“Let’s Play ‘Puters”: Expressive Language Use at the Computer Center

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The researchers investigated 25 preschool children’s expressive language while they were engaged at a classroom computer center and during their free play at traditional early childhood learning centers. The participants were enrolled in an inclusive preschool setting and ranged in age from four years, three months to five years, two months, at the beginning of the study. Over a period of six months, trained pre-service educators collected multiple language samples from each child at the computer center and at a variety of other classroom centers such as blocks, housekeeping, library, and art. An analysis of each child’s mean length of utterance (MLU) indicated that 21 of the children evidenced no significant difference in the amount of language spoken at the computer versus other learning centers. Of the remaining four children, one used more expressive language at the computer, while three children were more verbal at other centers. Results indicated that the use of computers, as a self-selected activity, in early childhood classrooms could be as enriching for children’s language development as other traditional learning centers.
Educators agree that becoming competent with computers is a critical requirement for today’s learner. For the past several decades, however, child development experts have fiercely debated the appropriate age at which children should be introduced to computers (Cordes & Miller, 2000; Kelly, 2000). They caution that the time allocated for computer use in a developmentally appropriate classroom is often at the expense of traditional learning activities (Healy, 1998, Kostelnik, Soderman & Whiren, 1999; Oppenheimer, 1997). In 1987, Elkind, a child development authority, noted that the use of computers in preschool “…is a good example of miseducation” (p.87). Some 10 years later, the developmentally appropriate use of computers with young children was again questioned by Elkind (1996) and he cautioned early childhood educators not to use computers to assess a child’s cognitive skills, as the results could be an overestimation of their true abilities. Elkind’s concerns, and those of other early childhood educators, continue to surface as attempts are being made to determine the role that technology can, and should fill in promoting developmental skills of our youngest learners (Bowman & Beyer, 1994; Brett, 1994; Char, 1990; Katz & Chard, 1989; Moxley, Warash, Coffman, Brinton, & Concannon, 1997; Papert, 1993). Healy (1998) has even suggested that computers should not be introduced to young children before the age of seven, due to the multitude of cognitive developmental tasks in progress, which could “be distorted by too much electronic learning” (p.207).

A plea for more research was the conclusion drawn in a recently report-ed study underwritten by the Alliance for Childhood. The editors, Cordes and Miller (2000), stated that there is simply not enough research detailing the impact that computers have on the developing minds and bodies of young children. They also clearly note in their report, “Fool’s Gold: A Critical Look at Computers in Childhood,” the paucity of research that supports any positive developmental gains from the use of computers in early childhood settings. They state, “In fact, 30 years of research on educational technology has produced almost no clear link between computers in the early grades and improved learning” (p.19). Much of the research collected and reported by these editors dramatizes and highlights serious health hazards and developmental risks that computer use imposes on young children. Consequently, some professionals are calling for a national “time-out” for computer use in early childhood and elementary school settings (Kelly, 2000).

Educators and the general public alike are faced with the growing trend in schools to spend hundreds of thousands of dollars to keep up with the latest technology, often at the expense of other programs and equipment.
In addressing the dramatic increase in technology use in schools, Cordes and Miller (2000) warn that,

…the time spent with computers and other electronic media may distract both children and adults from directly communicating with one another, face to face, weaving together the rich variety of spoken and unspoken cues such interactions encourage. That, literacy experts warn, may place children at risk for language delays (p.35).

Language concerns are only one issue in a long list of developmental “hazards” recently identified as computer-related risks for young children. Social isolation and the creation of “mechanistic” children is another sign of the emotional detachment that may occur when computers are a primary focus in the lives of young children (Greenspan & Benderly, 1997).

In spite of these reported risks, the National Association for the Education of Young Children (NAEYC), currently the largest and most influential professional organization for early childhood educators, has endorsed the developmentally appropriate use of computers for children in preschools (NAEYC, 1996). The authors note, “The potential benefits of technology for young children’s learning and development are well-documented” (p.11). This influential position paper clearly states that the costs associated with the purchase of computers and software should not jeopardize funds for the purchase of more traditional early childhood materials. Instead, technology decisions should be based on accepted NAEYC principles of developmentally appropriate practices which support the use of computers as an integral and inevitable component of an integrated curriculum in early childhood classrooms (http://www.naeyc.org).

Regardless of the controversy, the introduction of computers into preschool classrooms is now a common occurrence. Currently, many of our nation’s preschools, including Head Start programs, offer computer activities to children through developmentally appropriate curriculum. According to Bredekamp and Rosegrant (1994), computers “have the potential to be infinitely patient and forgiving, completely individualized, eminently tolerant of mistakes, and emotionally neutral” (p.58). Several reviews of literature in this area (Clements, 1987; Clements, Nastasi & Swaminathan, 1993; Goodwin, Goodwin & Garel, 1986) suggest that computers have been found to promote significant cognitive, language and social-emotional growth when successfully integrated into developmentally appropriate classrooms.

Typically, young children prefer to interact and socialize with each other at the computer (Clements et al., 1993) and several specific models for
measuring and analyzing children’s language interactions at the computer have been proposed and researched (Bennett & Dunne, 1991; Tough, 1976; Wild & Braid, 1996, 1997). Particular attention to the tasks and the types of software used appear to be critical factors in the frequency and complexity of social and verbal interaction (Haugland & Shade, 1994; Rowland & Scott, 1992).

In analyzing the expressive language of young children, a typical measure often utilized is mean length of utterance (MLU). This method of analyzing children’s spontaneous speech is an excellent simple measurement of language development as almost every new language rule that children internalize increases their average utterance length (Bloom & Lahey, 1978; Brown, 1973; Dale, 1976). Muhlstein and Croft (1987) and Brett (1994) reported twice as much language usage at the computer as other classroom centers in similar studies of preschoolers. Davidson and Wright (1994) found children’s utterances at the computer to be longer and more complex, thus promoting language fluency. Preschoolers have even been overheard hypothesizing about certain programs (Fatouros, 1995). They attempt to discover how a program works and what they need to do to get it to work for them. Evidence has also been submitted that supports the role computer-based experiences might provide in designing the necessary scaffolding to support overall development, particularly spoken language and metacognitive skills (Elliott & Hall, 1990; 1997; Walker, Elliott & de Lacey, 1994). When the dramatic play of preschool children was observed, Char (1990) noted differences between their language with real dolls and their language with computer-generated dolls. Upon analysis, it appeared that the computer offered explicit choice points and required specific actions so the children formulated verbalized plans to express what they wanted to happen. Communication was not as frequent or as complex when the children played with the real dolls.

The present study was undertaken to investigate the effect that computer use may have on the expressive language of preschool children. Specifically the researchers examined the amount of language children used as they interacted at the computer center and during their free play in other learning centers in the classroom. In designing the study, the researchers asked the following question: What differences exist in preschooler’s (MLU) as they interact at the computer and as they interact at traditional learning centers?
METHODS

Subjects and Setting

The participants in this study were 30 preschoolers attending half-day, inclusive preschool programs on the campus of Adams State College in Alamosa, Colorado. Fifteen students each, in morning and afternoon preschool sessions were enrolled for the nine month academic year. The ages of the children ranged from four years, three months to five years, two months, at the beginning of the study. Demographic analysis of the subjects indicated that 16 subjects were male and 14 were female; four subjects were identified with special learning needs (one with suspected autism); and two subjects had a primary home language other than English (Spanish). According to parent reports, 14 (47%) of the children had computers in the home. The classroom was staffed with an early childhood education teacher and a paraprofessional. In addition, two undergraduate students were assigned for student teaching (one each semester) and two to three early childhood education students from methods classes were regularly in attendance to gain observational experience.

Curriculum and Computer Center

_The Creative Curriculum_ (Dodge, 1992), a nationally recognized and developmentally appropriate curriculum, had been implemented in the preschool for the previous two years by the classroom teachers and college Early Childhood Education (ECE) advisor. A computer learning center, with specific guidelines for integration of technology activities across the curriculum, was a typical free choice opportunity for all children. Curriculum guidelines adhered to, for the purposes of this study, included having at least two children at the computer whenever appropriate, providing an area free of traffic and distractions, offering a choice of high 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. Software used during the study varied, as the researchers did not control for this variable. The teachers made available to children four to six choices of software daily, including a variety of literacy, math, and creative
exploration programs. All software available to children were recommended as developmentally appropriate by the Creative Curriculum and were selected according to developmentally appropriate guidelines (Shade, 1996).

Two Macintosh Performas, model 6214 (75mhz), were used for this project. Equipment specifications for each computer were: 8 megabytes of RAM; a 1 gigabyte hard drive; a quad speed CD-ROM drive, and a 15 inch monitor. These computers shared an Apple Imagewriter II printer. Following curriculum guidelines, the computers were placed in tandem on two low tables with four appropriately sized chairs. This arrangement was designed to encourage social interaction and promote independence. The center was located in such a way as to be one of the set of daily learning center choices: blocks; sand and water tables; legos and table toys; housekeeping; dramatic play; library and writing center; art; music and science areas. According to the curriculum guidelines, children were generally given 45-75 minutes each day to engage in these free-choice learning center activities. Following the opening circle activities, children made choices on where they wanted to play and indicated their choice with a token or name card at the center area. Most centers were limited to three or four children at any one time and if more were interested a “waiting list” was available. The adults in the classroom monitored the movement in and out of center activities and encouraged children to complete activities (i.e., finish art work, put toys away) prior to making another choice. 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. Children who wished to stay longer were encouraged to visit another center and return later so that more children could have an opportunity with the technology.

Procedures

To begin the data collection process, college student observers received two to three hours of training in the language sampling technique. 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 entitled “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 of the sampling session and name of software used. The researchers monitored the training sessions of the selected student observers.
When observers achieved a 95% accuracy level in data collection they were scheduled for language sampling at the preschool. As a result, nine trained preservice educators collected multiple language samples from each child over the six-month research study. These observers were instructed to document all utterances during their observational sessions, however, they were not trained in the calculation of mean length of utterance. When questioned by a child about the documentation procedure, observers were instructed to reply, “I’m doing my homework.”

Each child was observed over a six-month period, always with another child at the computer center and at other traditional play centers (blocks, housekeeping, art, fine motor, library, science, music, etc.). Data collection of language samples were scheduled at various times throughout the two preschool sessions (Monday - Thursday; 8:30-11:30, and 12:30-3:30). Two large notebooks, labeled A.M. class and P.M. class, were provided onsite to maintain sampling schedules, data forms, and participant demographic and organizational information. Documentation/observation events were generally recorded for 5-10 minute periods per child, although on some occasions the sampling session was terminated as the child chose to move to another activity, or the session went longer as the child was actively engaged in the center. Each child was observed a minimum of six times (three sessions at the computer and three elsewhere), although most were observed more frequently in order to establish a 50 utterance minimum for MLU calculation. The researchers observed the data collectors periodically to monitor language sampling techniques.

At the end of the six-month study period, data notebooks were collected by the researchers, for analysis of MLU. Participants 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.

Mean Length of Utterance (MLU)

According to Brown (1973) the calculation of a child’s MLU is a reliable method for grossly analyzing development of language skills. Measuring MLU, or counting the morphemes within an utterance, has been found to be a strong indicator of language development until the utterances reach four to five words. In young children, an increase in utterance length is typically due to several factors, such as an increase in vocabulary, an addition of a grammatical rule or rules into the child’s language repertoire, the inclusion of negatives or auxiliary verbs, or the beginning stages of embedding
language phrases into statements. In this study, the researchers used Brown’s guidelines for calculating MLU (Brown, 1973, p.54). Each meaningful element of speech, or morpheme, was calculated from transcripts of the children’s utterances. For example, the word “dogs” counted as two morphemes: “dog” and the plural indicator “s.” Filler words such as “um” or “oh” were not counted, while single words such as “hi,” “no,” or “yeah” were counted. Stuttering, or dysfluencies were not counted, however, when a word was repeated for emphasis, such as “No, no, no,” each repetition was counted. Brown recommends a 100 utterance sample for reliable MLU calculation, although he notes that predictive calculations can be made with as few as 50 utterances. To calculate MLU, the length of each utterance in the language sample is totaled and then divided by the total number of utterances.

**RESULTS AND DATA ANALYSIS**

Of the 30 participants in the study, 25 met the minimum utterance requirements for data analysis. One of the students not included in the analysis had a diagnosis of pervasive developmental delay and had minimal expressive language. Three other children had poor attendance and were frequently absent during language sampling sessions. The fifth child’s family moved out of town during the study.

To initiate data analysis, the language data sheets were tallied for each child using a frequency count of utterances during each sampling. The resulting data were entered into an Excel spreadsheet for further statistical analysis. The total number of utterances and means were then calculated for each child at each center. 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 an MLU at the computer center 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 (Figure1).
Computer center MLU and traditional center MLU were then compared for each child, using t-tests to determine significant differences. Using an alpha level of .05, statistical significance in MLU was not indicated for 21 of the 25 participants (84%). Four children were found to have a significant difference in the amount of their expressive language use between centers (Table 1). One child (C9), a female, was found to have a significantly higher length of language utterance at the computer center. Upon examination of the data, it appeared that most of her language activity was directive in nature as she enjoyed “teaching” her partners how to maneuver through certain computer activities (Table 2).

**Table 1**
MLU and Significant $p$ Values for Individual Children ($p$< .05)

<table>
<thead>
<tr>
<th></th>
<th>Computer</th>
<th>Centers</th>
<th>$p$ Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>C4</td>
<td>4.5</td>
<td>7.8</td>
<td>0.000</td>
</tr>
<tr>
<td>C9</td>
<td>5.1</td>
<td>3.2</td>
<td>0.030</td>
</tr>
<tr>
<td>C12</td>
<td>3.8</td>
<td>5.3</td>
<td>0.003</td>
</tr>
<tr>
<td>C17</td>
<td>3.1</td>
<td>5.2</td>
<td>0.003</td>
</tr>
</tbody>
</table>
Three children, two girls (C4 & C12) and one boy (C17) evidenced significantly higher MLU’s at traditional centers. The data revealed their utterances were measured primarily in the dramatic play areas (e.g., “going to the doctor” and “wild animal jungle adventure”) and during sensory/creative arts activities (e.g., playdough and making valentines) (Table 3).

Table 3

Samples of Expressive Language for Child 4, Child 12, and Child 17 at Dramatic Play and Arts Center

<table>
<thead>
<tr>
<th>Child</th>
<th>Utterances</th>
<th>Morphemes</th>
</tr>
</thead>
<tbody>
<tr>
<td>C4</td>
<td>I need to give you another shot.</td>
<td>7</td>
</tr>
<tr>
<td>C4</td>
<td>Let me check your blood pressure, so let me see your arm.</td>
<td>12</td>
</tr>
<tr>
<td>C12</td>
<td>Somebody has to help us get out of the jungle!</td>
<td>10</td>
</tr>
<tr>
<td>C12</td>
<td>Pretend I was throwing these because I was afraid of the lion.</td>
<td>13</td>
</tr>
<tr>
<td>C17</td>
<td>I’ll make a Darth Vader pancake.</td>
<td>7</td>
</tr>
<tr>
<td>C17</td>
<td>I made the wings and then this part.</td>
<td>9</td>
</tr>
</tbody>
</table>

While four children evidenced statistically significant differences in their expressive language use between the computer center and other centers, no overall significant differences were indicated between total group MLU ($p=0.328$) and gender group MLUs (girls, $p=0.737$; boys, $p=0.321$).

**DISCUSSION AND FUTURE RESEARCH**

The study described above was designed to examine preschool children’s expressive language use at the computer center as well as during traditional, developmentally appropriate learning activities. The research design and analysis were clearly limited by the small sample size and should be viewed as a pilot or exploratory study. With that in mind the results reported should be interpreted cautiously, with the understanding that the
range of typical language development and computer literacy for young children is broad and varies greatly according to numerous variables not addressed in this study.

The results of the study indicated the amount of spoken language at the computer for the children was not quantitatively different from the amount of language used at other centers. In fact when analyzing individual MLU, 88% of the children used about the same or more expressive language while interacting at the computer center as they did during interactions at traditional centers. 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. Specific examinations of the rate (e.g., words per minute) spoken language is used (Muhlstein & Croft, 1987) as well as an analysis of the quality of language used (e.g., function and complexity) is clearly indicated (Halliday, 1988). In this way, an analysis of the effect the computer has on facilitation of, or interference with, the development of expressive language skills could be addressed.

Several areas to be considered in expanding and refining a program of future research are outlined below. Certainly a larger sample size, with more detailed demographic and developmental assessment information from parents and classroom teachers, would lend strength to future research efforts. Other areas to be considered include:

1. The use of videotaping equipment for data collection, with a directional and highly sensitive microphone. Transcription of language samples would allow for analysis of rate, length, complexity, function, and developmental levels of expressive language skills.

2. In addition to language sampling, a collection and examination of social interactions such as turn-taking, technology problem-solving, use of directive, and instructional language, joint attention, sharing, and impulse control in a variety of centers, would lend rich comparative data to the developmental implications of technology use in early childhood settings.

3. The use of a case study format to develop profiles of children who consistently self-select the computer center as a free-choice learning activity and of those children who rarely do so would be informative. Similar single-subject case studies may serve to produce considerations regarding computer use (or nonuse) for children identified with special learning needs, and specifically, children with language delays or deficits.

4. Standardizing the study design at the computer center through careful selection of developmentally appropriate children’s software may provide additional clues as to the language functions supported through the use of computers in early childhood classrooms.
In summary, results of this study indicated that the use of computers in early childhood settings is not a barrier to expressive language development and continues to be appropriate when used as a self-selected learning center. As noted by proponents of best practices in early childhood (NAEYC, 1996) young children’s development is clearly enriched through activities that expose them to a variety of learning opportunities, including those associated with computers in the classroom environment.

References


National Association for the Education of Young Children Position Paper: Technology and young children- Ages 3-8, (adopted April, 1996) *Young Children 51*(6), 11-16.
