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ABSTRACT
                This paper establishes a link between children's
development, appropriate teaching practices, and the use of computers in the
early childhood classroom. The paper notes the growing body of research on
young children and computers which educators can use to assist them when
integrating technology into their programs. Current investigative studies
include information about six aspects of children's development, each of
which is discussed in this paper: social development, gender, emotional
development, cognitive development, thinking skills, and physical
development. Computers can be particularly useful tools for enhancing social,
language and cognitive skills, and much of the bulk of technology research
falls into these categories; the paper attempts to summarize some of this
research about computer use and preschoolers. Of the many issues addressed in
the research, the paper highlights the computer's effect on such areas as
problem solving, reflective thinking and the cognitive development of young
children. (Author/JPB)

ENHANCING LEARNING:
COMPUTERS AND EARLY CHILDHOOD EDUCATION

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Enhancing Learning: Computers and Early Childhood Education

Many of the decisions educators make when developing programmes for children are supported by current educational research. There is now a growing and informative body of research on young children and computers, which educators can use to assist them when integrating technology into their programmes. Current investigative studies include information about six aspects of children's development, each of which will be discussed in this paper : social development, gender, emotional development, cognitive development, thinking skills and physical development. Computers can be particularly useful tools for enhancing social, language and cognitive skills. Much of the bulk of technology research falls into these categories and the following paper tries to summarise some of the research studies about computer use and preschoolers. Several crucial issues will be highlighted particularly the computer's effect on such areas as problem solving, reflective thinking and the cognitive development of young children.

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ENHANCING LEARNING: COMPUTERS AND EARLY CHILDHOOD EDUCATION

Many of the decisions educators make when developing programmes for children are supported by current educational research. There is now a growing and informative body of research on young children and computers, which educators can use to assist them when integrating technology into their programs. A lot of debate has arisen around certain issues involving the use of computers with very young children. The most controversial and well discussed concern is the impact the computer has on the social development of children. Other issues that have generated a lively discussion are the effects of gender on children's use of the computers and the influence of using computers on the development of children's self-esteem and confidence as well as their creativity. Many teachers are also concerned about the potential for computers to enhance children's problem solving skills, reflectivity and understanding of abstract concepts of the physical world. The purpose of this short paper is to establish a link between children's development, appropriate teaching practices and the use of computers in early childhood classroom.

The curriculum objectives for young children in early childhood centers should normally include experiences that stimulate every aspect of children's development – social, emotional, cognitive and physical. Computers certainly have the ability to offer activities that enhance every area of development but a discerning teacher has to examine the computer environment to focus on specific goals relevant to the child's needs. The developmental focus shifts from one domain to another depending on whether the child is alone or with another child playing on the same software scenario.

Kaden (1990) has summarised very well four crucial issues affecting computers and preschoolers . These are:

Social Development

Many children aged three to five spend much of their time using their newly discovered social and language skills like sharing and talking in the homes or preschools. Teachers facilitate the development of these positive social skills all the time and opportunities are created to provide essential skills in cooperating, helping, negotiating, and mutual planning. Computers have been shown to be helpful in furnishing such skills though critics are convinced that computers will isolate children in the crucial years when they are just developing new social skills.

Many studies reveal that, in fact , computers encourage more cooperation and collaboration in young children (Bracey, 1982; Vaidya & McKeeby, 1985). Some research has also shown that students are often less competitive and more cooperative in attempting to solve common computer problems (Watt, 1982; Zonderman, 1982). More peer tutoring and conversation has also been observed (Hawkins, 1982; Spencer &

Baskin, 1981). These evidence demonstrate that, rather than causing the isolation of children, computers can enhance their social development in areas of cooperation, peer assistance and sharing of possible solutions to common problems.

In the early childhood classrooms, research results indicate that as much social behaviour occured around the computer as in other typical play areas (Watson, Nida & Shade, 1983). The computer does not lead to social isolation or have deleterious consequences on the social development of young children (Nida, Shade, Lipinski, & Watson, 1983). Researchers found that rarely were the children alone at the computer; they were usually in dyads or triads. In a similar study (Watson, Nida, & Shade, 1983), the investigators examined the effects of the microcomputer on young children's free play choices. After the novelty of the computer wore off, its presence did not dominate children's classroom activity preferences.

The Children and Technology (CAT) Project (1983)

This piece of research on the effects of computers on preschool children's social behaviour was done at the University of Carolina under Dr. Daniel Shade . The project and key findings were reported by Kaden (1990). The following is quoted on page 265.

The CAT Project observed children's interactions with age-appropriate software and reported some interesting conclusions about their social development, as well as their technical ability. Using the Stickybear (1983) software, the children soon realised that they would all get turns at the computer, competition decreased, and their helping behaviours increased. Initially, the children spent their time jockeying for turns at the keyboard. Over time, though, the focus became centered on the use of the software and proper use of the computer.

Children began to form natural dyads, and there was less aggression toward the machines and their classmates. The teacher's presence at the machine also served to decrease any aggression toward the machine and increased the children's interest in the computer. Indeed, the teacher's apparent availability for assistance increased the children's independence. The CAT project found that more children using the machine tended to increase the amount of aggression observed, so dyads and triads seemed an ideal strategy for reducing competition.

Most of the children liked working with the teacher at the computer, and most also liked programmes that gave them control over their interactions. Class "experts" emerged from this preschool group. Children who watched the monitor made an easier connection between the keyboard and the resulting action on the monitor. These children, as a result stayed at the computer longer, and soon were considered the "experts" to ask for advice by classmates. Other researchers, too, reported that most children spend time at the computer with a peer and look to class "experts" for computer assistance more than assistance with other classroom tasks (Muller & Perlmutter, 1983); Nieboer, 1983; Sheingold, Jewson, Gearhart, & Berger, 1983; Taylor, 1983).

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Another report made by the CAT group describes a two-study investigation of the effect of the microcomputer on preschoolers' social behaviour. Conclusions were that the only difference in children's social interaction patterns was in their antisocial behaviours. The research group found that the critical factors affecting antisocial behaviours were the ratio of children to computers and the amount of structure provided by the classroom teacher. A ratio of 10-1 and appropriate teacher-initiated structure, rather than 20-1, reduced aggression significantly. Clearly, this research has strong implications for the use of the computer in a preschool setting. The role of the teacher is still central to the effectiveness of computer use in the classroom.

Gender

Another concern expressed by many educators is that boys would be more interested in the computer and, therefore, use it more than girls. In one study, Lipinski, Nida, Shade, and Watson (1983) found no significant sex differences in children's free-play choices. But in another study, they observed that boys did spend more time at the computer than girls. But both studies found that with the children with high and medium competency, both sexes spent equal time at the computer.

Beeson (Beeson & Williams, 1983) looked at this issue and found a significant difference between five-year old male and female use of the computer. Males chose the computer much more frequently than females. But with older children (six year olds), neither gender nor age influenced their computer usuage. Research on this issue is still being conducted in order to clarify the effects of gender and age on children's use of computers. It shows that computer use needs to be closely monitored and managed by the classroom teacher.

Cognitive Development and Thinking Skills

The computer can offer novel intellectual experiences for young children and a unique opportunity (difficult or impossible to derive from other media) for young children to manipulate the variables in the physical world (eg gravity, momentum, speed in physics) and to discover the effects of each. Developmentally appropriate simulations from computer games can plunge children into the world of economics , politics or biology and in addition , children can also explore the internal workings of a computer. These can provoke children's reflective thinking in previously unexplored way. Eg children intuitively know how to build a block tower and suppose a computer programme allows children to move block images on the screen to reconstruct this same tower. Here, the child will need to teach the computer how to do what the child intuitively does in the three-dimensional medium. The translation from muscles to symbols is important thinking.

Barnes and Hill (1983) strongly believe that children ought to reach the stage of concrete operations before they begin working with computers. However, many researchers have begun to investigate preschoolers using computers and disagree with Barnes and Hill's argument. Brummel and Jaworski (1984) studied a group of twenty eight first graders after working with them for 10 weeks on computer skills and then LOGO. The children developed the required keyboarding skills to interact with the machine, and all exhibited some degree of logical thinking demonstrated by the use of LOGO for the development of a final graphic display. They all exhibited enthusiasm when they were in control of their own learning on the computer and proudly finished their final products. Research has shown that there is no question that preschool through third grade children can interact successfully with a computer and learn to think and program.

Research with young children and technology has also focused on thinking skills and computers. Forman (1984) suggests that interactive video may enhance children's reflectivity by allowing the child to gain new perspectives previously impossible with three-dimensional toys. Interactive video offers control as a new element to computer play. Children can manipulate variables and experiment with the effects of their changes. Forman and Kaden (1987) indicate that video replay can be a powerful tool for provoking refelctive thoughts. Using SmurfPaint and Play, children can create and enact scripts for Smurf characters and animate them in a playful, immediate mode. They tend to reflect back on what they did with their Smurfs.

Additional research on problem solving by young children with computers has been reported by Clements and Gullo (1984). Their research observed first graders programming in LOGO. They found that the children showed improved results on two specific thinking tests after learning LOGO, but not on an overall thinking test. LOGO tend tonded to increase their creativity and ability to reflect on their own thinking, but there was no revolutionary change in their overall cognitive development. Such data will certainly help educators develop reasonable expectations for using computers in our classrooms.

Emotional Development and Attitutes toward Computer-Based Learning

In every area of the curriculum (Kaden 1990, p266), teachers are always alert to children's interests, and to establish environments that engage and challenge children. Teachers need to select experiences that are exciting and interesting. What kinds of computer software do children prefer? In a study by Sherman, Divine, and Johnson (1985), four year old children indicated an overwhelming preference for problem-solving software over drill and practice software, that are relatively passive and offer little freedom of choice. Drill and practice software offers few opportunities for invention (sheingold, 1986). Instead, computers could be machines that children could use for making, doing, and creating, using dynamic, user-controlled software environments. The computer's uniques properties ought to be emphasised when planning computer activities for young children.

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Children can now compose music or stories using the computer and this opens up more opportunities for technology to supplement more traditional educational media. The young child's aesthestic development can be addressed in a unique form. They can enjoy and experiment on various forms of music and art. Computer graphics, word processing, Cd Roms etc can have facilitate young children's appreciative and expressive qualities.

In a study by Bergen , Ford and Hess (1993) it was reported that patterns of motivation and social behaviour among 95 kindergarten children working in pairs at microcomputers were investigated over a four month period. These children displayed a high level of interest that did not diminish over the course of the study as a novelty effect would have predicted, although on-task behaviour and indications of intense interest did decline slightly over time. It was observed that generally , the children were equitable and cooperative in their interactions. Almost no gender differences were evident in either motivational or social behaviour patterns. Teachers were equitable in their interactions with boys and girls, and they were more likely to interact with low-achieving children than with high achievers. The results suggested that introducing children to microcomputers reduce the predominance of male computer use and interest that may emerge during that age.

In another study, Yelland (1995) interviewed sixty young children and asked them about their attitudes to computers and computing . He found that the children had positive attitudes towards the use of computers and were able to describe and discuss the range of functions that they could perform. A recent research by Seng and Choo (1997) looked into the attitudes and level of anxiety of 77 children toward the computer and it appeared that these children showed a high level of self-esteem and confidence. Results showed that only 5 did not feel confident working on computers and very few worry about performing on the computer in front of peers or the teacher. The children also had a strong liking for computer-related activities, over one third expressed a strong liking for learning to use programming software and to install a computer and about half liked to maintain and repair computers and learn how computers are assembled.

Singapore Sample

A group of 34 Singaporean children (4-6 year olds) were given the same questions similar to the Yelland (1995) study and the following highlights are noted. (see tables attached)

1   Both the Singapore and the Australian sample identified similar functions of the computer eg a computer can play games, write messages, help you to study.
2   Similar descriptions were given about the computer eg has a keyboard, has a cursor or mouse, buttons, square or rectangular shape.
3   More Singapore children (boys and girls) have computers at home than Australian children
4   More Singapore children have also computer games at home.

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5   90% of the Australian sample say they are good at using computers compared with 82% of the Singapore sample.
6   29% of the Singapore sample think boys like computers more compared with 16% of the Australian sample
7   More boys (47%) in the Singapore sample think boys are better at using computers than the boys (16%) in the Australian sample.

Summary

There is now so much research indicating the benefits of technology in the early childhood classroom that it is a question of not if but how teachers can incorporate technology into their curriculum. Educators may disagree on the most beneficial and effective ways to use computers, which should be used as tools for thinking, not as drill and practice machines. It is now recognised that computers are being used successfully by even very young children and contrary to the sceptic's beliefs, computers will not make children social isolates. Rather evidence exists that computing may serve to promote independence, cooperation and communication. It also improves problem-solving ability and reflective thinking. More and more often these days, the early childhood teacher can have access to such a growing body of knowledge about computers and how as discerning educators, they must make use of this body of research to help them make wise decisions integrating technology into their curriculum.

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SINGAPORE SAMPLE

	BOYS	GIRLS		
4 year old	2	2		4
5 year old	7	6		13
6 year old	9	8		17
Total	18	16	N=	34

ARE YOU GOOD AT USING COMPUTERS?

	YES	NO	
BOYS (n=18)	15	3	
(n=30)	27	3	
GIRLS (n=16)	13	3	
(n=30)	27	3	
TOTAL (n=34)	28	6	Singapore (4 – 6 year olds)
(n=60)	54	6	Australia (6 – 7 year olds)

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DO YOU HAVE A COMPUTER AT HOME?

	YES	NO	
BOYS (n=18)	18	0	
(n=30)	15*	15	
GIRLS (n=16)	14	2	
(n=30)	7	23	
TOTAL (n=34)	32	2	Singapore
(n=60)	22	38	Australia

DO YOU HAVE ANY COMPUTER GAMES AT HOME?

	YES	NO
BOYS (n=18)	16	2
(n=30)	17*	13
GIRLS (n=16)	9	7
(n=30)	4	26
TOTAL (n= 34)	25	9
(n= 60)	21	39

WHO YOU THINK LIKES COMPUTERS MORE (boys, girls, same)

	BOYS	GIRLS	SAME	DON'T KNOW
BOYS (n=18)	8	1	9	0
(n=30)	7	1	22	0
GIRLS (n=16)	2	3	10	1
(n=30)	3	5	21	1
TOTAL (n=34)	10	4	19	1
(n=60)	10	6	43	1

WHO ARE BETTER AT USING COMPUTERS? (boys, girls, same)

	BOYS	GIRLS	SAME
BOYS (n=18)	12	1	5
(n=30)	7	1	22
GIRLS (n=16)	4	5	7
(n=30)	3	5	21
TOTAL (n=34)	16	6	12
(n=60)	10	6	43

Interview Questions:

1   Can you describe what a computer looks like?
2   What can a computer do?
3   Do you think computers help you to learn?
4   Are you good at using computers?

5   Do you have a computer at home? (if yes, the types & use)
6   (If no) Would you like one?
7   What have you used a computer for at school?
8   Do you have any small computer games?

9   Do you think that boys LIKE computers more than girls,
    or do girls like them more than boys, or do they like
    them the same
10 Who do you think would be better at using computers; girls or
    boys or would they be the same?

Describe a computer for me:

(Australia)	(Singapore)
Screen (50%)	TV
Buttons	Mouse
Keyboard	Keyboard
Letters/numbers	Square monitor
Play games with it.	Mouse pad
Square shape.	Printer
Plug/cards/switch	CPU
Little box	Disc holder
Machine number	Internet
It can help you.	CD Rom drive
It has a brain	Buttons
Grey	Wires
Has a cursor	Headphones
	Has volume
	Speakers
	Needs electricity
	Rectangle
	Something you can save
	Diskettes

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What can a computer do?

(Australia)
play games
write messages
tell you things
help you do sums
record messages
help you
make noises
put things on screen
shows you things
let you do things
uses discs
memorises
shows pictures

(Singapore)
play games
help you do work
type words
surf the net
store games
help you to study
help you to read and learn
do work for us
can speak
can tell you things
can think from the CPU
make a picture
can discover things
tell you how to count money
can print
can colour
make cards
can draw
can teach
can do homework

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