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ABSTRACT

Early childhood practitioners should evaluate whether or not computers contribute to the growth of their students by considering computers in the planning phase of the educational program. The first approach, computer assisted instruction, includes drill and practice programs, tutorials or programmed instruction, and simulations or games. Computer awareness or literacy, the second approach, often emphasizes computer information rather than skill with computers. The third approach, computer usage, recognizes that computers are a tool and prepares the student to enter that world with skills and understanding. LOGO, a new computer language, is simple enough for preschool children and also encourages creativity and exploration of concepts. Five goals are specifically recommended for early childhood personnel: (1) learn about computers for yourself by reading computer magazines; (2) learn about LOGO; (3) learn about computer software; (4) say "yes" to computers, but choose wisely; and (5) remember early childhood goals. (BJD)

MICROCOMPUTERS AND YOUNG CHILDREN

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MICROCOMPUTERS AND YOUNG CHILDREN

The director of a local preschool was on the telephone:

> "The parent advisory board wants to buy a computer for the preschool. What kind do you recommend? I don't know what we'll do with one when we get it."

Panic in the voice subsided with discussion of kinds of computers, cost and reliability, programs and languages, suppliers and catalogs. The issue of getting the "best buy" often seems to overshadow the the more important and more difficult question of what to do with it.

Goals in education are the place to start considering computers. Enhancing childrens' cognitive, physical, emotional and social development has been the rationale for early childhood programs. Whether the newly available technology of microcomputers can contribute to that growth is the question which early childhood practitioners need to answer.

Reduced cost and increased capabilities have made microcomputers accessible and desirable to the general population in the last five years. In response to public pressure and technological advances, elementary and secondary schools have adopted a variety of approaches to computer education. The specific implementations of these models vary, but they can be grouped in the broad categories of Computer Assisted Instruction, Computer Awareness, and Computer Usage. Early childhood teachers may decide if any of the existing approaches are suitable for the goals of early childhood.

COMPUTER ASSISTED INSTRUCTION

Computer assisted instruction (CAI) includes drill and practice programs, tutorials or programmed instruction, and simulations or games. In all three, the computer poses problems and makes judgments about the quality or correctness of answers of the user. Many programs, called software or courseware, are available commercially or to the individual who can type in a program from a computer magazine or book. The type of material and the nature of the response varies widely among the different kinds of CAI.

Drill and practice. Drill and practice exercises are similar to workbook pages. Questions or problems, such as math facts or spelling words are presented; the student types in an answer. The computer provides feedback and keeps score of the number right and wrong. One application of this format, called Comput Managed Instruction (CMI), keeps continuous records of childrens' progress while they practice on a skill until they reach mastery level.

In elementary and secondary schools, drill and practice programs can be found in software catalogs for almost every subject area. For preschool the topics in drill and practice concentrate on discrimination of shapes, letters, and words and matching or classification of objects by number, shape or color. The fact that these programs are advertised as readiness or intelligence builders emphasizes their academic intent.

Tutorials. Tutorials are more complex than drill and practice because they try to do more than ask questions and judging answers. First, tutorials provide some information and

instructional quidance toward understanding the right answer. Many tutorials are based on reading to get information although graphics can be used effectively to present certain information. Each "frame" of information is followed by one or more questions which test understanding of the idea. Tutorials also differ from drill and practice in their response to answers. In addition to assessing right or wrong responses and counting them, a tutorial tries to decide what kind of errors have led to an incorrect response and to provide some corrective information with another chance to get the correct answer. Tutorials are similar to programmed instruction texts.

Compare drill and practice to tutorial for teaching shape discrimination. A drill and practice approach might present a picture of an object shaped like a circle and ask the learner to find the one like it from pictures of a circle, triangle and square. A tutorial might give three examples of circles (wheel, plate, penny), then ask the child to find another object which has the shape of a circle. Then, if a child fails to find the picture with a circle in it, the program might draw a circle on the lollipop and ask the question again immediately or later. In two ways, the tutorial provides more instruction to the learner. In a well designed tutorial, the goal is to simulate a one-to-one teaching situation with the most sensitive, patient and understanding teacher. If the computer/teacher is successful, the learner cannot make a mistake or cannot leave the computer with any incorrect information.

CMI can also be part of tutorials. In fact, the features of drill and practice and tutorials are so similar that they differ mainly in the degree of how much instructional guidance is provided. Both emphasize self-paced, sometimes called individualized, learning and are based on psychological principles of repetition and reinforcement.

Simulations. Instead of aiming at the learning of particular factual information or reinforcement of skills. the goal of simulations is the development of strategies which allows players to outwit the computer. In a common high-school simulation of going west in a covered wagon, students must plan for the amount of food, ammunition, and other supplies necessary to get to the frontier. Then they must respond to situations such as blizzards, attacks, and getting lost. Playing the simulation many times, students may eventually arrive at a new settlement. Through trial and error they learn to manage all the factors and events in successful ways. Of course, the computer can always change the rules to simulate real life and frustrate even the best plans.

An elementary example of a simulation is a cookie factory in which students decide which kind of cookies to make. Recognizing that chocolate chip cookies cost more to make than sugar cookies, they must price the cookies accordingly and advertise for customers. The computer determines how many of each kind of cookie customers will buy. On each turn, students make a new set of decisions which results in a profit or loss.

Many video games are a kind of simulation which call for a combination of strategy and manual dexterity. Points are accumulated by capturing opponents or eluding them. Winning depends on understanding how the computer controls the games and proficiency in executing the strategy. Except for simplified arcade type games, few simulations are designed for young children.

<u>Computer assisted instruction in preschool and primary.</u> Computer assisted instruction can be implemented in every school setting including preschool. Computer systems cost from $200 to $2000 with a choice of prepackaged educational programs for each system. Very little teacher training beyond knowledge of how to turn the computer on and load a program is required. However, the ease with which CAI can be implemented should not be confused with its value. Especially in Early Childhood Education, where the emphasis is development of the "whole child," CAI must be criticaly examined.

Would a kindergarten program concentrating on CAI promote academic learning to the detriment of social interaction and physical development? If CAI were balanced with other developmental needs, would the computer be a better teacher than more traditional work with blocks, paints and talk? Will the arrival of computers in preschool dehumanize both children and teachers? No empirical answers exist to these questions. If research did exist, the results would be argued on philosophical grounds about the nature of children and learning.

On philosophical grounds, computer assisted instruction would be unacceptable to many early childhood practitioners who see CAI as a high tech extension of packaged, academic workbook materials. Most teachers of young children believe in the necessity of first hand experiences as the basis for meaningful learning. Even though a skill taught with a computer have the same name, the medium and therefore the message may be very different.

For example, classification skills developed with actual blocks or picture cards children move around can be simulated on the computer screen. The children use the key board or a hand-held response device to indicate which items should be grouped. The pictures on the screen cannot be moved directly. Actual interaction with the materials is impossible; sensorimotor learning as a bridge to cognitive learning is negated. That children are actively involved requires a definition of active not typically used in early childhood. Finally, the picture on the screen is often less realistic than a photographs or even a drawn picture.

On practical grounds, the kinds of CAI now available for preschoolers are very limited and of poor quality. Economics determine the availability of computer assisted instruction. As drill and practice is the simplest, therefore the cheapest to produce, about 80 per cent of the available software can be classified as drill and practice. Most of the simulations which have been developed are arcade and adventure rather than educational.

The arcade and adventure games generally take full advantage of the graphics and sound capabilities of computers. Typical CAI and simulations are much less sophisticated in their use of "whistle and wow." Whether elaborate graphics and sound effects contribute to learning is not established, but they are deemed important for motivation in CAI so that children will stay with the learning task.

Game formats are also employed in many drill programs for motivation. Accumulation of points enables the learner to win a game against the computer or against a competitor. Correct answers may result the players' horse moving ahead in the computer race or their car jumping over obstacles. Occasionally, wrong answers in packaged software get more exciting response than correct answers.

Even as the quality and quantity of software improve, the balance between the amount and kind of learning and expense needs to be considered. Does a thirty dollar software program on matching numerals to number result in "better" learning than a ten dollar number peg puzzle? Do preschoolers need to learn to discriminate between b's and d's and if they do, is the computer the best way to learn this? Early childhood teachers will need to continue to ask these questions. Lack of understanding of developmental learning, limited selection of material, and deficient execution contribute to the poor quality of much current educational software.

Even though the current state of CAI is not good, teachers at all levels must be careful not to take a rigid stance on CAI in all situations. Quality is certain to improve. Educational simulations may be the most exciting area as programs which use video-discs to display events will make computers more realistic graphicsally. Field testing, revision, and evaluation are required before the learning outcomes of CAI can be determined. In a learning sequence which includes introductory experiences and concepts, CAI may provide an important adjunct to developmental teaching. Certain children may learn somethings particulary well with CAI.

COMPUTER AWARENESS

Many schools have adopted a general introduction to computers called computer awareness or computer literacy. Topics such as the history of computing, social impact of computers and terminology about computers are included with some actual work on computers. Computer assisted instruction or video games are often used as the hands-on part of computer awareness. Library books for children explain parts of the computer and issues of jobs and data security. Some packaged programs with teacher guides, computer programs, and childrens' books are available for computer awareness.

While the games may be entertaining and knowledge about computers potentially important, the activities in isolation do not promote understanding how computers are used. When Pascal lived and what is ROM are remote from the lives of children and their interaction with computers. Too often computer awareness

provides the least important knowledge about computers for the most children.

The most realistic argument for computer awareness is financial. Schools who can afford only a few computers for many students may adopt this approach because only casual or infrequent contact with computers is necessary. On the other hand, computer assisted instruction requires many computers and software packages and much time per child on a computer. Estimates from 20-50% of the school day per child have been suggested for CAI. Both of these approaches miss the real significance of computers in the world; they are tools which people use to do their jobs better. Academic knowledge about computers is secondary to the tasks they are used for. Only in schools has the reverse become popular. Some schools have programs called computer awareness which emphasize learning to use computers.

<u>Computer awareness in preschool and primary.</u> As generally implemented, computer awareness is questionable for elementary and high school students; factual knowledge about computers is even more inappropriate for young children. Abstract definitions do not contribute to understanding their here-and-now world. Playing games or using CAI has the benefit of actually working with the computer equipment, but learning how computers are used is more important. Early childhood educators must look for ways a computer can be used to accomplish what a child typically wants to learn and master. Can the computer be used as a tool in the child's world?

COMPUTER USAGE

A secretary uses the word processor, an accountant uses a computerized spreadsheet to keep accounts and a machinist makes parts by programming a computerized lathe. Computer use is the approach to computers which emphasizes that computers are tools to do tasks.

If an early childhood educator is asked what a child's work is, the answer will be "play." There fore the question of computers in preschool can be rephrased, "Can the computer be used by young children to play." The outcomes of play are a sense of mastery over self and the world, self confidence, creativity, increasing ability to represent things, events and ideas symbolically, and better adaptation to the demands of social interactions. Until recently, the hope of using a computer to achieve these goals seemed remote. However, the development of a new language called Logo and some other user programs makes this more realisitc.

Logo. Logo was developed at the Massachusetts Institute of Technology Artificial Intelligence Laboratory over the past two decades in anticipation of the time that microcomputers would be relatively inexpensive and widely available. The idea of Logo is deceptively simple.

A child only needs three or four commands to begin directing the computer to draw lines and pictures on the screen. Kindergarteners learn what keys to push to get the triangle on the screen, called a Turtle, to move. With Logo a child controls the computer. Before children ever work with the computer, they

have worked through the idea of distance and direction with their bodies and with a floor toy. Moving from body to toy to symbol is a fundamental premise of developmental learning from Piaget. In fact, Seymour Papert who directed the deveopment of LOGO studied with Piaget and incorporated many of Piaget's ideas about learning.

Moving a "turtle" around the screen may seem trivial to some, however they would be deceived. Logo is also one of the most powerful computer languages available. What marks it as different is that it grows in power with needs of the individual. As children design more elaborate pictures or projects, the language changes and expands.

At the same time children are moving the the turtle around the screen and drawing designs, the learner is finding out that the turtle commands obey certain rules of the microworld it lives in. The rules are arithmetically and geometrically accurate so that as figures are drawn, the child explores concepts of addition, subtraction, and angles. Children learn that a circle can be draw by moving a little, turning a little, moving a little, turning a little, etc. This understanding is deeper than the ability to point at circles.

Simple vocabulary for immediate control of the computer and Turtle geometry for exploration of mathematical concepts are only the beginning of Logo's power. As children and adults create programs in Logo, they learn that programming is a problem solving technique which involves breaking a big problem into a series of smaller problems which can be solved separately. Papert calls the process "mind-sized bites." The simple vocabulary of

Logo enables the programmer to move directly to problem solving with the computer through more complex programming skills. The skills, rather than the specific language, are an important outcome of programming in Logo. Another aspect of Logo is its language ability. No one is surprised when computers deal with numbers, however the "list processing" capability of Logo makes it unique among other common languages. Second graders can begin to program poetry and manipulate text using Logo.

Logo attempts to mirror how people think and learn. The developers studied how people gradually accumulate more complex understandings about and gain mastery over their world. Seymour Papert, in his book Mindstorms: Children, Computers, and Powerful Ideas, sees the computer as radically changing the environment which children live in and therefore the kind of intellectual experiences they will have to learn from.

Logo in the preschool. Whether Logo fulfills its promise as a play environment in which children problem solve and create will depend on the way teachers respond to the challenge of a new material. The teachers' responsibility with Logo is much greater than for CAI. The role of the teacher is similar to guidance and support roles in other parts of preschool environment. A casual observer does not recognize the complexity of good play environment. Attention to individual children and thorough knowledge of the subject and objectives are essential. The demands of being effective with Logo and using it creatively for children will provide a new challenge for the early childhood teacher. Several schools have pioneered ways to teach with Logo

this effort, notably the Lamplighter School in Richardson, Texas. The report of teachers at Lamplighter (<u>Microcomputing</u>, October 1981) are enthusiastic about the children and about their own growth with computers. Although most of the projects are for primary and intermediate age children (<u>Byte</u>, August 1982), individual teachers are using Logo with younger children.

At the present time, Logo seems to be the approach which is most comprehensive and consistent with the goals of Early Childhood Education.

<u>Other computer uses in preschool.</u> Graphics and music generators are two other computer features which offer children ways to use the computer as a tool. With graphics generators, the child can specify colors and shapes to create pictures on the screen. Some are like sketching pads on the screen while other resemble a paper collage arrangements. Another type of graphics generator enables the child to design on picture which the computer then repeats all over the screen for a mosaic or quilt effect. Music generators are programmed so that children can play simple melodies or create their own tunes and play them again.

One of the most exciting uses of computers is with handicapped individuals. Children with language or physical disabilities are using computer adapted to their needs to overcome communication difficulties. Prosthetic uses of the computer enable many people to demonstrate what they know and to get information which was impossible before the technology. Goldenberg (1980) sees the computer as "eyeglasses" which liberate abilities.

Teachers and computers. A final way in which computers can be used in preschool and primary is as a tool for teachers and administrators in their jobs. Many of the routine jobs which teachers do could be facilitated with the computer. Letters to parents and reports can be written, printed and stored from year to year with only minor changes. Word processing will change ideas about writing and editing. Posters and bulletin board letters can be formed by the computer. Utility programs for teachers in elementary and high school include readability formulas, grade books, and crossword puzzle programs. Access to data bases such as the Library of Congress or ERIC will be available over telephone lines. Teachers who learn how to use computers to simplify their jobs will be prepared to help children use computers.

RECOMMENDATIONS

The goals of early childhood should be the first consideration in analyzing whether computers can be used with young children. Of the three approaches to computer education which are available in schools, only learning to use computers seems compatible with goals of cognitive, social, and emotional development. Computer assisted instruction in its present stage concentrates on abstract academic information. Computer literacy, or computer awareness, often emphasizes information about computers rather than skill with computers. Computer usage recognizes that computers are a tool and prepares the student to enter that world with skills and understanding. Logo is a new computer language simple enough for preschool children which also

encourages creativity and exploration of concepts.

Computers are a fact of life. By 1990, estimates are that 50 per cent of home will have computers. Early childhood educators have a responsibility to prepare themselves. Five things are recommended for Early Childhood personnel.

Learn about computers for yourself. Learn by going to computer stores and computer shows. Don't be fearful of not knowing anything; you are there to learn. Don't just look at the computers. Sit down and try out different brands. Take a computer for a test drive. Read general audience computing magazines such as Popular Computing or Personal Computing. Ask questions. Classroom Computer News is written for teachers. Look for courses in educational computing, rather than programming per se. This kind of computer awareness is aimed at preparing you to be a consumer.

Learn about Logo. Read Mindstorms by Papert for an overview of Logo philosophy. Harold Abelson has written Logo for the Apple II which is an excellent language manual. Currently, Logo is available on two microcomputers--the Texas Instruments 99/4A system which costs about $700 and the Apple II system which costs about $2000. Three versions of Logo are available for the Apple. Terrapin Logo by Terrapin, Inc. of Cambridge, MA seems to be the best implementation. Several colleges, including the University of Virginia, Lesley College, Teacher's College Columbia, and Austin College (Sherman,TX) , offer courses in Logo. The National Logo Exchange (POB 5341, Charlottesville, VA) is a newsletter for exchanging teaching ideas on Logo.

Learn about software. Although computer assisted instruction for preschool is not good now, new simulations and creative user programs may improve the status of software. By constantly looking at software, teachers will be prepared to recognize the good examples when they come. For now, two guidelines are justified. Never buy software without previewing and knowing what the program actually does. Software preview takes a great deal of time to make sure that the program does not have major technical problems and that the content is accurate and interesting. Second, no programs should be bought unless they makes a contribution to the curriculum which cannot be provided in some other way.

Say "yes" to computers. Say yes to the advisory committee. Again the comparison to buying a car is appropriate; no perfect answers on purchasing exist. You may have to have a computer before you can fully answer the question of what you want to do with it. Obsolescence of equipment is not as crucial as getting started and ready to move ahead in the future. No one expects to keep the same automobile or television forever. Technological improvements will not destroy the utility of one of the major brands. Choose a computer which will do what you want to do now at a price you can afford. But keep you eye on future uses also. If $300 gives you a great deal more flexibility of use and potential for expansion, the extra cost may be workthwhile.

Even more important is to say yes to computers in your life. Look for ways you think you could ease your tasks and ask how different hardware and software systems do that. Get a friend or group of friends who are interested in computers and work

together on determining how to use computers. Most computer users have a network of people who give them advice.

Remember your goals in early childhood. The final recommendation is a reiteration. Choose your approach with computers the same way you choose other materials and activities--on the basis of what children will learn from interacting with it. Think of computers as contributing to the learning environment. When a balance exists between the computer as a toy and as a tool, children will learn to appreciate its capabilities and enjoy its results.