Computer Mediated Learning in Preschools: Why Bother?

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This paper discusses a range of computer applications in preschools, provides a rationale for the use of computers with young children, defines characteristics of effective computer mediated learning for young children and reports on a number of research activities in which the author and colleagues are involved. Answers are given to a range of important questions. For example, will children voluntarily use computers, how frequently, and will they be able to use them efficiently and remain on task? Do computers encourage independent play and discourage parallel and cooperative play? Is the computer motivational and does it help to focus learning? And is an adult's presence at the computer necessary, or desirable?

Background

Computers are hardly widespread in Australian preschools. Indeed many Child Care Centres and Preschools are still to realise the benefit of computerising what is a complex and demanding management and administrative structure: the question of using computers as a milieu for learning would seem not to be on the agenda at present.

The research reported here, on computers and preschool children, dates from an Australian Apple Education Foundation grant awarded in 1984. At that time there was little research data available to provide guidance as how most effectively to use computers with very young children, so we conducted exploratory research on those variables important to the objectives and organisation of preschools (Elliott and Hall, 1986a). This research gathered data on the nature of young learners' interactions with computers and peers. In particular, data was gathered concerning the facility with which children used the computer, how frequently they used it and how long they stayed, how they used and interacted with the robot attached to the computer, the language used while at the computer, and the extent of independent, parallel and cooperative play (Elliott and Hall, 1985a, 1985b, 1986a, 1986b; Hall and Elliott, 1986).

Smart Enough to Use a Computer?

In the early 1980s questions were raised about young children's ability to use a computer. These questions concerned the skill of turning the computer on and loading the software, and the need to interact with the computer through a keyboard. Adults who were themselves either computer illiterate or fearful of new technologies expressed concern about the possibility of young children being smart enough to use this technology. Of course it was simply a case of misplaced anxieties: the adults allowed their anxieties to be projected onto young children, who in fact had no suspicions or fear of the technology. There was a second argument for not using computers with young children, perhaps more educational in nature, and related to the availability of only upper case letters on computer keyboards. Adults were fearful that this would be a handicap to youngsters, or that they would in some way have their future learning impaired through the use of uppercase letters. In reality, children are surrounded by examples of upper and lower case letters, just consider everyday advertising signs, traffic signs, and the like. In any event, young children with whom I worked have never expressed or shown any reluctance to use a computer or to be able to interact with it meaningfully. The fact that these issues died something of a natural death seems to suggest that perhaps they were never important issues.

Social and Emotional Development

A more serious concern that teachers of young children expressed when computers in early childhood education were first discussed, and an issue still with some currency, is the potential for computers either to encourage activities which are socially or emotionally isolating or at least to discourage social and emotional development. There was no obvious answer to this, and one's intuition was not as clear in this case as in the question of young children's ability to use a computer. In fact this question goes to the heart of preschool education, where a major objective is to socialise young children, to teach them to share, to cooperate, and to care for others (Ebbeck, 1991; Eliason and Jenkins, 1990). Research indicates that there is little need for concern in this area. That is, left as an optional learning centre, as is the block corner or the sand pit, the computer corner will attract children who will work together cooperatively. Data in Table 1 show the extent of social interaction and cooperative behaviour in an early research activity (Elliott and Hall, 1986a). More importantly, research that I will refer to later indicates that working in groups is an increasingly important part of the use of computers in educational contexts, and that the quality of learning is actually enhanced by group

interaction.

Table 1: Social interaction
and cooperative behaviour*

	Total	Mean
Children observed in computer area	190	3.3
Children observed interacting socially in computer area	148	2.6

(* data based on 57 observations)

Other skills to be encouraged in early childhood settings include learning to cope with social conflicts, being helpful and encouraging leadership. And of course the need to avoid stereotypes, uninformed opinions and unintended bias is all important. Will the availability of a computer influence young children in any of these areas? Many instances of observational data from this study showed resolution of conflicts, typically about the nature of the problem to be solved or whose turn it is to use the keyboard, and instances of sharing, caring and leadership behaviour. However, data from this study, shown in Table 2, clearly indicates sex differences in young children working with computers.

Table 2: Sex differences
in computer usage

Average number of girls in computer area at any given time	1.2	(10%)
Average number of boys in computer area at any given time	2.2	(24%)
Average time on task		
- girls	8.2 minutes	
- boys	18.8 minutes	

(Elliott and Hall, 1986a)

These data show that in this group of children there are more boys than girls at the computer at any given time, and there

are differences between boys and girls in the time they remain working in the computer area. That is, a higher proportion of boys than girls came to the computer, and they remained longer.

Play and Skill Development

Play is of course another of the corner-stones of early childhood education, where it is seen to have a broad range of values and purposes. Play is perceived to provide opportunities to express thoughts and ideas, to promote physical and motor development, and to encourage social and emotional development (Eliason and Jenkins, 1990). Where then does the computer fit in with play?

In those situations where the computer centre is an optional play area, children freely participate in computer based activities in the same manner that they may choose to play with blocks or use the dressing up corner (Elliott and Hall, 1985a, 1986a, 1986b). This research indicated that the computer provided no disincentive to expressing thoughts, ideas and social interactions, as is shown in the observation reported in Table 3.

Table 3: Children at the computer:
thoughts, ideas and social interaction.

Observation 6.3
Four children in the computer area, child 2 has never used the computer and is being taught by two other children.

child 1 Press B for backwards.
child 2 (Does this).
child 1 Now this one (the return key).
child 2 (Does this).
child 3 Do you want to make it walk?
Do you want to make it talk?
child 2 Yes.
child 3 (Types TOOT).

Now press the number you want.
child 2 (Does this).
child 1 Good. Now don't press any of these.
child 3 F please.
child 2 I did it.
child 3 OK, now press the one with the arrow
(the return key).
(Elliott and Hall, 1986a)

This research also identified a number of skills developed or practised while children were at the computer. For example, in

addition to learning to use the computer and its keyboard, children learned concepts such as left/right, forward/backwards, above/below, in/out, developed skills in estimating distances and angles, practised shape, colour, letter and numeral identification, increased their language skills and applied a range of problem solving strategies (refer to Table 4). Using the computer allowed children to practise and improve their fine motor skills, and encouraged them to focus their learning and to remain on-task.

Table 4: Problem solving
at the computer

Observation 6.2
Child working alone at the computer, talking to himself.

Backwards.
Oh, wrong way (types wrong key).
Right...done. Good (corrects mistake).
Forward.
Oh, wrong one (types wrong key).
There we go (pressed correct key).
Now I'll go right through the tunnel until I get to the other side...
(Elliott and Hall, 1986a)

Special Needs Children

A particular group of children who receive various forms of early childhood services support beyond the average are those referred to as special needs children or children with developmental delays. These children may have any of a range of physical or intellectual disadvantages, or may have social disadvantages in that they come from an environment which is highly stressful because of unemployment, drug abuse, inappropriate parenting techniques and the like. In Australia various funding agencies support curriculum development and to a lesser extent research to support these children through early intervention. The well known Head Start program in the USA takes the form of an intervention program to provide these categories of children, especially those from socially disadvantaged backgrounds, with educational, social and emotional support in the year before formal schooling begins. The Head Start experience indicates that a range of long term benefits accrue because of this program: children improve in cognitive development and school achievement, fewer of them are assigned to special education classes, and more stay on to complete high school (Berk, 1991). The question once again becomes what does computer mediated learning have to offer these developmentally delayed young children?

Research with at-risk children using computers has produced pleasing outcomes. In one research project involving computer

mediated learning two groups of children took part in ten twenty-minute at the computer sessions over a six week period, in the discipline area of mathematics. To overcome these children's typical low concentration span, they worked in pairs at the computer together with an adult. One group used commercially available mathematical software, the comparison group used a range of non-mathematical software. In each case the adult supported children in their learning, gave assistance when necessary, and encouraged children to remain on task. The data indicated that those children in the experimental group were able to make significant gains in their mathematical skills and concepts (Elliott and Hall, 1990a, 1990b, 1990c). Adults frequently have low expectations of these children, but the data indicated that computer based activities resulted in valuable learning outcomes: and the Head Start outcomes reported above give us some hope that these benefits will be permanent. Other important outcomes of this research were the role of the computer as a focus of learning, the structure that the computer activities gave to a curriculum area in which early childhood educators typically lack confidence, and the essential role of the adult to redirect any off-task activity by the children.

Teaching Approaches

The research reported above answers questions about children's ability to learn from computers, the potential benefit of appropriately selected educational computer software, and the value of an adult's presence. But what will be the outcome if the role of the adult is deliberately manipulated? That is, is there a particular pedagogical and interventionist approach that leads to learning outcomes beyond those one would normally expect? To answer this question three randomly selected groups of at-risk preschoolers were formed: two groups worked in pairs at a computer with adult assistance, for fifteen twenty-minute computer sessions over a four week period, the third group had no computer based experiences (Hall and Elliott, 1992).

In one experimental group the adult took on the role used in the previous research: that of a caring and supportive guide. The adult encouraged children to remain on task, and provided reinforcement. For the second experimental group the adult adopted a metacognitive approach to teaching. In this approach the adult gave direct guidance, provided cues and questions, and modelled and demonstrated aspects of the material to be learned (Elliott, 1991). The computer software focused the child on new learning, and the adult's interventions encouraged learners to link this new

knowledge with their present knowledge. This intervention is essential in ensuring there is a metacognitive aspect to the computer sessions, and typically took the form of 'show me three fingers', 'clap three times', 'count my (three) fingers', 'draw a three in the air with your finger', 'what song did we sing yesterday that had three in it?' and 'write a three for me'.

Data from this research are still being analysed (Elliott and Hall, 1992), but early indications are that both teaching approaches provide greater mathematical learning than the existing mathematical content of the preschool's curriculum. There is support too to show that a metacognitive teaching approach will result in greater mathematical learning than a typical caring, concerned teaching approach. That is, there is a specific teaching approach that encourages learning of mathematical concepts and skills, and it is a better approach than would typically be used by teachers in preschools.

The theoretical basis for this research is derived from Vygotskian notions of the zone of proximal development and the internalisation of externally provided guidance. In such situations learning is mediated by interactions with more competent group members (Rogoff, 1990; Vygotsky, 1978) resulting in ongoing stimulation and motivation for learning. The value of using the computer lies in its generating worthwhile learning experiences through already existing content, the in-built cognitive supports of its software, and its motivating and engaging nature. When these contextual features are supported by co-participants (teachers and peers) the result should be increased cognitive activity that serves to support learning and thinking.

Discussion

This paper set out to answer a range of questions about the role and value of computer mediated learning in preschools. The title of the paper may appear somewhat negative or pessimistic, but the paper has set out to show that the use of computers with young children is very likely to have positive intellectual and social outcomes. In particular this paper has argued that young children will voluntarily use computers efficiently and remain on task, and that computers support parallel and cooperative play. It has also been argued that the computer is motivational and helps to focus learning, and that while an adult's presence at the computer is not essential, learning outcomes are likely to be improved by both the presence of an adult and peer interaction at the computer.

Further research in this area needs to be concerned with the

role of metacognitive processes in early mathematics learning, the teaching of mathematics in preschools, the role of the computer in this process, identifying those contextual supports that maximise metacognitive activity and learning outcomes, and the professional development of early childhood teachers to allow them to apply these research findings.

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