank you for attending this workshop, your participation was greatly appreciated. It is the group's hope that you have gained an understanding of the skills demonstrated and taught today. Please take the time to fill out this survey. When you are finished with the survey, place it in the basket provided in the front of the room.

1) Please rate your level of improvement with the following skills by marking the appropriate space with a check mark:

	Negligible Improvement	Moderate Improvement	Considerable Improvement
Mouse skills			
Opening a program			
Exiting a program			
Opening an existing document			
Saving a file			
Saving a file to Floppy disk		✓	
Using a printer			
Creating a new document			
Closing a document			
Resizing a window			
Creating a new folder		✓	
Changing page layout			

n/a

n/a

2) Do you feel that the time spent in this workshop was worthwhile?

Yes ✓ No _____

Please explain:

3) Do you feel that you would be more apt to implement some of the techniques learned today with your students after this workshop?

Yes ✓ No _____

Please explain:

If the necessary equipment became available for large group instruction I would take every opportunity available.

4) If a second workshop was offered, to demonstrate more advanced skills as well as field specific software questions, would you attend?

Yes ✓ No _____

If you answered Yes to Question #4, what would you be most interested in learning at the second workshop?

Inspiration & Power Point

If you answered No to Question #4, what factors would influence your decision not to attend a follow-up workshop?

Thank you for attending this workshop, your participation was greatly appreciated. It is the group's hope that you have gained an understanding of the skills demonstrated and taught today. Please take the time to fill out this survey. When you are finished with the survey, place it in the basket provided in the front of the room.

1) Please rate your level of improvement with the following skills by marking the appropriate space with a check mark:

	Negligible Improvement	Moderate Improvement	Considerable Improvement
Mouse skills			
Opening a program			
Exiting a program			
Opening an existing document			
Saving a file			
Saving a file to Floppy disk			
Using a printer			
Creating a new document			
Closing a document			
Resizing a window			✓
Creating a new folder			✓
Changing page layout			

NA for most categories - (already knew) although it helped to see again!

2) Do you feel that the time spent in this workshop was worthwhile?

Yes ✓ No _____

Please explain:

Refreshed my memory as to completing tasks - also learned several new things.

3) Do you feel that you would be more apt to implement some of the techniques learned today with your students after this workshop?

Yes ✓ No _____

Please explain:

I think the manual would be useful, not only for myself in refreshing my memory, but also as a tool for students.

4) If a second workshop was offered, to demonstrate more advanced skills as well as field specific software questions, would you attend?

Yes ✓ No _____

If you answered Yes to Question #4, what would you be most interested in learning at the second workshop?

More information on how to create whole class presentations & documents for the class

If you answered No to Question #4, what factors would influence your decision not to attend a follow-up workshop?

Thank you for attending this workshop, your participation was greatly appreciated. It is the group's hope that you have gained an understanding of the skills demonstrated and taught today. Please take the time to fill out this survey. When you are finished with the survey, place it in the basket provided in the front of the room.

1) Please rate your level of improvement with the following skills by marking the appropriate space with a check mark:

	Negligible Improvement	Moderate Improvement	Considerable Improvement
Mouse skills			X
Opening a program			X
Exiting a program			X
Opening an existing document			X
Saving a file			X
Saving a file to Floppy disk			X
Using a printer			X
Creating a new document			X
Closing a document			X
Resizing a window		X	
Creating a new folder			X
Changing page layout			X

2) Do you feel that the time spent in this workshop was worthwhile?

Yes X No _____

Please explain:

I will be starting a computer class next week, and am unfamiliar with the iMAC computers. All of my experience was with PC's and this workshop helped me realize the similarities between the two.

3) Do you feel that you would be more apt to implement some of the techniques learned today with your students after this workshop?

Yes ✓ No _____

Please explain:

- See above -

4) If a second workshop was offered, to demonstrate more advanced skills as well as field specific software questions, would you attend?

Yes ✓ No _____

If you answered Yes to Question #4, what would you be most interested in learning at the second workshop?

I am not familiar with any of the programs, so I would be interested in anything I could use in my classroom.

If you answered No to Question #4, what factors would influence your decision not to attend a follow-up workshop?

Thank you for attending this workshop, your participation was greatly appreciated. It is the group's hope that you have gained an understanding of the skills demonstrated and taught today. Please take the time to fill out this survey. When you are finished with the survey, place it in the basket provided in the front of the room.

1) Please rate your level of improvement with the following skills by marking the appropriate space with a check mark:

	Negligible Improvement	Moderate Improvement	Considerable Improvement
Mouse skills			✓
Opening a program			✓
Exiting a program			✓
Opening an existing document			✓
Saving a file			✓
Saving a file to Floppy disk			✓
Using a printer			✓
Creating a new document			✓
Closing a document			✓
Resizing a window			✓
Creating a new folder			✓
Changing page layout			✓

2) Do you feel that the time spent in this workshop was worthwhile?

Yes ✓ No _____

Please explain:

Excellent presentation!
Thank you!

3) Do you feel that you would be more apt to implement some of the techniques learned today with your students after this workshop?

Yes ✓ No _____

Please explain:

4) If a second workshop was offered, to demonstrate more advanced skills as well as field specific software questions, would you attend?

Yes ✓ No _____

If you answered Yes to Question #4, what would you be most interested in learning at the second workshop?

Inspiration Software
Power Point
How to make a bar graph
" " grids
Good Internet sites for Teachers

If you answered No to Question #4, what factors would influence your decision not to attend a follow-up workshop?

Thank you for attending this workshop, your participation was greatly appreciated. It is the group's hope that you have gained an understanding of the skills demonstrated and taught today. Please take the time to fill out this survey. When you are finished with the survey, place it in the basket provided in the front of the room.

1) Please rate your level of improvement with the following skills by marking the appropriate space with a check mark:

	Negligible Improvement	Moderate Improvement	Considerable Improvement
I was already used to these applications. Mouse skills			
Opening a program			
Exiting a program			
Opening an existing document			
Saving a file		✓	
Saving a file to Floppy disk			✓
Using a printer			
Creating a new document		✓	
N/A Closing a document			
Resizing a window	✓		
Creating a new folder			✓
Changing page layout			✓

2) Do you feel that the time spent in this workshop was worthwhile?

Yes ✓ No _____

Please explain:

I appreciated learning a different method for saving files.

3) Do you feel that you would be more apt to implement some of the techniques learned today with your students after this workshop?

Yes ✓ No _____

Please explain:

I would be more likely to make use of the floppy disks

4) If a second workshop was offered, to demonstrate more advanced skills as well as field specific software questions, would you attend?

Yes ✓ No _____

If you answered Yes to Question #4, what would you be most interested in learning at the second workshop?

Networking

graphics

If you answered No to Question #4, what factors would influence your decision not to attend a follow-up workshop?

Thank you for attending this workshop, your participation was greatly appreciated. It is the group's hope that you have gained an understanding of the skills demonstrated and taught today. Please take the time to fill out this survey. When you are finished with the survey, place it in the basket provided in the front of the room.

1) Please rate your level of improvement with the following skills by marking the appropriate space with a check mark:

	Negligible Improvement	Moderate Improvement	Considerable Improvement
Mouse skills			
Opening a program			
Exiting a program			
Opening an existing document			
Saving a file			
Saving a file to Floppy disk			
Using a printer			
Creating a new document			
Closing a document			
Resizing a window			✓
Creating a new folder			✓
Changing page layout			

2) Do you feel that the time spent in this workshop was worthwhile?

Yes _____ No _____

Please explain:

3) Do you feel that you would be more apt to implement some of the techniques learned today with your students after this workshop?

Yes ✓ No _____

Please explain:

If we had all the equipment it would be wonderful.

4) If a second workshop was offered, to demonstrate more advanced skills as well as field specific software questions, would you attend?

Yes ✓ No _____

If you answered Yes to Question #4, what would you be most interested in learning at the second workshop?

inspirations
setting up charts, graphs.

If you answered No to Question #4, what factors would influence your decision not to attend a follow-up workshop?

APPENDIX H

Transcript of Help Session – September 28, 2000

Attendance: 1 teacher, 3 paraprofessionals, Principal Gauley
IQP Group: Aimee Kazlowski, Ursa Scherer, Melissa St. Hilaire

All workshop participants sit down and turn on the computers.

IQP Group: Thank you for coming back for the second workshop. This hour is open to any questions that you have about the software programs on the iMacs. From the responses to the survey, we noticed that you have specific questions about creating graphs, using PowerPoint and learning Inspiration.

Paraprofessional 1: Yes, I wanted to learn how to make bar graphs to display my students' grades.

Teacher 1: Yeah, we can do that using spreadsheets right?

Paraprofessional 1: How do I get to a spreadsheet?

Teacher 1: You can go in through Appleworks and open it from there.

IQP Group: Why don't we do a quick demonstration of how to make a chart with the spreadsheets.

Everyone gathers around the computer.

IQP Group: First, we want to enter some numbers into the columns for data.

Paraprofessional 1: Wait. What kind of information does that represent.

Teacher 1: You can use this to put students' names in and then you can put their grades next to that and make a chart of them.

Paraprofessional 2: Oh, that's interesting, show us how to do that.

Teacher 1: Also, show how you can change the width of the column to fit the entire student's name.

IQP Group: Ok, you can change the column width by going to the top of the spreadsheet and dragging the column heading until it is the size that you want it.

Paraprofessional 3: Do you have to hold down on the mouse while you drag it?

IQP Group: Yes, and you can see how big it will be by the dotted line that shows up as you drag it. Now that the column is bigger, you can enter names by clicking on the cell that you want the name to be in, and then you start typing in this top line. When you press enter the info appears in the cell.

Teacher 1: Can you also just type in the cell?

IQP Group: Yes, but it is easier to edit the entries by using this bar.

Paraprofessional 2: Now what do I do if I want to put something in another column.

IQP Group: You can either use the mouse or the arrow keys to move to different cells.

The IQP Group continues by entering more data into the spreadsheet to prepare a chart.

IQP Group: Now that we have this data entered, we can make a chart. First you have to highlight all the data. Next, you go to "Options" and then click on "Make Chart." This brings up this box where you can pick different charts.

Paraprofessional 1(pointing to a scatter plot chart): So with this one I can make a scatter plot of the grades?

IQP Group: Yes, you can click on the box to say that you want a scatter plot and then it will ask you to name your axes. So we want the names of the students to be on the bottom and the grades to be along the side.

All participants think that the graph is great.

Paraprofessional 1: How do I start a whole new spreadsheet?

IQP Group: There are a couple of options. You can either clear the data from this spreadsheet and start over. Or you can go to "File" and close the document, then start a new one.

Paraprofessional 2: If you put all the names of the students in and then want it to alphabetize, will it do that?

IQP Group: Yes, if you go to the menu and look under "Options" it should have a function called "Sort" or "Arrange" that will do that for you.

Paraprofessional 1: How many entries can be put on this sheet.

IQP Group: You can have as many as you want, basically its infinite.

All the participants go back to their own computers to play with the spreadsheet.

Paraprofessional 1: I am going to go upstairs and get some work to bring back down. This is so exciting!

Teacher 1: Ok, I have some data of students' grades. How do I get it to average them?

IQP Group: I'm not quite sure how to do this in an Appleworks spreadsheet, but in Microsoft Excel there would be a function button.

Teacher 1: Oh this has one too. Ok…so I can use the average function, but how do I tell it what numbers to put in?

IQP Group: I'm not really sure how to do this.

Paraprofessional 2: Doesn't the backslash key mean divide and the star key mean multiply?

Teacher 1: Yeah but there should be a formula that I can use so I don't have to do it all out.

Principal: What is the easiest way for me to take something off of the PC in my office and put it onto this iMac?

IQP Group: You can save it onto a disk and name it an RTF file.

Principal: Ok, thanks.

Teacher 1: Principal Gauley, do you know how to do averages?

Principal: Yes, there should be a formula that you can use, like in Excel.

Teacher 1: I know but I can't get it to work for more than one row at a time, isn't there a way that I can make it work for all of them without having to do it one by one?

Principal: In Excel you can drag this down and it should work.

Teacher 1: No, it doesn't work in this. I'll just do it one by one I guess. Ok, how can I weight different columns.

IQP Group: What do you mean?

Teacher 1: Like all these grades represent quizzes or tests but the tests count for more than quizzes.

IQP Group: Oh, in the formula you need to add a percentage before the column value.

Teacher 1: Ok I have a spreadsheet that I need to make, but I have to put a header on it first. How do I make a title for this?

A member of the IQP Group shows Paraprofessional 1 how to do this while another member helps Teacher 1 with the averages and formulas. Paraprofessional 2 is working with Paraprofessional 1 but needs to leave. Paraprofessional 3 is quietly exploring different programs.

Principal: Hey, could one of you help me with a picture?

IQP Group: Sure, what do you want to do with the picture?

Principal: Ok I need to put a picture of the school on a website and I need to know how to get the picture from my digital camera to the school's website.

IQP Group: Ok well first you need to get the picture onto this computer so that you can upload it onto your website's directory.

Principal: Ok and what should I save the picture as?

IQP Group: You can try to save it probably as a JPEG file.

Principal: Ok I'll go try to do that.

The principal goes to try to save the picture file from his PC to a floppy disk. Meanwhile, Teacher 1 finishes playing with the formulas and leaves. Paraprofessional 1 finishes the spreadsheet file.

Paraprofessional 1: Is this computer connected to a printer?

IQP Group: No, but that one at the end is.

Paraprofessional 1: Oh, well how will I get all this work that I have just done?

IQP Group: We can save it to a floppy disk and then go to the computer down there and open up the saved file and print it from there.

Paraprofessional 1: Ok, do you have a disk?

IQP Group: Yes you put the disk in here. Now you just want to go to "File" and then "Save As". Now you want to make sure you save to the floppy disk so you have to click on that. Now to get the disk out of the drive, you need to take the picture of the disk here on the desktop and drag it to the trash.

Paraprofessional 1: Ok so that ejects the disk?

IQP Group: Yes, it's kind of strange to put something in the trash to get it out, but that's how the Macs work. Ok now we can take this and open it up at this computer. Then you just go to "File" and "Print".

Paraprofessional 1: This is so great!

Paraprofessional 1 leaves.

IQP Group (to Paraprofessional 3): Is there anything that you would like help with?

Paraprofessional 3: I've never used an iMac before, I'm just looking through everything. I don't exactly know what to teach my students.

IQP Group: We have an example of something that you might want to do on Inspiration.

Paraprofessional 3: Ok.

IQP Group: We figured since the students are younger, they are still using multiplication tables so we made one using Inspiration that they could also make.

Paraprofessional 3: Ok, how do I make this?

IQP Group: Its really easy. You just open into Inspiration. Now, you can just click on the box shape you want and then you just place it wherever you want it on the screen. To make a table you just keep doing that in rows until you have as many as you want. Then to enter numbers or words into the shapes you can just click on them and type.

Paraprofessional 3: Ok that's interesting. Now, the kids also asked me if they could play CDs in these. Can they?

IQP Group: They should be able to, you can just put the CD into the CD slot and it should play.

Paraprofessional 3: Ok. Also, they wanted to know how you can make certificates?

IQP Group: Oh, like the ones that we showed you before?

Paraprofessional 3: Yes, those look like something easy that they can make.

IQP Group: Yes, you can go into Appleworks and there is a wizard that walks you right through it.

Paraprofessional 3: Ok, great. Well thanks for everything.

Paraprofessional 3 leaves. Principal Gauley cannot get the picture to save to disk because it's too big. The group tries but also cannot reduce the file size. He says that's ok and thanks us for coming.

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