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Abstract

This study addresses the issue of using computers in early childhood classrooms. Benefits, as well as problems, associated with using computers with young children were discussed. Guidelines for choosing developmentally appropriate software were outlined and conclusions were drawn from literature. Recommendations were made for future computer studies.

Computers and Young Children

Research Paper

Recent Research In Early Childhood

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April, 1998

ABSTRACT

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CHAPTER I

INTRODUCTION

Today, computers play a significant role in all aspects of American life. The growing use of computers in offices, stores, homes, factories, and schools is often cited as a reason for introducing computers to children at earlier ages. A highly computerized society can benefit from preparing its members to use computers, but there are critics who question the benefits, if any, of placing computers in classrooms and homes of young children. Opponents believe computers should not be placed in early childhood classrooms. They fear computers will replace other activities, are too abstract, provide children an unrealistic view of the world, lead to social isolation, and reduce creativity (Pardeck, 1986, Barnes and Hill, 1983, and Ziajkai, 1983). Young children are not miniature adults. They have different physical, emotional, and cognitive needs. Children have their own style for learning about themselves and the world. Through exploration and discovery, trial and error, and through experiencing cause and effect relationships, children acquire skills and learn about their world (Piaget, 1970). Computer experiences should be developmentally appropriate to fit learning styles of young children (Haugland, 1992).

Background of Study

Over the past twelve years, there has been considerable debate regarding the potential dangers and benefits of computers in early childhood classrooms. This debate was at its height in the early 1980s when computer utilization was beginning, and it continues to a lesser degree today (Clements, Nastasi, and Swaminathan, 1993). Opponents of computer utilization and computer advocates have made very different claims regarding how computers effect young children.

The earliest microcomputers, those available in the late 1970s and early 1980s, were too limited in memory capacity and display capability. Those microcomputers were designed to work mainly with letters and numbers, which were too highly symbolic for most preschoolers. Early micros, such as the Commodore PET, used cassette recorders and associated cassettes to store the program. Loading the program into the computer could take several minutes each time the program was started. Young children were intolerant of such a wait (Hohmann, 1990). By the early 1980s when the Commodore 64 and Apple IIe computers came on the market, it was possible to buy a simple computer with vastly increased memory, color display capability, and fast disk drives for storage and retrieval of programs. Programs could load rapidly, incorporate animated color pictures, and start not with keystrokes, but with the computers on/off switch. The advent of these features meant that earlier barriers to their use by young children were diminishing. The research question that arose was whether software designers would come up with developmentally appropriate software for young children.

For the first 30 years of technology use in K-12 education, research studies focused primarily on issues such as whether to use a certain technology to deliver instruction (e.g. computer-assisted instruction or LOGO), as opposed to a non-technology method, or to no other method (Papert, 1980). Some research simply compared traditional instruction to computer instruction, not even focusing on type of computer instruction (M.D. Roblyer, 1996). Common research questions were the following: Is computer-based instruction as effective as teacher delivered instruction in a given content area? Will the use of word processing improve the quality or quantity of students' writing? Will the use of a given technology product improve student attitudes toward school?

In recent years the focus of research studies has shifted dramatically. This

redirection is a shift from the impact of a technology product or method to that of how technology can help teachers change aspects of their learning environment, depending on whether it is the nature of their interaction with students, the ways a classroom functions, or the unique kinds of learning experiences teachers can incorporate in their classes by using certain technology resources.

This shift in focus parallels the trend in educational philosophies toward learning. The product-oriented view of the instructional process strongly influenced the development of programmed learning in the 1950s and 1960s, and still pervades the field of educational technology in the form of drill and practice and structured tutorials. This behaviorist attitude, which stems from B.F. Skinner's theory of operant conditioning, influenced the rise and fall of programmed learning (Sewell, 1990). Programmed learning stressed a highly structured and individualized approach to learning. This approach appears to offer the potential for learners to progress at their own pace, gaining mastery of a task through receiving reinforcement at successive levels of learning. Although superficially, programmed learning allowed for considerable individualization; however, the reality was that the standardization of materials did not allow for individualization. Learners followed very similar paths to the same ends, with the major variation being the time taken to achieve particular objectives. There was limited scope for genuine individualization of learning experiences, and similar objectives could not be reached by differing routes. Most programmed learning was linear and did not allow for branching, or for exploring reasons for making errors. The focus of reaching only the correct answers conflicts with recent approaches to educational technology which claim learning is optimized when individuals explore the reasons for making errors.

This belief leads to Seymour Papert's contribution to the computer education field. Papert (1980) discussed in Mindstorms his theories about how computers should

be used in the classroom. Like Piaget, he viewed learning as a constructive process in which optimum understanding comes when children build their own mental models. Papert advocated an active role for the child (the child's in control of the computer), with learners being in control and responsible for their own learning. Papert stated the computer is a tool to be used by the learner. He felt a computer is utilized best as an aid to the thinking process and not as a piece of hardware that dispenses information. Papert observed the following:

"In my vision, the child programs the computer and, in doing so, both acquires a sense of mastery over a piece of the most modern and powerful technology and establishes an intimate contact with some of the deepest ideas from sciences, from mathematics, and from the art of intellectual model building" (Papert, 1980, p.5).

Papert (1993) believed that school age children could program, and he stated previous computer-assisted instruction(CAI) was too abstract for the young child. This belief motivated him to create LOGO. In 1979, the first version of LOGO was written for the Apple and Texas Instruments 99/4 computers. Since then, there has been a proliferation of Logo versions. Papert developed a programming language, LOGO, in which children type commands to move a robot turtle or a cursor on the screen. Using simple commands, children are able to experiment moving the turtle. As they experiment they learn about numbers, size, shape, cause and effect relationships, directionality, geometry, problem solving, divergent thinking, flexibility, cooperation, turn taking, creativity, formulating hypothesis, following directions, and building language skills.

Lawler (1982) wrote that Papert believed discovery-oriented interactions with computers enhance children's learning and called discovery computer environments by the name of *microworlds*. Papert defined microworlds as *task domains* or *problem spaces* where a given cognitive mechanism can operate effectively. Children are in control acting on software to make events happen, rather than reacting to

predetermined questions and close-ended problems. Papert (1980) raised hopes that the use of computers could add another dimension to problem-solving skills, and many early childhood educators became interested in computers because of the potential for creative thinking and interaction.

Market researchers, who track software trends, have identified that the largest software growth recently has been in new titles and companies serving the early childhood education market. Of the people who own computers and have young children, 70% have purchased educational software for their children (SPA Consumer Market Report, 1994). As technology becomes easier to use and as early childhood software proliferates, young children's use of computers increases, also. Therefore, early childhood educators need to examine critically technology's impact on children and be prepared to use computers to benefit young children.

Purpose of the Study

The purpose of this paper is to determine if the use of computers is developmentally appropriate in early childhood classrooms. To accomplish this purpose, the following questions will be addressed:

1. What are the benefits in using computers in early childhood classrooms?
2. What are the problems in using computers in early childhood classrooms?
3. What are the NAEYC guidelines for developmentally appropriate use of computers in early childhood classrooms?
4. What are the software decisions which need to be made before implementing computers in early childhood classrooms?

Need for the Study

There is now considerable research that points to positive effects of computers concerning children's learning and development. Clements (1994) observed that, in

practice, computers supplement but do not replace highly valued early childhood activities and materials, such as art, blocks, sand, water, books, exploration, with writing materials, and dramatic play. Shade and Watson (1990) stated that computers can be used in developmentally appropriate ways that are beneficial to children and also can be misused, just as any tool can. There is a need to examine the implications of using computers in early childhood classrooms as literature continues to show conflicting views.

Limitations of the Study

The educational research focusing on using technology in education has been somewhat confusing. For roughly the first 25 years of the use of technology in education, researchers compared technology-based treatments with non-technology-based ones (M.D. Roblyer, 1996). Early research studies focused on gains in content areas by students using computers. These studies were difficult to summarize the results across various studies and the results were too general about the use of technology. Recent research has changed the focus from quantitative studies to qualitative, looking at how students process information and not on the product-focused research.

Definitions of Terms

The following terms will be defined and used accordingly in this paper:

Branching: Following one of two or more branches of a computer program as the result of a program decision.

CAI: Computer assisted instruction is the use of the computer as an instructional tool.

Developmental appropriate practices: Guidelines established by the National Association for the Education of Young Children which serve as a tool to distinguish

developmentally appropriate learning activities and environments.

Developmentally appropriate software: Software that is open-ended and exploratory. Children control the program making decisions and problem solving. Software is filled with concrete representations of people, animals, and objects which function realistically.

Drill and practice software: A type of computer instruction that lets students practice information with which they are familiar in order to become proficient, like an electronic worksheet.

Early childhood classrooms: Preschool through grade three.

Holistic Learning Environment: Learning is not divided into separate or distinct subject areas such as language, spelling, math, or science, instead children explore an environment such as the zoo, space, the human body, and in the process gain knowledge and skills in several diverse curriculum or developmental areas.

ILS (Integrated learning systems): A central computer with software consisting of planned lessons in various curriculum areas.

LOGO: A computer language that commands graphics.

Low-entry, high ceiling: Describes software that has expanding complexity and can be used by children at various developmental levels.

Microworld: The LOGO environment in which the child freely experiments, tests, and revises his or her own theories in order to create a product.

Software: The coded instructions that make up a computer program. Usually contrasted with the physical parts of the computer system which are referred to as hardware.

Technology: This paper refers to primarily computer technology, but could be extended to include related technologies such as telecommunications and multimedia.

Universal focus: Focus of software reflects the diverse society by representing

people of color, people of differing ages and abilities, and people from various family styles (Haugland & Shade, 1994).

World Wide Web: A resource on the Internet that lets individuals retrieve and display information based on a word search.

CHAPTER 2

REVIEW OF THE LITERATURE

Benefits in Using Computers in Early Childhood Classrooms

Clements, Nastasi, and Swaminathan (1993) stated it is not computers, but the type of computer experiences provided young children that determines whether computers enhance or inhibit development. Many of the concerns raised by critics are possible when computers are used with drill and practice software. It is only when teachers use computers in developmentally appropriate ways that these problems are eliminated and computers provide significant benefits to young children.

When children are provided developmentally appropriate experiences, computers have tremendous potential to benefit young children. Research indicates preschool children can use appropriate computer programs (Clements, Nastasi, and Swaminathan, 1993). These researchers stated that “what is ‘concrete’ to the child may have more to do with meaningful and manipulable than with physical characteristics” (p. 56). In other words, if the computer program is relevant and is a concrete representation of the real world, children can explore and experiment throughout the program; then, the computer program provides young children concrete experiences. Developmental computer experiences fit children’s learning styles because they provide children with participating learning experiences, with intrinsic and motivating experiences, and tend to be holistic learning experiences. Leeper and Malone (1985) identified four characteristics of microworlds and simulations which maximize their potential to motivate children to learn; these four characteristics are the following: challenge, curiosity, control, and fantasy.

In spite of early predictions that computers would isolate children, research has

shown that there is a higher level of social interaction when working with computers than during other activities (Clements, Nastasi, and Swaminathan, 1993). The computer area is rich with social interactions. Children can discuss what they are doing; they can ask a peer for help; they can share their knowledge with friends, and teachers can engage in complex questioning about the children's computer experiences. Clements' (1994) studies have shown that not only can children work together at computers, but they frequently prefer working with a peer to using the computer alone. Computers have facilitated social interactions for children who are shy or have not been able to find their *niche* in the group (Clements, 1994). Thus, rather than creating social isolation, computers provide children opportunities to build social skills.

We are becoming increasingly aware of the scaffolding power of the computer for children with special needs. For example, the computer aids children with attention deficits to focus, while children with autistic tendencies can relate to friends through computer interactions. Also, technology can provide a foundation for supporting children to become independent learners (Smith & Badgett, 1995). The work of Vygotsky (1978) revealed that interactions in the environment play a critical role in children's learning. Vygotsky viewed learning as an interactive process dependent on the stimulation and the support of adults and peers to teach children new skills and build knowledge. Vygotsky identified a *zone of proximal development*, a range of tasks that children are near accomplishing but need help from a peer or an adult. Sheingold (1986) applied Vygotsky's work to children's computer experiences. She discovered computers could provide children opportunities to master tasks that would be extremely difficult or impossible otherwise. Sheingold (1986) used the term scaffolding to label this type of learning.

Another benefit of using computers in early childhood classrooms is the ability

to connect people and resources throughout the world through the use of the World Wide Web, the information highway. Children have access to classrooms and libraries all over the world.

The teacher is the key to the success of computers in the classroom. The potential for computers to enrich young children's lives depends on the wisdom and expertise of early childhood educators. The way computers are used will decide if they are developmentally appropriate.

Problems Using Computers in Early Childhood Classrooms

The majority of studies that are found in this paper which criticize the use of computers tend to be completed in the 1970s and 1980s. An early fear was that computers would replace other activities, such as children's experiences with blocks, the housekeeping center, or art media (Barnes & Hill, 1983). Computers might *displace essential life experiences* and teach children concepts in a *functional vacuum* (Brady & Hill, 1984).

Critics fear that computers will push children forcing them to learn skills they are not ready to learn. Computers are viewed as one more vehicle to pressure young children, rushing them through the important childhood years and pulling children away from valuable play experiences (Barnes & Hill, 1983; Elkind, 1985 and 1987).

Brady and Hill (1984) stressed that, because of the abstract nature of the two-dimensional computer screen, children should reach the concrete operational stage (around age seven) before using computers. Elkind (1987) agreed by stating that greater intellectual maturity is required to use computers safely than young children possess.

Turner (1992) stated that "... microworlds provide children with a miniature view of the world, but it is too neat and predictable unlike the real world" (p. 32). Opponents

fear that computers will cause children to have less interaction and lead to a generation of social isolates (Barnes & Hill, 1983; Ziajkai, 1983), for children who spend time at computers will not have the opportunity to build their social skills.

Pardeck (1986) speculated that computers would change children's thought processes about how they viewed the world. Computers would create human automatons, individuals, devoid of feelings or creativity. Thus, it was feared that computers would cause children to function like machines.

CHAPTER 3

GUIDELINES AND SOFTWARE DECISIONS

Guidelines for Developmentally Appropriate Practices

In 1986, the National Association for the Education of Young Children (NAEYC) established developmentally appropriate practices for children, aged birth to eight years (Bredekamp, 1986). The guidelines were designed by applying child development theories and research to early childhood practice. They ensure that young children will be taught in ways that respect the developmental stages and promote learning through children's interactions with materials, ideas, and people. Teaching is child-initiated and teacher-supported play. The NAEYC guidelines define what materials and practices are appropriate and inappropriate.

In 1996 the NAEYC applied the principles of developmentally appropriate practice (Bredekamp, 1986) and appropriate curriculum and assessment to adopt the NAEYC Position Statement on technology and young children - ages three through eight. The statement addresses several issues related to technology's use with young children (NAEYC, 1996):

1. The teacher is required to determine if a specific use of technology is age appropriate, individually appropriate, and culturally appropriate.
2. Used appropriately, technology can enhance children's cognitive and social abilities.
3. Appropriate technology is integrated into the regular environment and used as one of the many options to support children's learning.
4. Early childhood educators should promote equitable access to technology for all children and their families. Children with special needs should have increased access when this is helpful.
5. The power of technology to influence children's learning and development requires that attention be paid to eliminating stereotyping of any group and eliminating exposure to violence, especially as a problem-solving strategy.
6. Teachers, in collaboration with parents, should advocate for more appropriate technology applications for all children.
7. The appropriate use of technology has many implications for early childhood professional development.

Developmentally appropriate software offers opportunities for collaborative play, learning, and creation. Early childhood educators committed to the belief that children are active learners, constructing their own knowledge, must use their professional judgment in evaluating and using this learning tool appropriately.

Developmentally appropriate software is open-ended and exploratory. Children control the program, making decisions and problem-solving through trial and error to make software do what they want. The software is filled with concrete representations of people, animals, and objects which function realistically.

In contrast, non-developmental software functions like an electronic worksheet or arcade game. Children are drilled to learn the correct answers to questions and are rewarded when they are right. Children are not given opportunities to discover how these objects function in our daily lives. Non-developmental software is frequently termed drill and practice.

Software Decisions Before Implementing Computers

A critical decision a teacher must make is that of selecting appropriate software. Some things have remained the same through the past decade in spite of all the software evaluation that has occurred. Drill and practice software still dominates the marketplace. Haugland & Shade (1994) estimated that approximately 25% to 30% of the software is developmentally appropriate. However, hidden in that small percentage are approximately 160 software programs for both the PC compatible and Macintosh. Software companies are still trying to market large, integrated learning systems or solutions and research has clearly shown software applications like these have the least success in helping children read or do math (Clements, Nastasi, 1993). Schools continue to place computers in isolated labs where children are taught *computer literacy skills* which Papert (1993) observed is the most useless thing we

could teach children because the technology skills will not be the same skills needed in the future. These trends make finding appropriate software difficult. Fortunately, some more recent, open-ended, creative software has been developed and well received, and perhaps, software companies will follow the trend.

For a teacher who has little experience with computers in the classroom, it is sometimes difficult to predict how a program will enhance a unit. However, the basic question to ask is whether the software will play a supportive role in promoting children's learning. The effectiveness of educational technology depends on a match between the goals of instruction, the characteristics of the learners, the design of the software, and the technology implementation decisions made by teachers (Sivin-Kachala & Bialo, 1996).

Haugland and Shade (1994) developed a checklist for evaluating software for young children. Three main areas to consider in evaluating software are the following: child features; teacher features, and technical features. Child features should involve active learning. Children set the pace and control the interactions. They should operate from a picture menu and the child should be able to use the software independently. The software should be open-ended, discovery-oriented and not simply drill and rote in order to produce independent computer users.

Also, child features should have concrete representations. In other words, graphics should be manipulable and should function accurately (i.e., a representation of a car moving, but not talking). The child should be able to manipulate the graphics and be an agent in the cause and effect process.

Another software feature should be low entry, high ceiling. This feature allows children of various developmental levels to access the computer easily, and the same software provides a wide range of complex skills each child can use depending on their developmental level.

The second area to consider when evaluating educational software is the teacher features. The software should be a tool that can be integrated throughout the curriculum, and it should empower children to learn through self-directed exploration, rather than rote memorization or drill. The software should reflect the diversity of our society by representing people of color, people with differing abilities and ages, and people from a variety of family styles (Haugland & Shade, 1994).

The third software evaluation area is technical features. Technical features are constantly changing. Software companies have made hardware more friendly, more complex, and more pleasing to the consumer eye. These changes have nothing to do with the software's content, and when making choices for educational software, teachers should know what it is they are looking for in software.

Computer-assisted instruction (CAI) refers to the use of the computer as a tool to facilitate and improve instruction. Different types of CAI software programs are on the market. These types are the following: 1) tutorials, 2) simulations, 3) drill and practice, 4) problem solving, and 5) games. The tutorials are based on the principles of programmed learning. The student responds to each bit of information presented in the material and then gets immediate feedback on each response to the question. There are two types of tutorials; branching and linear. The linear tutorial presents the student a series of frames, and there is no deviation from the presentation. The branching tutorial allows for more flexibility, and students advance according to their ability. An example of a tutorial program is Macintosh Basics by Apple Computer, Inc. 1983-1994.

In simulation programs, students take risks as if they were confronted with real-life situations without having to suffer the consequences of failure. Students can repeat experiments easily as often as they wish. Many educators believe that well-designed simulations software affords students the opportunity to apply classroom knowledge in

more realistic situations than can otherwise be set up in a classroom. This software can enhance students' learning and decision-making skills. A classic example of a simulation program is *The Oregon Trail* (MECC).

Drill and practice programs have received conflicting reviews. Drill and practice was very popular in the 1970s, and in the 1980s, until many educators agreed that drill and practice was being overused, for these educators believed that the computer should encourage higher-level thinking and not just be an electronic workbook. Today's drill and practice are said to be more sophisticated and offer greater capabilities. Educators using the drill and practice see value in good individualized drill and practice. The software frees students and teachers to do more creative work in the classroom. Many of these programs serve as diagnostic tools, giving the teacher data about how students are doing. The difference between drill and practice and tutorial is that tutorial teaches new skills and drill and practice helps students remember and utilize skills they have been previously taught.

Problem-solving programs emphasize critical thinking and cooperation and are suitable for small groups or individual students. Teachers prefer this type of software because it helps students with hypothesis testing and taking notes. Similar to simulation, problem-solving can be used with only one computer or with as many as thirty students. The whole class can be involved in critical thinking and inferences. This type of software gives students more freedom to explore than drill and practice software.

Game programs for the computer are classified as either entertainment or educational software. The educational programs have specific learning objectives, with the game serving as a motivational device; whereas, the major goal of the entertainment programs is playing the game. Educational software offers a range of learning outcomes while entertainment software has little academic value except that

in learning game strategy.

Most CAI programs incorporate more than one type of software in their design; for example, a program that is tutorial may have a drill and practice element. Many programs have good graphics and sounds. However, despite their glitzy appearance, these programs often have little value because they are not based on sound educational theory. Thus, incorporating learning theory is a crucial part of the instructional design of any high-quality classroom software package.

In addition, younger learners need to use software that teaches them how to work independently, explore, discover, learn, and make choices. Many recently published programs are multisensory and multidimensional, with vivid characters, brilliant graphics, lively music, realistic sound, and interesting animated movement. These programs hold the learner's attention and are enjoyable. Software should allow for realistic, age-appropriate expectations. Young children need quick response to their commands to the computer. These responses should not require a high level of reading skill. The younger the learner, the more the directions, and feedback should be with auditory and visual (graphics) representations.

As stated earlier, software selection is the most critical decision an educator makes in bringing computers into the classroom. After all, a computer is of little value until the software is loaded. Just as how crayons are used depends on whether children are given blank paper or coloring books (Elkind, 1987), the effective use of the computer is determined by the developmentally appropriateness of the software selected.

CHAPTER 4

SUMMARY, CONCLUSION, AND RECOMMENDATIONS

Summary

In summary, the use of computers in the classroom has improved in the past 30 years, and the educational focus utilizing computers continues to change each day. Research studies have also changed their focus, and early childhood educators are beginning to find the information they need in order to make decisions on using computers in their classrooms.

The purpose of this paper was to determine if the use of computers is developmentally appropriate in early childhood classrooms. This study addressed the following questions to accomplish this purpose:

1. What are the benefits in using computers in early childhood classrooms?
2. What are the problems in using computers in early childhood classrooms?
3. What are the NAEYC guidelines for developmentally appropriate use of computers in early childhood classrooms?
4. What are the software decisions which need to be made before implementing computers in early childhood classrooms?

Many educators became interested in computers because of the potential for creative thinking and interactions when Papert (1980) raised their hopes that the use of computers could add another dimension to children's problem-solving skills with the creation of LOGO. The early childhood educators were a bit hesitant to see computers in their early childhood settings filled with blocks, crayons, and sand boxes. Many questioned if computers were too abstract for young children. (Elkind, 1987). Brady and Hill (1984) were concerned that children must reach the stage of concrete operations before they are ready to work with computers. Recent research, however,

has found that preschoolers are more competent than has been thought and can, under certain conditions exhibit thinking traditionally considered concrete (Shade and Watson, 1990). Clements, Nastasi, and Swaminathan (1993) stated if the computer program is a concrete representation of the real world and children can explore and experiment throughout the program, then the program provides young children concrete experiences. These same researchers stated despite early predictions of computers creating social isolates their research has shown that there is a higher level of social interaction when working with computers than during other activities. Children discuss what they are doing and share their computer experiences. LOGO programming has been found to increase both prosocial and higher order thinking behaviors (Clements, Nastasi, 1985 and Clements, 1986). Thus, computers may represent an environment in which both social and cognitive interactions are encouraged.

One concern in using computers in early childhood classrooms is that computers may replace early childhood activities and materials, such as, art, blocks, sand, water, books, exploration, and dramatic play. Computers, just like any educational tool, should supplement the educational goals and program and should be used in developmentally appropriate ways beneficial to children (Shade and Watson, 1990). In following the NAEYC guidelines, early childhood educators should promote equitable access to technology for all children and children with special needs should have increased access when needed. The teacher is required to determine if the specific use of technology is appropriate. The use of technology should not involve stereotyping of any group or expose children to violence.

This leads up to the critical decision in choosing appropriate software. Developmentally appropriate software is open-ended and exploratory. Children should control the program by making decisions and by doing problem-solving

through trial and error. The software offers opportunities for collaborative play, learning, and creation. The effectiveness of educational software depends on the match between the goals of instruction, the characteristics of the learners, the design of the software, and the technological implementation decisions made by teachers (Sivin-Kachala & Bialo, 1996).

Conclusions

After reviewing the literature, one can conclude that there are potentially rich benefits to acquire through informed use of computers with young children. Inappropriate uses will have little or no benefit. Effectiveness depends on the quality of the software and the amount of time it is used, and the way it is used.

Research needs to evolve beyond simply assessing; for example, it should go beyond the effects of computers on social behaviors. We need guidance on effective software programs to use and effective ways to implement them in early childhood programs. Computers and software are changing radically and we need to keep abreast of what is best for early childhood classrooms. Teachers should be proactive in determining what to use, how to use, and when to use technology in their programs and they need the best research possible to do this appropriately.

Recommendations

My recommendations would be to research the current software programs to see how they can be incorporated best in early childhood curricula. It appears there is little information about effective ways to integrate computers in early childhood classrooms; for example, which programs fit which educational goals, how can a teacher set up the classroom to ensure each child benefits from the integration of computers, how do teachers assess the benefits of the computer being in her classroom? It is evident that computers can be used in developmentally appropriate

ways and there is software available to use, I recommend we find ways to incorporate them more effectively in early childhood programs.

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This project by: Suzanne Parsons

Titled: Computers and Young Children

has been approved as meeting the research requirement for the
Degree of Master of Arts in Education.

6-25-98

Date Approved

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7-8-98

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