COMPUTER USE WITH PRESCHOOL CHILDREN:
A REVIEW
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Abstract

The purpose of this review of literature was to determine how beneficial computers are related to cognitive, language, social development with preschool aged students. Does digital media, in early childhood education, affect student achievement? Much has been written about actual and potential uses of computers with young children, but there is a limited amount of sound research-based information on the cognitive, communication and social effects of such use. Computers may be beneficial as an additional tool for remedial purposes with children who are at risk or who are identified as having learning difficulties and that children talk and interact with one another when paired at the computer. Compared to traditional preschool activities, computers have not been proven to be more beneficial for the typical developing child. However, technology is here to stay and preschool children who do not have access to computers need to be prepared to use technology by the time they enter into the K-12 system.
Chapter I

Introduction

Rideout, Vandewater, & Wartella, (2003) studied 1000 families in a project titled *Zero to Six: Electronic Media in the Lives of Infants, Toddlers and Preschoolers*. They found that children six and under spend an average of two hours a day with screen media, mostly TV and Videos while at home. Seventy-three percent of the families interviewed have computers in their home with 70% of the children using them. Forty-eight percent of all the children six and under have used a computer by the time they are in the 4 to 6 year old range. A market of videotapes and DVDs such as Baby Einstein, Noggin, Backyardians and computer software such as Giggles Computer Fun Time for Baby aimed at 6 to 24 month old children are widely available. Multi-million dollar industries such as Hatch and Genius Babies selling computer games, touch screen windows, and special keyboard toppers for children as young as six months old have also become widely available. Acquisition of computers by elementary and secondary schools in the 1980’s was dramatic. Since, preschools and daycare centers have become entranced with this technology.

The National Association for Educating Young Children’s (NAEYC) a leader in the field of early childhood education position regarding computer use is as follows:

Technology plays a significant role in all aspects of American life today, and this role will only increase in the future. The potential benefits of technology for young children's learning and development are well documented (Wright & Shade 1994). As technology becomes easier to use and early childhood software proliferates, young children's use of technology becomes more widespread. Therefore, early childhood educators have a responsibility to critically examine the impact of technology on children and be prepared to use technology to benefit children.
However, there is concern among professionals who believe that movement and physical experience provide the foundation for intelligence through integration of the brain’s sensory association areas, that computer use will limit and alter the way the brain processes information. According to Healy and Ayres (1972), the brain develops from the back to the front. Young children’s visual area will be much larger than the auditory, so the brain will attend to what the child sees rather than hears. The sensory areas of looking, touching and moving should be refined during these years. They argue that sensory systems should become automatic so that by around age seven, children can integrate them smoothly. This sensory integration takes a lot of practice and is critical for good learning. Computer use, by their two dimensional design, provide less opportunity for children to integrate their senses than traditional types of learning activities.

**Problem Statement**

From 1980-2009 with the rapid advance of computers and digital media entering the public schools, preschools and daycare centers, several questions emerge: how beneficial are these technologies, specifically computers, to our preschool children? Is it cost effective to continue supporting computers, software, and related teacher in-services to maintain them in the preschool programs during a time of financial crisis and educational scrutiny? Are computers beneficial regarding brain development?

**Research Question:**

The purpose of this review of literature is to address the following research questions: First, how is the use of computers related to cognitive, language and social development in a preschool setting? Second, what effects do digital media have in early childhood education student achievement?
**Definition of Terms**

Scaffold Instruction: (Shute, 1997) This is a teaching strategy aimed at the zone of proximal development of the child. The level of assistance is tailored to the learner’s degree of competence.

False-Belief tasks: (Gletcher-Flinn, 1998) that is, to recognize that others can have beliefs about the world that are wrong. To do this, it is suggested, one must understand how knowledge is formed, that people’s beliefs are based on their knowledge, that mental states can differ from reality, and that people’s behavior can be predicted by their mental states.

Theory of Mind (ToM): (Gletcher-Flinn, 1998) concepts of mental activity: the way somebody conceives of mental activity in others, including how children conceptualize mental activity in others and how they attribute intention to and predict the behavior of others.

Sensory Integration: (Aryes, A. 1972) Sensory integration is the ability to sort out and connect information from our tactile, olfactory, gustatory, vision, auditory, vestibular and proprioceptive senses through our central nervous system. Sensory integration is preprogrammed to develop at somewhat predictable sequence. By about 8 to 10 years of age, the basic functions of sensory integration are felt to be matured or well integrated if all goes according to plan.
Chapter II

Review of Literature

The following review of literature will address computer use relative to cognition, language and social development. Although motor development is significant when considering brain development in young children, computers do not lend themselves to motor activities.

Cognition

Shute & Miksad (1997), compared the impact of computer assisted instruction and conventional teaching resources on preschool childrens cognitive development. The purpose of the study was to answer the following questions:

1. Is the computer per se, superior to traditional teaching resources when level of scaffolding is controlled? (1997, p.239)
2. Is software successful in increasing specific cognitive skills such as counting, sorting, and word knowledge? (1997, p.239)
3. Would software with substantial levels of scaffolding advance cognitive development significantly more than minimal scaffolding? (1997, p. 239)

The study included 51 preschool children, ranging in age between 2 years, 10 months to 5 years 0 months. The 25 boys and 26 girls spoke fluent English and represented a cross-section of socioeconomic status. Although specifics of the socioeconomic status were not given, 19 or 37% of the students who participated had computers at home and spent any where from 5 to 120 minutes on the computer per week according to the parent questionnaires. The 51 students, representing 81% of the children attending an Australian preschool/day-care, were given permission by their parents by signing a consent form and completing a questionnaire to participate in the study. The children were grouped by pretest scores on the McCarthy Short Form in below average, average, or above average ability then randomly allocated to one of three treatment conditions. It is important to note that included in the 6 subscales of the McCarthy
addresses counting, word knowledge and sorting. Also, prior to pre-testing, a computer was left at each center for one day during free time with neutral game software to counter some of the novelty effects. The control group received instruction using traditional resources such as balloons, animal toys, and cards with words, numbers, and pictures. Two groups received instruction via the computer, one using minimal and the other substantial assistance (scaffold) software. In each group, children received one individual 20 minute session per week, for 8 weeks simultaneously, with catch-up sessions provided for absentees. After the 8 weeks of treatment sessions, a post-testing on the McCarthy Short Form occurred one week after the end of the treatment.

Using the control group compared to the minimal computer group, the first comparison focused on the relationship between computers as a medium of learning and traditional resources. Researchers found no evidence that general cognitive development was promoted more by computer use than by traditional teaching resources matched for level of scaffolding. However, the results provided evidence that computer assisted instruction software significantly increases word knowledge but not counting and sorting.

Li and Atkins (2006) researched home and school computer use on school readiness and cognitive development among Head Start children. Utilizing four classrooms, this study included 122 Head Start student participants, 57 boys and 65 girls ages 38 to 61 months of age. Their purpose was to examine the impact of computer use on school readiness and psychomotor skills. Children were either placed in a control group which received a standard Head Start curriculum or in an the experimental group given the opportunity to work on a computer for 15-20 minutes per day with their choice of developmentally appropriate educational software. The experimental and control groups were purposefully established to create minimal variance in
terms of age, gender, parents level of education, frequency of computer accessibility, computer use at home and family characteristics as well as pre-test scores on four standardized tests.

Four standardized tests were administered at baseline and 6 months later to assess their school readiness, visual motor skills, gross motor skills, and cognitive development. The four tests were: BoehmTest of Basic Concepts (3rd edition)- school readiness: The Bender Visual Motor Gestalt Test for Children: Test of Gross Motor Development (2nd edition): and, the short form of the Wechsler Preschool and Primary Scale of Intelligence-Revised. During the period between the baseline and the follow-up assessment (i.e. 22 week period) teachers were asked to record on a weekly recording sheet the number of days each child worked on a computer. However, only one classroom provided recording data for all 22 weeks, and two classrooms provided data for only half of the time. The fourth classroom provided recording data for only 9 weeks; therefore, the researchers used available data in each classroom, calculated the average days of computer use per child per week for their analysis.

The results showed that the children who had used a computer at home and/or at school performed better than those who had not used a computer in the area of school readiness on the Boehm-s test. On the Boehm-3 post test, the mean score for the control group was 40.23 and the experimental group 54.66. However, the percentage of growth on the WPPSI-R, which measures cognitive development, showed a similar and sometimes better performance by the control group than the experimental group when comparing the pretest and post test in block design, picture completion, information, similarities, and estimated IQ. In the area of block design, students in the control group scored 8.31 (2.99%) on the pretest and 8.62 (3.03%) on the post test where as the experimental group scored 8.16 (2.42%) and 8.70 (2.40%) respectively. In the area of picture completion, the control group scored 10.49 (3.21%) pretest and 10.76 (3.37%)
posttest and the experimental group scored 10.85 (2.88%) pretest and 11.16 (2.46%) post test. In the area of Information the control group scored 7.62 (2.43%) pretest and 8.29 (2.68%) post test where as the experimental group scored 8.07 (2.32%) pretest and 7.70 (1.97%) post test. In the area of similarities, the control group scored 8.05 (2.30%) pretest and 8.22 (2.71%) posttest where as the experimental group scored 8.87 (2.29%) pretest and 9.12 (1.94%) posttest. In the area of estimated IQ, the control group scored 90.36 (13.44%) pretest and 93.11 (14.68%) posttest where as the experimental group scored 92.34 (11.09 %) pretest and 94. 49 (9.37%) post test.

A linear comparison between children with home and outside of school access to computers and children who did not have access with computers outside of school was also calculated. According to Li and Atkins, the children who had used a computer at home and were assigned to the experimental group performed the best in the Boehm-3 test, WSPPSI-R performance tasks (block design and picture completion). Although data was not given for the WSPPSI-R performance tasks, on the Boehm-3 post test, students in the control group that did not have access to computers outside of school performed the lowest at the 21st percentile where as the students in the experimental group that did not have access to computers outside of school performed at the 48th percentile. Children with access to a computer outside of school either at home or somewhere else scored at the 42nd –control group and 50th percentile-experimental group. Students who had access at home and were in the experimental group scored the best at the 68th percentile.

Goodwin, Goodwin, Nansel, and Helm (1997) investigated the effects of microcomputers use on preschoolers’ knowledge of basic reading-readiness concepts and on their attitudes toward the microcomputer. Seventy-seven children enrolled in a child care center on an urban campus
that includes three institutions of higher education. The center consisted primarily of children of
the faculty, staff and students at the three institutions. The 39 male and 38 female subjects
ranged in age from 37 to 66 months. The majority were Caucasian with 5 being black, 3
Hispanic and 1 Oriental. Thirteen percent of the parents indicated that they had a microcomputer
at home, but typically their preschoolers had spent less than one hour using the home
microcomputers. The center did not yet incorporate microcomputers into its educational
program.

A true-experimental, factorial design was used. The independent variables were
treatment, age, and sex. Subjects were stratified by age and sex, then randomly assigned to one
of three treatment conditions: adult assisted, adult-unassisted, or control. Age was broken down
into two groups: 37 to 48 months, and 49 to 66 months. The children assigned to either of the
two microcomputer-use groups were randomly assigned again to one of three software groups.
All subjects were given a pretest and posttest that measured knowledge of basic pre-reading
concepts. A 48-item test was developed to measure children’s knowledge in five reading skill
areas: Matching Letters (simple), Matching Letters (memory), Letter Recognition, Word
Recognition and Alphabet Sequencing. An interview also was administered, but only at the time
of the posttest, to measure the affective variable.

To measure the affective variable, a simple individually-administered interview technique
was designed. Three 5” X 8” cards were presented simultaneously to the child, in a randomly-
determined order. The cards depicted a microcomputer, a toy, and some books. The adult asked
the child which activity he or she would most like to do: “use this computer,” Play with this toy,”
or “have someone read these books to you?” The child would then point to the card that
represented his or her first choice and then second choice.
Following pre-testing, each child in the adult-assisted and adult-unassisted group received three separate 20 min. sessions at the microcomputer about one week apart. In the adult-assisted sessions, the adult assumed an active teacher role. Children in the adult-unassisted group were shown how to use the software program at the beginning of each session and then told to work alone. The mean number of days between pretest and posttest was 22.14. Although pre-test and post test data was not given for the cognitive subtests, the authors concluded that “it matters little whether preschoolers are assisted in such microcomputer endeavors or not. Further, their performance on the cognitive measure was not better than the control youngsters.” (1997, p.354) Ordinal-level data techniques were used on the affective data. Goodwin found that few children in the assisted and unassisted groups selected the computer as their first choice. However the control group selected the computer more frequently as their first choice. The control group had been well aware that their friends in the other two groups had been receiving time on the microcomputer; “being denied a similar opportunity likely loomed large on them.” (Pg 355) “In sum, then, explicit or implied claims about the appropriateness of these software programs for very young children appear overstated.” (1997, p.355).

Gletcher-Flinn and T. Suddendorf (1998) proposed a Theory of Mind (ToM) which is related to cognition. Fifty-nine children, thirty-two boys and twenty-seven girls, with a mean age of 49 months ranging in age from 32 to 60 months participated in the study. The children attended one of 3 preschool classrooms on Waiheke Island, a suburb of Auckland, New Zealand. The ethnicity and socioeconomic status of the people who live on the island are mixed: however, most of the children used in the study were classified as middle to low socioeconomic status Caucasian with at least 50 percent from low income single-parent homes, and with a few caregivers having post-secondary qualifications.
The children were placed into one of three groups based on how they responded to a three false-belief tasks and if they had a computer at home or not. Children who did not have a computer and failed two of the false-belief tasks were either placed in an intervention or control group. The children were then matched on birth order, number of sibling, gender and age to form pairs. Twelve pairs were formed and one member of each pair was randomly assigned to a third group. Both groups consisted of eight boys and four girls.

A third group of children consisting of sixteen boys and nineteen girls was formed from the rest of the participants, to include children who had a computer at home and those who passed 2 or 3 of the false-belief tasks. This group served as a standard by which the performance of the other two groups could be compared. The study used the following resources: Wechsler Preschool and Primary Scale of Intelligence-Revised (WPPSI-R) and the British Picture Vocabulary Test. These measures were used to control for chronological and mental age effects.

Using a chi-squared analysis carried out on the frequency of children passing the false-belief tasks, that is the number of children in the intervention and control groups who received a score of 0,1,2, or 3 on the ToM at the first re-testing, indicated that the chi-square was not significant at 6.14. Fletcher-Glinn and Suddendorf found in calculating Chi-square resulted in two comparisons that stood out from the others. First, there were more children in the control group who scored a 1 than the children in the intervention group, and more children in the intervention group who scored 3 than the control group. They concluded that the control group showed a pattern that would be more in keeping with a “maturational” model where as the pattern for the intervention group is more bimodal with 42 percent passing all three false-belief tests, and the same percentage showing no improvement. “For those not yet “ready,” the environment will have little effect.” (1998, p.114) In their discussion, they stated that “a
planned intervention failed to demonstrate that computers facilitate theory of mind development in young children.” (1998, p. 114) ToM tasks. In conclusion, Fletcher-Flinn stated “we have failed to provide substantive proof that computers can accelerate the natural development of ToM.” (1998, p. 16).

Elliott and Hall (1990) conducted an evaluation of computer based activities in an Early Intervention Program. They examined computer based learning activities to enhance learning, specifically learning of mathematics with students who have behaviors consistent with aspects of developmental delays, who are considered to be at risk, or who are identified as presenting early signs of learning disabilities. Preschool children are typically not identified as having specific learning disabilities or identified as having a categorical cognitive impairment before the age of eight. Eleven students enrolled in a center based early intervention program (6 in the experimental group and 5 in the control group) took part in an 8 week study. The experimental group received 7-12 sessions ranging from 140 to 240 minutes using mathematical computer-based activities to the activities that the control group received. The study used a pretest posttest control group design and commercially designed software. The computer was set up in a quiet area and the children were to work on the computer in pairs with the guidance and support of a teacher to be consistent with the “structured teaching model” of an early intervention classroom.

Quantitative analyses was obtained by comparing the pre and posttest scores in order to determine the effectiveness of computer based activities on children’s mathematical skills and knowledge. The application of a Mann-Whitney test of significance on the differences in gain scores for the arithmetic questions and across the total range of test items indicated that in both cases the larger gain scores of the experimental group were significant at the 2% level. The posttest scores indicated that subjects in the control group have had only small increases in
scores, while there is a large increase between the pretest and posttest scores of the experimental group. On average, the scores of the children in the experimental group increased by 65% on the arithmetic questions as opposed to 18.3% for the control group. The scores of the children in the experimental group also showed a larger increase (49.3%) than did the scores of children in the control group (17.8%) across all ten items.

Language

Kelly & Karen, (2001) studied 25 of 30 preschool children’s use at the computer center and during their free play at traditional early childhood learning centers. The researchers asked: “What differences exist in preschooler’s mean length of utterance (MLU) as they interact at the computer and as they interact at tradition learning center?” (2001, p.125). Five children were eliminated from the study due to poor attendance or for the reason that they did not meet the minimum utterance requirements for data analysis. Specifically, the five children who did not meet the utterance requirement had a diagnosis of pervasive developmental disorder or significant language impairment.

The participants attended half-day inclusive preschool programs on the campus of Adams State College in Alamosa, Colorado. The participant demographics were: 16 subjects were male and 14 were female; four subjects were identified with special needs and two subjects had a primary home language other than English. According to parent reports, 14 (47%) of the children had computers in the home. A computer learning center, with specific guidelines for integration of technology activities across the curriculum, was a typical free choice opportunity for all children. For the purpose of their study, curriculum guidelines adhered to having at least two children at the computer whenever appropriate, providing an area free of traffic and distractions, offering a choice of highly quality software, and providing consistent prompting by
adults in the classroom to first ask peers for help in solving problems as they occurred, thus promoting a sense of independence. The computer center was established and used by all children six weeks before this study was initiated in order to minimize novelty effects. Researchers did not control the type of software used, however the software available to children daily, included a variety of literacy, math, and creative exploration programs. All the programs were recommended by *Creative Curriculum* and were selected according to developmentally appropriate guidelines. During this study, four children were typically engaged at the computer center at any one time. The average time engaged ranged from 2-20 minutes at any one sitting.

To begin the data collection process, college student observers received two to three hours of training in language sampling techniques. Using six, 10 minute videotaped samples of preschool children at the computer center and at traditional play centers, observers were instructed to document every utterance that the target child made during the videotaped session. Data collection forms titled “Systematic Preschool Observation Form” developed by the researchers included separate boxes for documentation of each utterance as well as notation of the child’s name, time of the beginning and ending sampling session and the name of the software used.

When the observers were able to document language samples with 95% accuracy, they were scheduled for language sampling at the preschool. Nine trained pre-service educators collected multiple language samples from each child over the six-month research study. The observers documented all utterances during their observational sessions but were not trained to calculate the mean length of utterances. The researchers at the end of the six month study period collected the documented utterances notebooks and calculated themselves.

The documentation/observation events were generally recorded for 5-10 minute period per child. Each child was observed a minimum of six times. Three sessions at the computer and
three sessions somewhere else such as the block, housekeeping, art etc. centers. Children who did not have the 50 utterance minimum at the computer center and at least one other center were not included in the data analysis.

The average MLU for the total group at the computer center was 4.31 and at other centers 4.62. With respect to gender, girls (n=12) averaged a computer center MLU at of 4.53 and at other centers 4.66. Boys (n=13) averaged a computer center MLU of 4.11 and at other centers 4.58. When MLU were compared for each child, a statistical significance in MLU was not indicated for 21 of 25 participants (84%). Four children were found to have a significant difference in the amount of their expressive language use between centers. According to the data, one girl was found to have a significantly higher length of language utterance at the computer center. It was reported that she enjoyed “teaching her partners how to maneuver through certain computer activities”. Also, three children, two girls and one boy had significantly higher MLU’s at traditional centers primarily the dramatic play areas and during sensory/creative art activities.

Given their findings, Kelly & Karin concluded that the use of computers is not a barrier to expressive language development. Expressive language of the children, evaluated by the lengths of utterances, was not different between computer center activities and other activity centers in the classroom. “However, the creativity, richness, and complexity of the language used by several of the children whose language was significantly greater at traditional centers warrants further investigation.”(2001, p.8)

Bhargava and Escobedo (1997) used video and audio tapes of children used in a larger study on preschool children’s ability to use the computer to create art to determine

1. “What were the types and frequency of language functions used by the children while learning the computer program?
2. What are the “characteristics” of the language used by the children in learning a program?
3. What were the differences in the language functions over the session? (1997, p.5)

A coding system including the four basic language functions - child direct, child informing, child inquiry, and expression was used to code the data of 4 children, 2 females and 2 males between the ages of 4 and 5. The study of the 1501 protocols recorded during 8 computer sessions revealed that the children used informative and directive functions of language to convey their ideas. During the computer session 30% of the language used was noted as being in the child directed category; focus attention, give directions, make a request, self talk etc. Thirty-two percent of the utterances were in the child informing category; indicate ability to perform task, describe depictions, evaluate, give explanations, reason, and to state facts. Nine percent of the language coded was in the child inquiry category: seek clarifications, seek confirmation, seek explanations, self directed questions etc. In the category of expressions, 10.6% of the utterances expressed excitement, frustration, interest, success or surprise. In conclusion, Bhargava and Escobedo stated “While all four children used primarily the Child Directing and Child Informing functions of language, they also asked questions and used expression to convey their inner feeling and emotions.” (1997, p.13) They also indicated that there was a peak in the amount of language used once the children became comfortable with the software.

Mercer, Fisher, & Somekh (1989) studied the talk of children who were working together at the computer on a range of activities involving various kinds of software. This project, called SLANT (Spoken Language and New Technology), was set up by a joint Open University/University of East Anglia research team to investigate the quality of talk in computer-assisted collaborative activity. Fifteen teachers from 10 schools were chosen from those who had responded to initial enquiries from the project to schools in four eastern counties of England.
The teachers developed activities which would fit in with and, enhance normal curriculum activities. A variety of software was used to include adventure games and simulations; word processing and writing packages; math, art and control technology. The researchers made video-recordings of groups of children during the activities, usually over a series of work sessions lasting 30 more minutes long. Interviews with the teacher and some children were also conducted and recorded. The project was not designed to make a controlled comparison but an observation of the effects of variables on the quality of talk at the computer center. They found three kinds of conversational sequences were picked out for their potential educational significance:

1. Disputation talk, where by speakers challenge other speakers’ view but without attempting to justify their challenge by building on previous utterances or offering new information.
2. Cumulative talk, whereby speakers contribute to discussion by taking up and continuing a previous speaker’s utterance, without explicit comment.
3. Exploratory talk, where by hypotheses are proposed, objections are made and justified and new relevant information is offered. (1989, p.27)

According to the researchers, all three kinds of talk, in certain context, stimulate decision-making and keyboard activity. However, they wrote that exploratory talk that encourages and develop children’s ability to use reasoning and to be receptive to the reasoned arguments of others when drawing conclusions, should be the aim of education. They found that cumulative talk and exploratory talk were dependent upon the physical configuration of the computer, the kind of software being used, and the structure of tasks therein. Also, the ways that computer based tasks are introduced, supported and integrated by teachers as well as the ways that children interpret the purpose of an activity and the ground rules for their collaboration are key variables in eliciting higher levels of communication.
Teacher support was also found to be important in regards to the impact of computer use on language in a review of literature by McCarrik and Xiaoming (2007). Ninety-three Head Start children assigned by classroom to one of three treatment conditions were compared for. In the first condition, children participated in a language-enhanced computer activity with the scaffolding and assistance of a trained instructor. The teacher encouraged language use, asked the children questions during the session and assisted the child on the computer. The second treatment group was given the same software and a passive instructor, whose purpose was to encourage children to answer questions asked by the computer and encourage on-task behavior. The third group was a control group in which children did not have computer access and only participated in the regular language-enriched activities. The methods of data collection and data analysis of the study was not given in this review, however the conclusion given was that children in the computer-assisted environments did have gains in language development over time. The gains, though, were not significantly greater than the gains experienced by children in the traditional language setting.

**Social:**

Bergin, Ford, Hess (1993) conducted a study observing the interaction of 95 kindergarten students in four classrooms in 3 different schools, over a 4 month period at the computer. In addition to other aspects of computer use, the researchers set out to document patterns of equitable social interaction and cooperation at the microcomputer. The population of the students did not contain a large gifted population, chapter 1 centers, or alternative schools. The communities in which the schools reside include about 10% minorities and a wide range of socioeconomic backgrounds (specifics were not provided). Each of the four classrooms were equipped with PCjr microcomputers and identical software selected by a selection panel that met
domain goals, high level of interactivity, individualized instruction and accommodation of a range of ability levels. Two researchers made observations in all four classrooms over the 4 month period (4 phases). Each student was observed and videotaped with a partner at least once during each of the 4 months/ phases. Both teacher and student behaviors were tallied in the classroom by an observer and categorized as non-verbal help, verbal help, encouragement, or managing turns. Also, the observers at the end of every 8-min., rated each child separately for the level of cooperation on a scale of 1-5, dominance on a scale of 1-5, and overall interest on a scale of 1-4. On the cooperation scale, a 4 indicated appropriate turn taking and a score of 5 meant the pair had to adopt the same goal and work together to accomplish the goal. A rating of 5 meant highly dominant and on the interest scale, 1 indicated no interest and 4 indicated an intense interest. The researchers concluded that students displayed a high level of interest that did not diminish over time with a mean over all 4 phases of 4.21. Interesting however, is a mean of 4.87 over all 4 phases showing no interest. Students were typically cooperative with a mean of 3.73 (M=3.73) over 4 phases and that there were very few observed episodes that reached the highest level of cooperation which consisted of working together to achieve the software goals. Most interaction related to managing turn taking with a M= of 2.38 over 4 phases and giving verbal help, i.e. telling which key to type, or providing an answer M=5.06. Although students were sometimes paired by the teacher and sometimes allowed to choose their partner at the computer, it would be interesting to identify and analyze the data when of differing abilities are paired together.

Anderson (1998) conducted a study to examine how 4 and 5 year olds interact in each of 4 settings (computer, dramatic play, block, and manipulative). Video tape was used to capture open choice of centers and playmates of 42 middle-class children attending two classrooms in
the same university preschool. The arrangement and the content of each of the four centers were controlled to be as similar as possible in each of the two rooms. There were 20 boys and 22 girls. The children were predominantly white coming from two parent families with the mother at home as a full time homemaker. Thirty-two of the children have computers in their home. Twenty-eight families reported having software specifically for the child. The computer centers were equipped with two computers with three chairs per computer. The same two software programs were used, *Mis Up Mother Goose Deluxe* and *Millie’s Math House*. Each center was taped four times for thirty minutes per session in an effort to obtain a representative sampling of the children who choose to play in them as well as a representative frequency and duration. Eight undergraduate students were trained to code the social interaction of the children in 10 second intervals. They watched one child through the four segments of each of the four centers, pausing the tape every ten seconds to record the predominant social interaction occurring during that interval. The number of minutes children were coded in each center was similar at $M=768$, range 730 to 827. The percentage of time children spent in solitary, parallel and cooperative play were 5%, 39% and 28% respectively in the dramatic play center, 5%, 30% and 36% in the block center, 1%, 44%, and 23% in the manipulative center, and 2%, 47% and 17% in the computer center. Solitary play occurred most frequently in the dramatic play center and block center at 5% of the time. Parallel play occurred most frequently at the computer center with cooperative interaction occurring most frequently at the block center at 36% of the time. According to Anderson, “the computer center can be as interactive as other centers. Teachers need to examine the arrangement and content of each center to facilitate their being used by the children for social interaction” (pg.10)
Shahrimin and Butterworth (2002) investigated the collaborative interaction patterns exhibited by 5 year old preprimary children in an educational computer environment. Subjects for the study were six pairs of children, aged 5 years, from one Perth metropolitan pre-primary center in Western Australia. Six children were randomly selected by the classroom teacher, and assigned to the study. Each of the six randomly chosen children in turn subsequently chose a partner with whom to collaborate and interact with at the computer. Each child was videotaped once, with their partner for a total of 10 minutes. All the observations took place during the children’s daily classroom activities and coded by the two researchers. The goal of the analysis was to distinguish all collaborative and non collaborative behaviors. Shahrimin and Butterworth found that directing partner’s actions was the most frequently occurring interaction pattern at 23.0 %. Other interactions exhibited included: providing information-19.8 %, asking for information/explanation -10.3%, self-monitoring/repetition -9.5%, declarative planning -7.0%, disagreeing with partner -6.2%, showing pleasure-6.2%, suggesting ideas-3.7%, defending control -2.5, showing displeasure – 1.2%, accepting guidance 0.8%, and sharing control 0.8%.

In conclusion Shahrimin and Butterworth conclude that “by integrating computer technology through appropriate strategies, and promoting and modeling pro-social behaviors, teachers can help children develop positive interaction patterns during collaborative activities on the computer.

Swigger & Swigger (1984) conducted a study for 3 consecutive weeks to examine the way preschool children interact with the computer. Specifically they posed the questions,

1. Which students use the CAI system together?
2. Are there identifiable clusters of children who learn together on the system?
3. What are the characteristics of group members, that is, in what ways other than common use are the groups consistent?
Forty-four children aged 3-5 at a North Texas State University Nursery School (laboratory-type) were observed. Specific demographical information was limited except to say that the school serves working and student parents who need all-day care for their children as well as those who need half-day sessions. The children’s day is somewhat structures with various activities, including indoor play at special centers such as painting, puzzles, crafts, and other activities. The study was conducted in April and most of the children had entered the school in the previous September therefore friendships and social patterns were already established. The computer was placed in a specific spot in the room and remained available throughout the three weeks. As a child approached the computer, an observer recorded the time and the program selected. Data was analyzed using a cluster analysis technique to determine whether natural groups existed among the computer users. The value of the coefficient was the ratio of the number of minutes of computer use shared by two children in a three-week period to the total number of minutes the computer was used by either child.

Cliques were defined as groups in which each member was related to every other member and some children belonged to more than one clique. Once the clusters were recognized, the groups were examined for signs of unusual behavior. A group of two or three children was almost constantly in front of the machine. The typical format was that one child operated the keyboard while the other children watched. Six children were heavy users and did not belong or were loosely associated with cliques. All the children except for the heavy users used the computer with their close friends. Swigger & Swigger found that computer use did not disrupt the existing social systems. The children continued to work mostly in established groups.
Chapter III
Results and Analysis Relative to the Problem

This review of literature, regarding the impact of computer use on young children’s cognitive, language and social development as well as student achievement, was explored. In the area of cognition, the review of literature indicates computers provide children with opportunities for active learning. Developmentally appropriate software programs that provide equal levels of scaffolding as teacher facilitated instructional activities in other centers are as effective in the area of cognitive development (Shute & Miksad (1997). Computer use, with preschool children, provides additional opportunity for children to practice concepts related to cognitive development and school readiness; especially for children who have special needs or are at risk for having learning difficulties. In addition, according to Li and Atkins (2006), computer use at home in addition to school has a positive effect on cognitive development and has a stronger impact on test performance. Although, the study did not compare the socio-economic status of the children who had access to computers at home and school compared to the control group that did not have access to a computer outside. The socio-economic status of the children in the subgroups might have been an indicator of cognitive abilities and test performance than computer use in and of itself. Furthermore, the software used in the study was chosen for the reason that the content was similar to the concepts in the tests given. There was no indication that the children who received the standard curriculum were given opportunities to practice similar or the same concepts in the activities presented by their teachers like the experimental group. Further, no mention of how much intervention and assistance was given at the computer during student free choice work activities. Another important factor was the omission of data present on teacher characteristics such as years of experience or professional
degrees and/or certification. A better comparison of computer use versus non computer use would be comparing a morning session to an afternoon session of preschool taught by the same teachers using the same assistance. Assuring for comparable demographics, however, for each class would take some planning prior to the children being assigned to a session especially in a rural area where children are assigned based on busing routes.

Computer use does not improve cognitive development. Computer use provides additional opportunities for children to practice concept skills and is a useful tool for children especially those who are at risk for developing learning disabilities. Computers hold the attention, are motivational, and facilitated the children’s ability to concentrate and practice difficult concepts (Elliot and Hall 1990).

In the area of language, the studies reviewed indicate that computer use is not a barrier to expressive language. The length of utterances at the computer center is similar to the length of utterances at other centers in the room. Children use a variety of language while at the computer to give direction, make requests, describe depictions, give explanations, seek clarifications and to express themselves, however, the amount of language used declines once the children are comfortable with the software. A comparison of language used at other centers with the computer center would have also been helpful in determining the benefits of computer use on language development in this particular research. The study reviewed by McCarrick (2007) also concluded while computers may not enhance language development more than traditional language activities, the computer environment provides an opportunity for children to use large amounts of language.

The review of literature in the area of language can neither support nor repudiate the benefits of computer use on language development, however, the talk that goes on can be
influenced by how the computer center is physically designed, the software used, the
introduction and support by the teacher, and the child perception of what is being required of
them during the activity.

In the area of social interaction, children interact with each other when paired at the
computer and mostly to give direction. Parallel play is the most common type of interaction of
children at the computer; however, the computer center could be used to teach collaborative type
social behavior with appropriate facilitation from a teacher using software that lends itself to
shared problem solving and if the center is physically conducive to children working together.
Compared to traditional centers, the computer center is no more conducive to socialization.
Chapter IV

Recommendations and Conclusions

There is concern among early childhood professionals that computers will alter and perhaps hinder connections in the brain from developing with computer use during the critical development years, birth to 7 years of age. In the study by Li and Atkins they found that children who used the computer less frequently performed better in the area of visual motor, gross motor, locomotor and object control. Two dimensional computers lack in tactile, proprioceptive, and vestibular stimulation necessary to develop the ability to concentrate, organize, improve academic learning, build on the capacity for abstract thought and reasoning and improve on the specialization of each side of the body and brain fully. Additional research on the developmental impact of computers and technology in general is crucial to the well being of our future. Ideally, the effects of computers on development would take a scientific approach. This could be accomplished by comparing synapses brain wave functions of preschool children during traditional teaching activities and comparing them to brain wave functions during computer assisted learning of similar activities. For example, brain wave functions of a child stacking blocks using computer software would be compared with brain wave functions of a child physically stacking blocks. Children in the study would need to be desensitized to wearing an electro-cap. Interpretation of the brain waves would need to be interpreted by a neurologist. However, this is a cost prohibited experiment and not likely to be funded by software or computer companies.

Regardless, technology will continue to develop and be apart of our future. We cannot afford to leave children behind in their exposure to effectively and efficiently use
technology. It is imperative that teachers and educators learn to use technology in a way that will optimize development beyond school readiness to include language and social development. The computer needs to be set up in a way that is conducive to group learning and provide software so children must work together to solve problems, develop creative thinking skills, practice expressive and receptive language skills, and encourage social interaction. Children who do not have access to technology need to be identified. Teachers need to ensure those students who do not have access to computers, develop computer skills similar to their computer using peers. More importantly, until we better understand how computer impact our children, it is important to continue to provide rich experiences using a variety of materials that incorporate sensory integration.

Additional information also needs to be obtained to first determine who is accessing the computer in preschool. Typically in preschool, the computer center is a free choice activity. Time limits for individual use are usually only enforced if there is a demand from other children to use the computer. Secondly, how much time are individual students using the computer and what is the correlation between the child who frequently uses the computer in school and computer access and digital media use outside of school. The information obtained from this research project would help teachers to identify the needs of the group as well as individual needs of children which should drive instruction. Children who spend a lot of time outside of school using computers, watching DVD’s and playing video games are more likely to need activities that incorporate proprioception, vestibular stimulation, social interaction, gross motor, etc. into their preschool experience. Conversely, if children do not have access to technology outside of school, they may avoid the computer center and need to be encouraged to use a computer.
The necessary information could be obtained by having parents fill out a questionnaire about their Childs’ use of technology outside of school along with an interview of both parent and child on an the initial home visit. Video taping of the computer center for the first month of school would provide accurate documentation of computer use trends of individual/ groups of student(s) in the class. An analysis, comparing each student’s use of technology at home and school would provide the necessary information to appropriately program and meet the needs of each child.
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