LANGUAGE BEHAVIORS AND SOCIAL STRATEGIES OF ENGLISH AS SECOND LANGUAGE AND ENGLISH AS PRIMARY LANGUAGE PRESCHOOL CHILDREN DURING COMPUTER ASSISTED INSTRUCTION EXPERIENCES

DISSERTATION

Presented to the Graduate Council of the University of North Texas in Partial Fulfillment of the Requirements For the Degree of

DOCTOR OF PHILOSOPHY

By

Stacia B. Emerson, B.S., M.S.
Denton, Texas
August, 1993
LANGUAGE BEHAVIORS AND SOCIAL STRATEGIES OF ENGLISH AS SECOND LANGUAGE AND ENGLISH AS PRIMARY LANGUAGE PRESCHOOL CHILDREN DURING COMPUTER ASSISTED INSTRUCTION EXPERIENCES

DISSERTATION

Presented to the Graduate Council of the University of North Texas in Partial Fulfillment of the Requirements For the Degree of

DOCTOR OF PHILOSOPHY

By

Stacia B. Emerson, B.S., M.S.
Denton, Texas
August, 1993
hypothesizing, and interacting with the computer. The researcher added categories as new patterns emerged: describing, irrelevant, soliciting teacher input, and interrupting. Social strategies were coded according to play categories that include: onlooker, solitary, parallel, associative, and cooperative behavior.

Subject interactions were tabulated according to each category and software used. EPL students used teaching/instructing language more and ESL students used turntaking language more than other language forms. Software had an influence on subject language behaviors. The dominant social strategy used most by both subject groups was cooperative behavior. Other language and social behaviors were used similarly by all subjects. The greatest difference among ESL and EPL subjects' computer use was time spent in the center. EPL subjects participated in two times more interactions in the computer center than ESL subjects.

Conclusions are consistent with previous research findings. Test scores and previous computer experience were not an identifiable factor on time devoted to self-selected computer use. Future investigations should focus on ESL pre-kindergarten subjects' language and social skills relative to the time spent on self-selected computer activities.
Emerson, Stacia B., *Language Behaviors and Social Strategies Of English as Second Language and English as Primary Language Pre-Kindergarten Students During Cooperative Computer Assisted Instruction Experiences.*

Doctor of Philosophy (Early Childhood Education), August 1993, 135 pp., 12 tables, bibliography, 54 titles.

This study describes the language behaviors and social strategies of English as Second Language (ESL) and English as Primary Language (EPL) pre-kindergarten students during cooperative Computer Assisted Instruction (CAI) experiences. Thirty-three pre-kindergarten subjects ages four to five years, were videotaped at two personal computers during self-selected center time. The sources of data for this descriptive study were a parent computer survey, videotapes, a subject interview derived from the Young Children’s Computer Inventory, and written records.

Parent surveys were used to determine subjects’ prior computer experiences outside school. Subject interviews described attitudes toward computer use, and the tests and developmental checklist characterized each subjects’ abilities.

Language behaviors were identified and arranged according to categories developed that include: turntaking, awareness of right/wrong answers, teaching/instructing,
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. INTRODUCTION TO THE STUDY</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Computers as tools for learning</td>
</tr>
<tr>
<td></td>
<td>Purpose of the investigation</td>
</tr>
<tr>
<td></td>
<td>Research questions</td>
</tr>
<tr>
<td></td>
<td>Research methods</td>
</tr>
<tr>
<td></td>
<td>Limitations of the investigations</td>
</tr>
<tr>
<td></td>
<td>Operational definitions</td>
</tr>
<tr>
<td>II. RELATED LITERATURE</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Development of the preschool child</td>
</tr>
<tr>
<td></td>
<td>Social development</td>
</tr>
<tr>
<td></td>
<td>Language development</td>
</tr>
<tr>
<td></td>
<td>The English as Second Language student</td>
</tr>
<tr>
<td></td>
<td>Computers and young children</td>
</tr>
<tr>
<td></td>
<td>Qualitative methodology</td>
</tr>
<tr>
<td>III. METHODOLOGY</td>
<td>41</td>
</tr>
<tr>
<td></td>
<td>Setting</td>
</tr>
<tr>
<td></td>
<td>Subjects</td>
</tr>
<tr>
<td></td>
<td>Computer experiences</td>
</tr>
<tr>
<td></td>
<td>Data collection</td>
</tr>
<tr>
<td></td>
<td>Data analysis</td>
</tr>
<tr>
<td></td>
<td>Summary of methodology</td>
</tr>
<tr>
<td>IV. RESULTS</td>
<td>61</td>
</tr>
<tr>
<td></td>
<td>Question 1</td>
</tr>
<tr>
<td></td>
<td>Parent surveys</td>
</tr>
<tr>
<td></td>
<td>Video recordings</td>
</tr>
<tr>
<td></td>
<td>Time spent in the computer center</td>
</tr>
<tr>
<td></td>
<td>Interactive episodes</td>
</tr>
<tr>
<td></td>
<td>Software interactive language</td>
</tr>
<tr>
<td></td>
<td>Question 2</td>
</tr>
<tr>
<td></td>
<td>Parent survey</td>
</tr>
<tr>
<td></td>
<td>Video recording</td>
</tr>
<tr>
<td></td>
<td>Social behavior</td>
</tr>
<tr>
<td></td>
<td>Language behavior</td>
</tr>
</tbody>
</table>
V. CONCLUSIONS ........................................................................... 103

Question 1
Social behavior
Language behavior
Question 2
Social behavior
Language behavior
Recommendations for future research
Summary

VI. APPENDIX. ............................................................................. 120

A. Young children’s computer inventory
B. Parent computer survey
C. Developmental checklist
D. Pre-IPT: English scoring levels

VII. REFERENCES ......................................................................... 129
## LIST OF TABLES

<table>
<thead>
<tr>
<th>Page</th>
<th>Table</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Description of students</td>
<td>46</td>
</tr>
<tr>
<td>2. Total minutes spent in the computer center - AM</td>
<td>66</td>
</tr>
<tr>
<td>3. Total minutes spent in the computer center - PM</td>
<td>67</td>
</tr>
<tr>
<td>4. Time spent interacting with other students at the computer center - AM</td>
<td>68</td>
</tr>
<tr>
<td>5. Time spent interacting with other students at the computer center - PM</td>
<td>69</td>
</tr>
<tr>
<td>6. Interactions categorized by social behavior and software</td>
<td>72</td>
</tr>
<tr>
<td>7. Interactions categorized by language behavior and software - EPL</td>
<td>81</td>
</tr>
<tr>
<td>8. Interactions categorized by language behavior and software</td>
<td>82</td>
</tr>
<tr>
<td>9. Summary of YCCI responses</td>
<td>87</td>
</tr>
<tr>
<td>10. Test gains from pre- and post-tests - EPL students</td>
<td>89</td>
</tr>
<tr>
<td>11. Test gains from pre- and post-tests - ESL students</td>
<td>90</td>
</tr>
<tr>
<td>12. Participation levels of students in the computer center</td>
<td>94</td>
</tr>
</tbody>
</table>
CHAPTER I

INTRODUCTION TO THE STUDY

Many American preschool classes appear to be very similar at first glance. They feature various "centers" arranged around the room that encourage young children to explore and experience various activities such as art, sand and water, children's literature, blocks and manipulatives, science and writing materials, and music and movement activities. All of these activities can be experienced in small groups of children or by a solitary child. Currently, one obvious change can be seen in the preschool setting - the addition of a "computer center".

A national survey of school uses of microcomputers has been conducted repeatedly over the past few years by the Center for Social Organization of Schools (CSOS) at Johns Hopkins University. According to the latest survey conducted in 1989, the past decade has seen an increase of microcomputers in U.S. schools from less than 50,000 to approximately 2.4 million (Tolman & Alfred, 1991). A recent increase in the development of software for children under five has led to the incorporation of microcomputers into a growing number of early childhood programs.
This trend has raised many critical issues regarding the influence of computer use on young children. Educators specializing in developmental early childhood education have been critical of computer use because they say it is another attempt to prematurely introduce academics to young children (Genishi, 1988). Genishi reported that "children's ways of learning have not changed over time; adults' expectations have". Other criticisms of computer use with young children relate to the possibility of forfeiting more appropriate activities for children to these abstract concepts on the computer.

**Computers as Tools for Learning**

Despite these concerns, computers have gained popularity with early childhood professionals. Computers are serving various roles in early childhood programs. As a tutor, the computer acts as a teacher, presenting information, asking questions, and evaluating responses. Lessons can be repeated or can branch off to other areas. The most simple form is similar to electronic flashcards; a more complex form provides interaction with music, speech, and pictures. Another effective method of using computers with young children is its application as a tool. Children may learn by doing tasks personally relevant and useful, as adults do. Adults use word processors to communicate through writing, and children can use simplified versions. Children can also use the computer to draw, design, and
scribble, as adults use computers to create graphics. Adults and children, both, can use computers for programming (Clements, 1985a).

One of the most valuable aspects of educational personal computers is that students can be participants, not spectators, as learning experiences become more interactive (Taylor, 1980). Another benefit to education that Taylor describes is individualization. The learning experience for each student can be unique, tailored to the student's needs and learning style. Student responses are analyzed and various actions are taken depending on student input. Papert (1980a) stated children gain unprecedented power to develop exciting projects when they are provided a computer.

Clements (1985a) mentions several metaphors that have surfaced regarding the use of computers with young children. He states that Papert wants computers to be thought of as pencils. They can be used for scribbling, writing, math, drawing, etc. Clements describes Bamberger's approach to the computer as an artist. The artist works with the sensory world creating and recreating designs. The computer can also be used to create and recreate, giving reflection regarding the designs. Another metaphor that is relevant to early childhood education is the computer likened to building blocks. The computer is only limited by the imagination of the builder - the same materials, used by different minds, can be anything from a spaceship to a
playhouse. These materials can grow with the child in complexity and depth of meaning.

"Literacy" today must include "computer literacy". Emphasis should be placed on teaching children to use computers effectively, as well as teaching them to read critically and write coherently (Barnes & Hill, 1983). Children should become comfortable with the tools and processes that will impact their lives and living in an age of technology means it is necessary to become familiar with the technology around them (Barnes & Hill, 1983).

Computer technology has provided educators with new opportunities of thinking about learning and about thought itself, but some of the old ways must be abandoned. These tools need to be used to enrich the lives of young children and should be used in addition to, rather than as a substitute for other experiences (Clements, 1985a).

**Purpose of the Investigation**

The purpose of this investigation was to describe the computer use of English as Second Language (ESL) pre-kindergarten students and English as Primary Language pre-kindergarten students (EPL). This investigation focused on social strategies and language behaviors of these children.
Research Questions

This ethnographic investigation focused on the social and language behaviors of pre-kindergarten children as they worked with computers during daily self-selected center time. The following questions narrowed this investigation:

1) What types of social strategies and language behaviors are used among ESL and EPL pre-kindergarten students during cooperative Computer Assisted Instruction (CAI) experiences?

2) What language and social differences exist between ESL pre-kindergarten students and EPL pre-kindergarten students during cooperative Computer Assisted Instruction (CAI) experiences?

Research Methods

This investigation used qualitative research methods that included video recording, parent surveys, subject interviews, and written records. The investigator also used information obtained from the Peabody Picture Vocabulary Test-Revised (PPVT-R) and the Preschool IDEA Oral Language Proficiency Test: English (Pre-IPT: English) tests. Data collection took place in a pre-kindergarten classroom in a metropolitan school district. The 33 subjects attended a half-day program with 17 students in the morning class, and 16 in the afternoon class. During this three hour program, children had 45 minutes to one hour available for self-selected center time which included experiences in Computer
Assisted Instruction. Data analysis included: 1) a review of video recordings of children while working at the computer center, 2) an examination of pertinent student school records, 3) pre- and post- language tests and 4) child and family background information.

Limitations of the Investigation

1) Because of the convenience sample used in this study, the findings cannot be generalized to other groups (Gay, 1992). However, the depth of individual subject analysis will provide an accurate picture of student performance and relevant information to generate hypotheses for future investigation.

2) The length of the study could have affected the results. Subjects were not exposed to the computers during the entire school year, therefore their attitudes and reactions towards computers may have been influenced by their unfamiliarity with the computers.

3) Participant observer biases and prejudices are recognized as having an influence on data analysis in ethnographic research (Bogdan & Biklen, 1982). However, the classroom offers the most natural setting where children can interact. These interactions would be disrupted if put in an experimental context.

4) Only one researcher analyzed the video tapes, therefore inter-rater reliability did not exist. However, because the observer participant was also the teacher, a
deeper understanding and knowledge of the subjects existed.

5) The software was not chosen strictly for the purpose of this study. This software was chosen for the use of the entire pre-kindergarten program, therefore consideration was given toward what would benefit all classrooms.

6) Spontaneous, unplanned parent observations occurred when parents came early to pick up their children. This may have affected the students' behavior, especially if their parent was observing while they were using the computer.

Operational Definitions

**Computer-Assisted Instruction (CAI)** - CAI programs can be classified as drill and practice, tutorial, simulation, and exploratory/game. The purpose of the computer used in this mode is to teach children skills, facts, or concepts from the traditional curriculum, and can be used as a teaching machine, teacher's assistant, or audiovisual device (Clements, 1985a).

**Ethnographic Research** - Ethnography literally means "a way of life" of some identifiable group of people. The investigator's purpose is to learn about, record, and ultimately portray the culture and understandings of the group. This is always done within the context of the peer culture. Ethnographic research techniques include participant observation, interviewing, and use of written resources (Wolcott, 1988).

**English as a Second Language Students (ESL)** - Students
were identified as ESL by their scores on the Pre-IPT English test. These students participated in another classroom in a smaller group for 45 minutes each day where they were exposed to activities and events designed to promote the development of a second language.

**Peabody Picture Vocabulary Test Revised (PPVT-R)** - This test is designed primarily to measure a subject’s receptive vocabulary for Standard American English. It suggests the extent of English vocabulary acquisition. The test is designed for persons 2 1/2 through 40 years of age who can see and hear reasonably well, and understand Standard English to some degree.

**Preschool IDEA Oral Language Proficiency Test: English (Pre-IPT: English)** - This test was developed as an instrument that could be used to assist teachers in identifying preschool-aged children who may have English language needs. This test is a process by which a student is required to respond to controlled stimuli, both verbal and visual.

**Interactive Episodes** - Corsaro (1981) defined interactive episodes as related to research methods as: "a sampling unit, that is a sequence of behavior that begins with the acknowledged presence of two or more interactants in an ecological area, and end with the physical movement of interactants from the area, which terminates the originally initiated activity". (p. 212)
CHAPTER II

RELATED LITERATURE

Development of the Preschool Child

Preschool children are rapidly growing and developing in all areas of life. The experiences that they are exposed to during this critical time of growth may foster or hinder development. Understanding this development is necessary in order to recognize how computer use may influence or effect it. Because this investigation focused on the social and language behaviors of preschool children as they worked with computers, establishing a clear understanding of preschool child development in these two domains is important.

Social Development

Preschoolers are very sociable and they make significant improvements during this time, using language to facilitate social interactions (Charlesworth, 1987; Seefeldt & Barbour, 1990). Webb (1989) notes that parents, siblings, peers, and television personalities are significant socialization agents of the preschool child.

The major social task of the preschool child is developing their relationships with others. They become less socially dependent on family and begin to include the neighborhood or peer group (Charlesworth, 1987; Helms &
Turner, 1981; Seefeldt & Barbour, 1990). They value having a friend and being a friend. Preschoolers can be heard initiating contact by asking "Can I be your friend?" and persuading one another by saying "I'll be your friend" (Zigler & Finn-Stevenson, 1987).

Peer groups. Children are moving from parallel play to associative play, participating in group activities which may lead to the emergence of peer groups (Seefeldt & Barbour, 1990). Peer group members are bound by a common interest, but have an exclusiveness about them which is demonstrated by the frequent statement "You can't play with us!" Gaining acceptance into this group depends on the child's ability to comply with the group's rules, and the degree of friendliness exhibited. Gender is another factor, as preschool children prefer playmates of the same gender (Helms & Turner, 1981; Zigler & Finn-Stevenson, 1987). According to some researchers, for normal social development preschoolers should have the opportunity to interact with same-age children. If not given this opportunity, children are at risk of being socially incompetent and unsure of themselves in personal relationships later in life (Zigler & Finn-Stevenson, 1987).

Peer relationships enable children to evaluate themselves according to comparisons with others their age. Children are known to make statements such as "let's see who can run faster" which is not so much competitive as it is a
reflection of the child's emerging sense of self (Zigler & Finn-Stevenson, 1987). Children feel a sense of pride, worthiness and self-esteem when they are involved in successful peer relationships. Friends also provide a sense of identity and status while supplementing the standards and values they have already learned from family. These friendships allow the child to develop an eagerness to please someone else, to be helpful, cooperative and a source of companionship (Webb, 1989).

Smith (1982) has outlined the sequential development of children's concepts about friendship. Initially, young children see friends as interesting people who may enjoy similar activities or live nearby. They value friends for material resources and important physical skills. Because children at this age are preoccupied with their own needs, they assume others want the same things they do. A three-year old views friendship as an avenue of self-gratification (Smith, 1982).

Around age four relationships evolve into "friendship as one-way assistance", where friends become important if they meet the other's needs. At this time, children are becoming more aware of the psychological and emotional benefits of friendships. Children are now shifting from a focus on physical characteristics to an awareness of more subtle psychological characteristics. The final stage of this development is a change from the perspective that
friendships are brief interactions to a belief that these relationships will endure. Younger children will be less selective in choosing friends and probably initiate and terminate more friendships than older children (Smith, 1982).

Social development between three to five years will increase in complexity. One reason for this is that children are now able to direct social acts to more than one child at a time, whereas during the toddler years they only focused on a single child. Second, the increase in language competency also adds to the complexity of relationships. Using more language allows children’s relationships to become more clearly defined and allows them to strengthen social bonds by using each other’s names and commenting on play. A third factor that influences the complexity of children’s social development is that children are now able to adjust their behavior to suit the age of the child with whom they are playing. Older children playing with younger children tend to act younger to accommodate their playmates, and younger children will try to emulate their older friends (Smith, 1982).

Prosocial behavior. According to Helms and Turner (1981), when children participate in groups their behavior becomes more independent, more prosocial, and a competitive spirit emerges. Prosocial behavior includes cooperation, altruism, sharing, helping others, generosity, and patience, and are based on the ability to see others’ perspective.
These behaviors seem to be influenced by exposure to an adult model and certain social situations. Positive reinforcement also affects the expression of prosocial behavior. According to Webb (1989) the socially competent child is able to relate effectively with both children and adults. Children as young as three have exhibited this behavior, but in order to develop this role-taking ability they must have many opportunities to interact with others. When children are capable of understanding the needs of others, sharing increases. Three and four year olds may not be mature enough to share personal possessions, but this is very different from taking turns with toys that belong to a school or center they attend (Webb, 1989).

Aggression. One personality trait that becomes evident during the preschool years is aggression. Aggressive behavior is common to most species, therefore is considered a biological component, but it is also a problem-solving method and subject to the influence of learning and experience (Zigler & Finn-Stevenson, 1987). Freud believed that aggression is a biological instinct and is influenced by environmental factors. The aggressive drive is innate to the child, but the way it is expressed is learned.

When a child sees people around him using physical aggression to solve problems, that is what he learns to do (Zigler & Finn-Stevenson, 1987). Other researchers believe that both environmental and biological factors contribute to
the development of aggression, along with several variables in the child, the family, the community, and in the culture.

Preschoolers have many reasons to feel frustrated during a day. They may be told no over and over, or try to do something and be unsuccessful. Many researchers believe that preschoolers' aggression is a result of this frustration. These young children are rarely aggressive deliberately. They usually strike out because someone or something is interfering with what they are trying to do, or to get an object or remove an obstacle. As they get older they begin to use deliberate aggression. The occurrence of deliberate physical aggression climbs to its peak in the preschool years, but as children are directed and given adult expectations, they soon learn to use other means of attack such as words and insults (Zigler & Finn-Stevenson, 1987).

Language Development

Language development follows a regular sequence. Toward the end of the first year infants produce their first words (Sarafino & Armstrong, 1986; Webb, 1989). Soon after the child begins using one-word sentences with lots of body language and intonation added. Progression continues with two and three-word sentences as grammatical rules are learned, such as adding -s and -ed to words. Four and five year old children have a surprising understanding of grammar and can express themselves with lengthy and complicated
Grammar development. Using grammatical rules of language is an important accomplishment during the preschool years. Meaning is added to a preschool child's speech by using such rules as word order and word form. The preschool child is not able to follow complex grammatical rules, but does have the ability to apply basic rules such as putting the subject before the verb (Zigler & Finn-Stevenson, 1987).

Grammatical progress can be recorded using an index called mean length of utterance (MLU). The utterance length is tabulated in terms of the number of morphemes, which is the smallest meaningful unit of adult speech. When the MLU reaches three and children are around 2.5 years old they first show an appreciation of the formal grammatical types of language. By the middle of the third year it is clear that they have implicit knowledge of these formal language types, such as adjective, article, noun, noun phrase, preposition, and prepositional phrase (Berk, 1989).

Evidence of forms of the auxiliary verb "to be" makes room for a variety of new expressions at 3 to 3.5 years old. Auxiliary verbs are necessary in many sentence structures that are complex modifications on the primary subject-verb-object form. Examples of this are negations and questions. First, children simply add "no" to a sentence to make it negative, as in "No go there". Gradually they learn the proper use of negatives, as in
"Don't go there". This explanation makes it apparent that the acquisition of grammar is a gradual process that progresses from simple to complex (Zigler & Finn-Stevenson, 1987).

Questions also evolve over the preschool years. English-speaking children can use rising intonation to transfer a sentence to a yes-no question. The acquisition of "wh" questions conforms to semantic and structural complexity. "What", "Where", and "Who" questions, ask about concrete objects, places, and things. These appear first in a child's language. "When", "Why" and "How" questions reference more complex concepts and appear later on (Berk, 1989).

Another obvious aspect of grammar acquisition is the remarkably regular order in which the rules are developed. This is evident by children's use of morphemes. Using -ing, -ed, and -s endings to qualify words is an example of morphemes. Although children develop at various rates, they always acquire these morphemes in the same order. Children begin using the -ing ending, and then acquire more complex qualifiers, such as plurals and past tense.

Once children learn a grammatical rule as it applies to one word, they generalize its use to other words even if they are not familiar with them. As reported by Zigler & Finn-Stevenson (1987), Jean Berko illustrates this in an experiment she conducted to evaluate four to seven year
old's understanding of pluralization. The children were shown a drawing of a bird-like animal and told "This is a Wug. Here is another Wug. Now there are 2 _____." The children were asked to orally complete the sentence. This was used with other nonsense words that required various plural forms such as bix or zat. Some mistakes were made, but even the youngest child often gave the right answers, indicating that they learn general rules for pluralization, rather than individual word and that they can apply these rules to new contexts (Zigler & Finn-Stevenson, 1987).

When children first learn a rule they tend to apply it to all words. Even though many children use correct irregular forms of words at first, possibly through imitation, they eventually discover the correct regular inflection rule and rotate between correct and incorrect usage. Now the child who previously said "I went" now says "I goed" or changes from saying "feet" to saying "foots". When a child incorrectly applies a regular rule in an irregular case, it is called overregularization (Zigler & Finn-Stevenson, 1987; Webb, 1989).

Rapid Expansion Period. When children are between two and six years old they experience a rapid expansion in their language development. They are extending their vocabulary development during this time and also developing language through modifications in word formations. If words are too difficult, younger children simplify their language by
shortening a word and by omitting laborious blends in words. They also simplify language by using the same consonant throughout a word, such as "goggy" for "doggy", and substituting sounds they make readily for those that are awkward for them. Children also fill in the voids in their language by forming new words. They may do this by mispronouncing words due to misunderstanding or affixing new endings to words already known (Webb, 1989).

During this time of language expansion meanings gradually become defined. Children exhibit development of relational meanings as they begin to use three dimensional words such as "big" and "little" before they use one dimensional terms. Children also begin to acquire such spatial relation terms as "up" and "down", "on" and "under". Because of recurring usage "front" and "back" are learned before "side" (Webb, 1989). Another component of children's language during this period is the constant use of "why". This begins at age three and continues through early elementary years. Even though these questions may be irritating to adults, the child needs answers to expand understanding (Webb, 1989).

The English as Second Language Student

Nationally, there are approximately 3.4 million school children that are limited in the English language skills needed to be successful in schools designed for native English speakers (Dolson, 1985). Dolson also reported that
approximately 23-28% of all U.S. Spanish-speaking students do not graduate from high school. Minority children will become the majority in public schools over the next two decades (Bowman, 1989). These statistics indicate a need for earlier intervention in language learning for these students.

"Limited-English-Proficient" (LEP) refers to children who speak a language other than English at home and who either do not speak English at all or not well enough to communicate effectively in English speaking settings. There is evidence from research and class experience that limited English proficient children who are at risk of later academic difficulties due to language differences between home and school, benefit from special assistance in language development in the preschool and early primary years (Hoegl, 1987).

Immediate benefits can be gained in English language acquisition and readiness for kindergarten and long-term benefits in language ability and cognitive development can be obtained when children have an opportunity to begin English language acquisition in preschool education programs (Hoegl, 1987). According to Hoegl it is the initial English language learning in pre-kindergarten that gives the Limited English Proficient (LEP) child an opportunity in kindergarten and primary grades to experience meaningful English language interaction with teachers and English
speaking peers. This also allows the learning of a new language to take place in a meaningful context, making use of concepts the child has acquired already. By second grade, on the average, the child makes a transition from the home language to English as the language containing sufficient meaning to support concept formation and comprehension in the elementary grades (Hoegl, 1987).

The literature on second language learning in childhood indicates that second language learning is not automatic for children (McLaughlin, 1982). McLaughlin stated that a child must go through a lot of trial and error, creative hypothesis-testing, and awkward experimentation to acquire a second language - many do not succeed. According to Black, Puckett, and Rodriguez (1987) many children are the first in the family to learn English and they are pushed into the role of spokesperson or translator for the family. These "becoming-bilingual" children are expected to learn the English language in spoken and written contexts within the classroom. Becoming-bilingual children may not understand the teacher. They may not be able to express the need to go to the bathroom, or to communicate with other children. They may have difficulty asking questions, expressing feelings or thoughts, or sharing in discussions, stories, rhymes or songs.

Children learning a second language often experience a silent period that lasts from several weeks up to two years
after they enter a classroom with a different language. This is a time when they are absorbing the sounds and vocabulary of this new language. They are also adjusting to and taking in the new culture they are being exposed to at large and in the classroom (Black, Puckett, & Rodriguez, 1987). This pre-speaking stage is essential in the acquisition of a new language. Teachers, however, must be aware of the differences between the child who is actively listening and absorbing new cultural and language patterns, feeling secure and happy, and the child who remains withdrawn because of the inability to cope with risks and expectations of those around him.

Previous research of early bilingualism consists mainly of case studies, and suggests that children can, without apparent effort, learn two languages simultaneously. There is little support in the literature of the idea that learning two languages at the same time interferes with learning either one of them adequately, or causes cognitive strain (McLaughlin, 1982).

One of the findings that seems to hold true in the literature is that most successful results are obtained when the conditions of language presentation are made clear to the child. There should be a clear distinction between speakers, for example, the father speaks one language and the mother another. This "one-language-one-person" rule seems to help the child keep the two languages separate.
Confusion seems to occur when adults mix their language, speaking one now and another later (McLaughlin, 1985). Language groups do exist where language is interchanged by all speakers. In this case there is a base language - for example, Spanish with words or phrases interspersed from a second language (English) for rhetorical or stylistic purposes. This "code-switching" does not appear to lead to interference between language, as research with children from such communities shows little confusion between languages. Greater confusion occurs when speakers change languages unpredictably from sentence to sentence, or from day to day. The implication through research is that young children will learn a second language best in an environment where the languages are clearly separated by persons (McLaughlin, 1985).

McLaughlin (1985) stated that child care practitioners who are bilingual promote language acquisition best if they do not speak to the child in a second language when they fail to understand the first. Studies reveal that it is best to use one language consistently and try to promote understanding by paraphrasing and using context instead of switching over to a second language. These children may need additional or expanded explanations.

According to Bowman (1989) changes that occur in children because of the interaction of biology and experience, such as language learning, are similar in kind
and sequence across cultural groups. Cultural learning that children acquire from family and community is where the differences in specific knowledge and skills occur. Another finding supported by early childhood bilingual studies is that children go through the same developmental stages in acquiring their second language as do monolingual speakers of each of these languages (Black, Puckett, & Rodriguez, 1987; McLaughlin, 1985). A child who is bilingual in Chinese and English goes through the same developmental stages in learning Chinese (or English) as does a Chinese (or English) monolingual child. This indicates that it is not sound practice to teach grammatical constructions to young children. They will learn them in given time. This instruction in grammar forces children to learn constructions for which they are not developmentally prepared. These premature practices confuse children and interfere with natural developmental progression (McLaughlin, 1985). Attempts to speed up the learning process by teaching rules are likely to be counter-productive. Black et al. (1987) stated that language activities based on repeating and practicing sentences and phrases over and over again do not encourage second language acquisition. Teachers need to understand that second language development takes place when children are given the opportunity to use English for real-life purposes as they interact with English speakers to carry out
daily tasks. Second language instruction should be heavily dependent on concrete objects. The learner can own a word or phrase only when there is a frame of reference or a direct experience to relate (Trute, 1990). Children learn their first language this way and it is how they best learn a second language. Since the 1960s the dominant thought among linguists has been that caregivers can do very little. Noam Chomsky insisted that the language young children are exposed to is too "meager and degenerate" to account for the rapid growth that children experience when acquiring their first language. This theory claimed that children do not learn by hearing people speak, but because they are pre-programmed to learn language (McLaughlin, 1985).

McLaughlin (1985) described how researchers of the 1970s discovered that the speech children are exposed to is not "meager and degenerate". Most speech addressed to young children is well-formed and ideally suited to the child language learner. This speech is slower than normal, directed at the here and now, it is simpler and shorter, and contains a more restricted vocabulary than speech addressed to adults. Caregivers intuitively modify their speech to young children to make it more easily understood. If they speak as they would to another adult the child tunes out and communication is disrupted.

**Classroom Context**

The classroom environment is an important factor in
second language learning. McLaughlin (1985) noted that language development was promoted when children were in a rich linguistic environment and had opportunities to use the language in meaningful social interactions. Many suggestions for implementing this have been made regarding cooperative learning. This would involve native and non-native speakers working together to communicate and solve problems. Using native-speaking peers greatly increases the sources of language input that non-native speaking children receive. Teachers have limited time that they can spend with each child, therefore children should be exposed to native-speaking peers to receive maximum input, feedback, and social interaction. This is a strong argument for balancing classes with native and non-native speakers (McLaughlin, 1985). Black et al. (1987) recommended that teachers and peers provide an abundance of input to second language learners. Their speech should be modified for non-native speakers, just as adults and older children do when speaking with very young native-speaking children.

Peer teaching is an effective way to promote the social use of second languages and develop vocabulary. In Johnson's (1988) research a small group of children were taught in English, by the teacher, how to do an activity, such as art, science, or cooking. After being taught, each child was paired with someone who was not familiar with the project. These pairs consisted of one ESL child and one
native English speaking child. The ESL child took the teacher role and showed the partner how to do the activity, but had to communicate in English to reach the goal. Empowering ESL children to serve as teachers for their peers is one way to create functional and successful second language learning environments. The teacher's role in structuring the social environment is critical because some children do not actively participate in the kinds of situations that encourage second language development. These children need the encouragement the teacher gives by setting up situations that encourage language use in a variety of ways and allows them to experience success.

Great cultural variations in terms of patterns of adult-child interactions exist. According to McLaughlin (1985) there is considerable evidence from ethnographic research that children from minority cultures learn better when classroom interactional patterns match patterns they are familiar with. In some cultures, questions are asked about whole events or objects and their uses, and causes and effects. Often there are many ways of answering. These answers may involve storytelling, describing, or making comparisons. Many teachers, however, ask questions about things, labels, attributes, and details of objects and events that may be removed from the immediate environment. Children are challenged to learn new rules for communication within the classroom. Children whose past experiences are
not parallel with the new rules will have to learn the new ways of communicating before they can use language to learn in the classroom (Bowman, 1989). The implication for language acquisition is that patterns at home may not match patterns at school and it will take children longer to become accustomed to the classroom interaction patterns. Teachers could enhance this process by incorporating interactional patterns of children's culture into the classroom setting (Black, Puckett, & Rodriguez, 1987). Second language acquisition requires a friendly, non-threatening environment, where language is a natural function, integrating listening, speaking, reading, and writing (Trute, 1990).

Black et al. (1987) listed other factors that teachers should consider when working with children acquiring a second language. First, teachers should realize that the child who does not speak English is not lacking intelligence. Children in the early stages of second language acquisition do not verbalize to a great extent or in complex ways. Second, teachers should have an understanding of the individual differences in second language acquisition. These differences exist in strategies used to acquire a second language and in the rates of acquisition. Teachers should provide a variety of learning experiences that meet individual needs, just as they should for native speakers. Teachers should also realize that
children who acquire a second language will experience cognitive and linguistic advantages. Teachers who are helping them acquire a second language are giving them an opportunity to know an additional language system and learn new methods of handling information. Bowman (1989) suggested that teachers need to also recognize developmentally equivalent patterns of behavior. When children do not respond to the social and cognitive expectations of the school, the teacher should first look for a developmental equivalent task to which children will respond. If children do not respond in large group settings, the teacher should observe language use by them in one-to-one settings.

Until recently, methods of teaching ESL had a strong behavioristic, skills orientation. This usually involved direct teaching of vocabulary and syntax, using techniques such as drill and practice. This philosophy also viewed the first language as interfering with the acquisition of English and its use was discouraged. Research that has led to the whole language movement in literacy development, has also affected ESL instruction. Parallel with a whole language approach a model of second language teaching follows these assumptions: a) children learn language by communicating instead of studying language, b) listening, speaking, reading and writing are interrelated and should be developed simultaneously, c) children learn language through
purposeful interaction within a variety of contexts, d) communication most likely occurs when it is meaningful and connected to concrete experiences, e) language use is encouraged by focusing on meaning rather than correctness of form (Abramson, Seda, & Johnson, 1990). Language experience activities, environmental print, and reading materials appropriate for the students' cultural background encourage second language growth. These materials and practices found in a developmental, whole language program will support language and cognitive development for native and non-native speakers.

**Differences and Similarities**

Many English monolingual learners follow the same developmental sequences observed in children learning English as their second language, regardless of their first language. Research suggests that the patterns followed while acquiring a second language are the same as those followed by native monolingual speakers (McLaughlin, 1982). Studies that suggest similarities between first and second language learners also highlight differences.

Children learning a second language must learn how to express the meanings of the target language, but does not have to learn the basic concepts because they are already in the first language. Second language learners also bring prior knowledge and additional experiences of a first language into the process of acquiring a second language.
Prior knowledge may cause learners to seek familiar ways of expressing information in the new language, that is related to meanings already acquired in the first language. The learner may make distinctions in the new language that are relevant to the first language, even though they may not be correct (McLaughlin, 1982).

Research by Wong-Fillmore, Ammon, Ammon, and McLaughlin (1985) suggested that children learn better when the interactional patterns of the classroom are equivalent to those of their home, that cultural background contributes to differences in learning styles. Their research was conducted with Spanish- and Chinese-speaking children learning a second language in a bilingual classroom. One conclusion of this study was that children who were poor in their second language skills showed large gains in oral language production scores when they were in classes where they had many opportunities to interact with native-English-speaking peers. This held true for the Hispanic students, but not the Chinese students. The Chinese-speaking students did not show the same kinds of improvements. They experienced more success in classrooms with low noise levels, and where teachers kept students on task. They had a low tolerance for distractions, and accomplished more when they received a lot of independent help, and teacher-directed instruction rather than group work. Chinese-speaking children seemed more dependent on
their interaction with the teacher than Hispanic children. Spanish-speaking children seemed to benefit from opportunities to interact with peers who served as good language models and Chinese children seem to benefit from close interactions with the teacher.

Computers and Young Children

Since the influx of microcomputers in education, specifically early childhood education, much literature has been written concerning the effects of microcomputer use on young children. Preschool and primary grade children can use computers and be successful with them. Adults working with these children should examine the influence the use of computers can have on young children.

Children have learned to program the computer as well as complete computer games and puzzles offered in some computer-assisted instruction packages. Papert (1980) developed a programming language for children of all ages called LOGO. Papert, who studied with Piaget, stated the most beneficial learning is what he calls "Piagetian learning" or "learning without being taught" (Clements & Gullo 1984). Papert suggested that computer programming environments can create situations in which young children can learn concepts that were thought to be too abstract for their developmental level. Computers can make the abstract concrete and personal and let children learn more effectively by teaching how, rather than what, to think
Language Development

Research with LOGO reveals that it fosters language rich in emotion, humor, and imagination (Genishi, McCollum, & Strand, 1985). Computers encourage an increase in social development, therefore they should foster increased language development. According to Muhlstein and Croft (1986) preschoolers' language measured as words spoken per minute, was almost twice as high at the computer than at other areas such as blocks, art, or games.

Conversations about what is happening at the computer center, such as what happens on the monitor, and what it means are rich content for language development. "It is ironic that computers have gained the reputation of being 'chatterboxes' as originally professionals worried that they might become isolation booths" (Swick, 1989). Children at this center give information and directions, ask and answer questions, settle disputes, critique work, and make up games. Language at the computer center has also been categorized as social and nonsocial comments. Within these categories language was coded as being indicative of turntaking, being aware of right and wrong answers, teaching, hypothesizing, and verbally interacting with the computer itself (Borgh & Dickson, 1986). Nonsocial language is defined as comments not directed at another person. The nonsocial category included hypothesizing which was evident
when the researcher observed the student wondering how the program worked and what happened with specific key strokes, or thinking about how the computer worked. Also included in this category were instances of counting aloud and labeling a key before striking it.

Borgh and Dickson (1986) suggested that the software characteristics have great influence on the child's verbal communication. In software that required correct answers, almost five times the amount of language was used talking about whether responses were right or wrong, than used with software that had no "right" answers. More peer teaching occurred when using software that emphasized finding the correct answer.

**Social Development**

The influence that computers may have on young children's social interactions is a concern among many researchers. Computers will allow interaction between the child and the computer and between the child and another child. Swigger and Swigger (1984) surmised that having a microcomputer in an early childhood classroom would not interfere with existing social patterns or interactions. The authors note that computer use encouraged joint problem-solving, cooperation, and verbal interactions among small groups of children.

To determine if the social and cognitive behavior patterns in a preschool classroom are influenced by the
presence of a microcomputer, Campbell and Schwartz (1986) observed 30 four year olds during free play for a period of eight weeks. Observations were done four days each week. Two days were observed with the computers present and two days were observed without computers. The coding system consisted of three cognitive categories crossed with Parten’s (1932) indices of social participation. Additional behavior was coded as conflict, nonplay, and adult-directed play. This data revealed that constructive play was seen most often, and this was evident with and without a computer in the classroom.

In a study by Muller & Perlmutter (1985) that compared the social aspect of puzzle play to that of computers, children worked together at the puzzles only 7% of the time, whereas 63% of the time at computers was spent working together. Children were seen taking turns at the computer, but not at the puzzles. Other results of this study were that 70% of peer interactions at the computer consisted of actively sharing use of the computer by taking turns, and 30% of these interactions consisted of verbal and nonverbal assistance. The only negative social behavior that seemed to appear in a computer center was when it was first introduced and children were excited but were competing for time at the computer. This effect usually subsides after a short time, with the assurance of repeated opportunities to use the computer (Campbell & Schwartz, 1986).
Researchers have reported that young children prefer the social use of computers (Clements, 1985a). In fact some teachers say the greatest impact of computers is that children tend to share more. Clements also reported that there is no substantial difference in social patterns between a computer area and other areas of the classroom where students choose free play. He stated that children were more likely to share and instruct each other when they worked on the computer.

A study was conducted (Genishi, McCollum, & Strand, 1985) involving kindergartners that were videotaped over a three month period while they used LOGO and were observed during center time when one of the centers was a computer. During this study attention was given to the different types of interaction: child-child, child-computer, and child-adult. They found that children both gave and received information and their learning occurred as a result of mistakes made and problems that they helped each other resolve. Children developed their abilities to cooperate and to share what they saw, knew, thought and felt. Genishi et al. discovered that fears that computer activity would make children social isolates did not happen and that computer activity can be highly sociable. For these children LOGO activities were as motivating as other kindergarten activities and encouraged more interaction. During this study 95% of the talk was child-child, but
children often spoke directly to the computer calling it "he", "you", etc. (Genishi, McCollum, & Strand, 1985).

Giving young children opportunities to share accomplishments and experiences and to work together can encourage social development. When children gain control of the computer, experience success, develop computer literacy, make choices and learn to program, their self-esteem and self-concept can be enhanced (Baker, 1986).

When teachers allow it, computer activities may invite collaboration, which enhances the achievement of children as individuals and as members of a group. The computer can be a scaffold to help children in discovering problems, seeking help and advice from peers and group problem solving (Osborne, 1986).

Researchers have found that computers facilitate various social behaviors such as cooperation (Muhlstein & Croft, 1986; Muller & Perlmuter, 1985), friendship formation (Swigger & Swigger, 1984), and group constructive play. Others confirm that children spontaneously and effectively teach and help each other in computer environments (Borgh & Dickson, 1986).

The early concern that computers would stifle social interaction appears overstated. It seems children would have to be forced into solitary use of computers for an extended time. Children actually prefer social use of computers and seldom work alone (Swigger & Swigger, 1984).
and cognitive interactions simultaneously are encouraged, each to the benefit of the other (Clements, 1987; Muhistein & Croft, 1986).

Some of the strongest argument for preschoolers' use of the computer emphasize socio-emotional development as a child's sense of competency in computer use increases, self-confidence, personal satisfaction, and feelings of success also increase, which results in the development of a sense of autonomy as a learner (Barnes & Hill, 1983; Brady & Hill, 1984; Clements, 1985a; Swigger & Swigger, 1984; Ziajka, 1983).

In a study conducted by Shade, Nida, Lipinski, and Watson (1986) with four year olds in a university nursery school setting, assisting behaviors had the most dramatic increase from the beginning of the study to the last week. One reason for this increase could be the presence of the teacher at the center, although even without a teacher children generated their own set of rules for turntaking. Another study conducted by Borgh and Dickson (1986) paired two children at a microcomputer, and revealed that a substantial amount of verbal interaction reflected the management of turntaking.

The microcomputer need not have negative effects on social interactions among young children. If appropriate software is used and a classroom policy of sharing the
computer is enforced, the computer can increase the amount of cooperative, collaborative interaction in preschool classes (Borgh & Dickson, 1986). The amount of child-computer interaction depends on the type of software used, and the amount of child-child interaction depends on the software and the arrangement of the environment (Anselmo & Zinck, 1987).

Children's interactions at the computer center change over time. Initially, children's turn-taking has an egocentric emphasis. Soon a peer-oriented emphasis on helping and instructing appears, and finally collaboration and independence from adult guidance (Clements, 1991).

Qualitative Methodology

Qualitative research focuses on the natural setting as the direct source of data using the researcher as a key instrument. Because qualitative researchers are concerned with context, they go into the setting which is being studied. Observing action in the setting in which it occurs gives researchers a more meaningful understanding. Often qualitative researchers use only a pad and a pencil as their instruments while spending considerable amounts of time at the setting. When other equipment, such as video cameras, are used the data are collected on site and are supplemented by the knowledge gained by being on location (Bogdan & Biklen, 1982).

The subject group that was examined for this study was
a rarely observed population, in that it combined English as a Second Language (ESL) students and English as a Primary Language (EPL) students in a pre-kindergarten classroom. The setting is also unique because it is a public school that is utilizing current technology in an early childhood program. Because the setting and subject group for this study are unique, it is important to study it in context so that the influences on interactions between subjects can be noted.

Because qualitative research is often descriptive, the data are collected predominantly in words rather than numbers. With all of its richness these data are analyzed as closely as possible to the form in which it was recorded. Nothing is trivial during this data analysis and everything has the potential for becoming evidence that will bring about a more comprehensive understanding of what is being studied (Bogdan & Biklen, 1982).

The qualitative researcher never relies on a single observation, instrument, or approach, but strengthens the work by the use of triangulation. Triangulation is a method of cross checking multiple methods and multiple sources of data in a qualitative study. Qualitative research does not seek to prove or disprove hypotheses, but to use this triangulation process to produce grounded theory (Wolcott, 1988). The goal of this study is to use the data collected from video recordings, subject interviews, parent
interviews, and written records, to develop theories that will lead to recommendations for future research.

Qualitative researchers strive to interact with their subjects in a natural, unobtrusive manner. They do not want to change the behavior of the subjects as a result of their presence, but would like the behavior to be the same as if they were not present. "Observer effect" is the term used to describe the change in the subjects' behavior due to the presence of a researcher. The greater the control and obtrusiveness of the research, the greater the chance that the researcher will be studying the effects of the methods. If people are treated as research subjects they will usually act like research subjects (Bogdan & Biklen, 1982). In this study observer effect will be minimized because the subjects are accustomed to interacting with the researcher on a daily basis as their classroom teacher.

Qualitative research methods are the most effective way to study young children in this unique setting. Using video recordings in the context of this setting and written records will allow the researcher to understand how young children make sense out of their world and how they think and act in their own setting.
The purpose of the study was to analyze the computer use of English as Second Language (ESL) and English as Primary Language (EPL) pre-kindergarten students during center time. This investigation focused on 1) the types of social strategies and language behaviors that were used among English as Second Language (ESL) and English as Primary Language (EPL) pre-kindergarten students during cooperative Computer Assisted Instruction (CAI) experiences, and 2) the language and social differences between ESL and EPL pre-kindergarten students during cooperative Computer Assisted Instruction (CAI) experiences.

Setting

Kookan Educational Center was the main site for pre-kindergarten in the Arlington Independent School District. The school district had approximately 47,000 students.

Kookan had six classes of pre-kindergarten students and eight classes of preschool special education students. All of the teachers had a three-hour morning class and a three-hour afternoon class. The pre-kindergarten classes could enroll a maximum of 18 students in each class. Students at Kookan followed the same calendar as all other elementary
schools in the district. They attended school five days a week for 180 days a year.

The children who qualified as ESL students by the Preschool IDEA Oral Proficiency Test: English (Pre-IPT: English) were provided instruction by separate ESL teachers. The children were taken from the regular classroom to the ESL class for a period of 45 minutes daily. These smaller classes allowed time for more individual, intense instruction and experiences that focused on language development. The ESL teacher followed the same schedule of unit themes as the regular classroom teacher to provide continuity for students.

The pre-kindergarten classroom that was studied was arranged in centers to correlate with Kookin's philosophy of "hands-on" learning through a variety of concrete materials. This arrangement allowed students to make choices and to work at their own pace. The classroom in this study contained these centers: art, dramatic play, blocks, science, writing, library, math and manipulatives, sand and water, listening, games, and computers. Activities in many of these centers correlated with the week's unit of study. Students were allowed to choose any center to work in provided there was space for them. Most centers had a capacity of four children. Center time usually lasted one hour with a ten minute clean-up time.
**Subjects.** To enter the pre-kindergarten program at Kooken, children must be four years old by September 1 of the current school year (see Table 1). They must also qualify as an ESL student, or qualify for free or reduced meals. This means that students were from low-income families or from families whose primary language is not English.

These children also faced the challenges present in non-traditional family compositions. Nine children in the class studied were from single-parent families. These were usually headed by females.

Other types of families included those with stepparents, grandparents as guardians, or live-in companions as a mother or father figure. Seventeen of the families in this class of subjects had three or more children. This might have presented a challenge for adequate care and attention to each one, especially in a single-parent setting.

The students who qualified as ESL students had challenges of language and cultural barriers. The ESL children in this class represented Asian, Hispanic, Eastern Indian, and African ethnic groups. These families all had a primary language other than English. A notable transition occurred as children came into the class at the beginning of the school year with no English-speaking abilities and left speaking fluent English. The parents usually had more
difficulty communicating with teachers. Without a translator it was difficult for the teacher to communicate class activities and the progress of their child.

The morning class in this study consisted of 16 students. Five of them qualified as ESL students (4 girls and 1 boy). A total of seven boys and nine girls was in this class. Among the 17 students in the afternoon class, five of them were ESL students (4 boys and 1 girl). A total of nine boys and eight girls was in the afternoon class.

**Computer experiences.** The computer center in this study was set up to accommodate four children at one time. There were four chairs facing a long table that was equipped with two Macintosh LC computers.

One of the software packages that was used by the children was *The Playroom* from Broderbund. It is a child-sized world that’s filled with games, toys, surprises, and learning experiences. *The Playroom* is designed to foster young children’s natural desire to explore and reward it with fascinating new discoveries. As students played in *The Playroom* they learned about letters, numbers, time, how the computer works, and exercised their thinking skills. They used the mouse to click on the active objects. Some of the objects such as the fish in the fish bowl, the radio, the curtain, the bird, the dinosaur, the drawer, and the bed all produced sounds or movements when clicked on. Other active objects, such as the Clock, the Mixed-up Toy,
Mousehole, Spinner Toy, ABC Book, and Computer, led to a game or activity on another screen. From another screen the child returned to the playroom at any time by choosing the little door in the lower right corner of the screen.

Students explored the playroom by moving the cursor around the room with the mouse. The Clock activity helps children learn how to tell time to the nearest hour. Children discovered that each time happens twice a day. The position of the sun or moon in the window helped children learn that time corresponds to the progress of the day or night. Children chose a number on the clock face to see what Pepper Mouse was doing at that time of day. If they clicked on the middle of the clock face, a surprise time would appear.

When students clicked on the computer, a screen featuring a computer keyboard and monitor appeared. This activity focused on reading readiness, spelling skills, and computer keyboard skills. It introduced students to uppercase and lowercase letters, positions on a standard keyboard, and three-, four-, and five-letter words. When students chose a letter from the computer keyboard it appeared as a large, lowercase letter on the computer screen. When they were ready to spell a word, they woke up Pepper Mouse by pressing the spacebar key and 11 gifts appeared on the screen. They then chose one and began spelling its name.
Table 1

Description of Students

<table>
<thead>
<tr>
<th>ESL AM Students</th>
<th>EPL AM Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>Home Computer</td>
</tr>
<tr>
<td>F6</td>
<td>4-9</td>
</tr>
<tr>
<td>F7</td>
<td>4-10</td>
</tr>
<tr>
<td>F8</td>
<td>4-11</td>
</tr>
<tr>
<td>F9</td>
<td>5-4</td>
</tr>
<tr>
<td>M15</td>
<td>5-7</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ESL PM Students</th>
<th>EPL PM Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>M7</td>
<td>5-0</td>
</tr>
<tr>
<td>M13</td>
<td>5-3</td>
</tr>
<tr>
<td>F17</td>
<td>5-5</td>
</tr>
<tr>
<td>M14</td>
<td>5-6</td>
</tr>
<tr>
<td>M15</td>
<td>5-8</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
When students clicked on the Mixed-up Toy a screen with a large version of the toy appeared. This activity encouraged students to be creative and helped develop analytical skills as they discovered how to manipulate the parts of the toy to create a complete drawing. The three body parts (head, torso, legs) of the toy could be changed by clicking the cursor on each one. A new combination was created each time one of the body parts was selected. To change all of the parts at once, the students chose the picture of the toy in the upper right corner of the screen. Students printed a copy of their favorite toy by clicking on the printer icon.

Clicking on The Mousehole produced a screen with a game board format. This counting game teaches mathematical skills as well as game strategies. The game has three levels and can be played by one or two players. The object of the game is to be the first one to the winner's square at the end of the board. To roll the dice the students chose the dice shaker and three dice appeared. The student then picked one with the cursor and the character automatically moved forward the number of spaces shown on the die. White circles move the player forward and the black circles bounce the player backward.

When a student chose the ABC Book one of the various storybook scenes appeared on the screen. This combined the creativity of arranging objects in a drawing with a basic
reading skill of associating a beginning letter with a word picture. This activity reinforced beginning sounds and increased vocabulary by using different sets of words for each scene. Children could also make up creative stories about the picture they created. Students first chose a letter of the alphabet and an object appeared. Then they picked up the object with the cursor and placed it anywhere in the scene. To make a new scene appear, they chose the page flap in the corner of the screen. Each scene had its own set of objects. Students could print favorite pictures by choosing the printer icon.

If a student chose The Spinner Toy a large version of the toy appeared on the screen. This teaches students how to count and recognize numerals 1-12. By counting many objects, students learn the concept that three means three whether it is three hats, or three candles. All of the games described here can be classified as exploratory/game activities.

Another software package used in this study was Magee. Magee is a simulation activity that allows students to learn logical consequences, recognize parts of a whole picture, and practice using a mouse to manipulate the computer. Magee is a toddler boy depicted in various rooms of his house and outdoors. The majority of the computer screen is a scene of a room in Magee's house or the backyard. The bottom strip of the screen consists of four squares that
feature some part of the overall picture. The student can click on each square to see what happens as a result. In the kitchen the student can choose the telephone and see Magee go over and dial and listen for an answer. Upstairs the student may choose to go in the Mother's room, Magee's room, the hallway, or the bathroom. Each room features four new choices at the bottom of the screen.

This class also had access to free computer programs that the kindergarten classes in the district used. These involved the students in drill and practice activities that required matching colors, shapes, numbers, letters, objects and classifying objects.

The Playroom and Magee were chosen because they both have excellent graphics that the students can relate to, and both provide opportunities for exploration. Magee is a simulation program that depicts situations that are realistic. This program does not require any prerequisite skills, so even the youngest student of the class can experience success.

The Playroom has a combination of realistic (clock, computer) activities and playful, imaginative ones (mixed-up toy, mouse hole, ABC book). This program features a variety of activities that are constantly changing depending on responses or response combinations. This characteristic of the software is important for holding the students' interest. The skill levels for the various activities range
from very easy, to challenging. This allows the students to work at their own level and challenge themselves when appropriate. Students are exposed to a variety of concepts in this program. Some activities focus on readiness skills such as letter and number recognition, beginning sounds, and counting. Other activities focus on creativity and problem-solving.

Drill and practice programs do not have the extensive graphics characteristic of the other software packages. These programs exhibit simple objects that are easily recognized by the students. In some cases students must be able to read to perform the activities. They must be able to read color and shape words and understand the directions for the activity. A dot-to-dot program requires students to recognize numerals and the order in which they occur. These programs do not offer the variety and exploration that Magee and The Playroom possess. These activities are the same repeated over and over again.

Data Collection

Data was collected over a four week period (which was 18 hours of video recordings of all subjects at the computer center). Methods for data collection included video recordings, subject interviews, parent surveys, and written records.

Parent computer surveys. The study began by asking parents to complete a survey. These were done before the
computer center was ready to be used. Parents were asked to complete a written survey consisting of ten questions (see Appendix A). The survey provided information about the pre-kindergarten student's computer use other than at school, and about the parents' knowledge and use of computers. The parents were given the survey when they came for parent-teacher conferences near the end of the second semester of school. For those parents that could not attend a conference, a survey was sent to them through the student. The questionnaire took five minutes to complete. Besides information about computer use, the survey asked parents to list all other children so the researcher would have an understanding of their family composition.

**Video recordings.** The computer center was set up at one end of the classroom near other quiet centers. The computer center had space for four children - two at each computer. A video camera was placed on a tripod in the corner of the classroom near the computer center. The camera was placed behind the students that worked on the computers and positioned so that all four children and both computers could be viewed at once. The camera was on during center time (1 hour) in the morning and afternoon classes to record interactions between the students as they used the computers. The video recordings began the day after the computers were set up in the center and continued until the last day of school. This resulted in 18 hours of video
recordings.

**Subject interviews.** Each student participated in an interview based on the "Young Children's Computer Inventory" developed by Dr. Keiko Miyashita (see Appendix A). This inventory has been used with kindergarten students and was adapted for use with pre-kindergarten students. The Young Children's Computer Inventory measures attitudes rather than achievement (Miyashita & Knezek, 1992).

The students were interviewed individually by the researcher. Each student was called to a table in one of the classroom centers, where the researcher had the materials ready for the interview. Three poster board circles with large faces on them were placed in front of the students on the table. A happy face represented "yes" or "I like it". A frowning face represented "no" or "I don't like it". And a straight face indicated "I don't know". Students were told to answer the questions by pointing to the face that illustrated how they felt. A Spanish version of the test was used for the Hispanic students that spoke mainly Spanish and was administered by the teacher assistant who spoke fluent Spanish. Each interview lasted 5 - 10 minutes. The interviews were conducted simultaneously with the video recordings in the computer center.

**Written records.** Written records that were already being used by the school were collected and retained by the researcher. These records were used by the pre-kindergarten
teachers to monitor the development and progress of the students. These records consisted of a developmental checklist, the PPVT-R test, and the Pre-IPT: English. The developmental checklist was used for a mid-year and final evaluation (see Appendix C). The checklists were developed from the collaboration of all the pre-kindergarten teachers and the supervisor using other checklists as guides. The objective of the checklist was to convey to parents what was considered important by the teachers for their child to accomplish and to reflect the goals of the curriculum. The checklist was written in simple terms so that all of the parents would understand what was expected. It was also translated in Spanish for the Hispanic parents.

The checklist was divided into five major areas which included: communication, cognitive, motor, fine arts, and social-emotional. Communication included skills relating to expressive, receptive, and written communication. This area focused on skills such as speaking clearly, responding to stories, recognizing name in print, remembering names, and talking to other children. Cognitive skills included recognizing colors, shapes, body parts, sorting objects, and solving problems. Working puzzles, using writing tools and scissors with control and jumping and climbing were some of the motor skills highlighted. Fine arts included listening to music, singing, creating with art materials, and acting out stories. Social-emotional skills included areas that
help the child function in a group.

The Peabody Picture Vocabulary Test-Revised (PPVT-R) is an individually administered, norm-referenced, wide-range, test of listening vocabulary. The test contains five training items, followed by 175 test items arranged in order of increasing difficulty. Each item has four simple, black-and-white illustrations arranged in a multiple-choice format. The student’s task was to select the picture considered to illustrate best the meaning of a stimulus word presented orally by the examiner.

This test is designed for persons 2 1/2 through 40 years of age who can see and hear reasonably well, and understand Standard English to some degree. Testing requires only 10 to 20 minutes, because the subject must answer only about 35 to 45 items of suitable difficulty. Items that are far too easy or difficult are not administered. The PPVT: R was given to students soon after they enrolled in school and near the end of the school year.

The Preschool IDEA Oral Proficiency Test: English (Pre-IPT: English) was given to determine if students whose primary language was other than English qualified for the ESL program. This test was designed to assess four areas: vocabulary (42 items), comprehension (42 items), grammar/syntax (16 items), and verbal expression (29 items) which includes children’s use oral language ability. It is organized by developmental or sequential levels of
difficulty. Internal consistency reliability (Cronbach's Alpha) for the instrument is .97 (Williams, Ballard, & Tighe, 1988).

The Pre-IPT: English is a process by which a student is required to respond to controlled stimuli, both verbal and visual. Responses are then assessed as to correctness, appropriateness and completeness. Vocabulary for the test was chosen from among words most commonly used by native English speaking preschool age children. Vocabulary is implicit in every test item. Comprehension was also assessed with every item. The child must either respond or perform according to the instructions given by the examiner. Grammar/syntax was elicited through the verbal interaction between the child and the examiner. The arrangement of adjectives, nouns, and verbs as well as correct and appropriate usage of language was assessed. Finally, verbal expression was assessed as a part of every item in which the child was expected to respond. This was demonstrated when the child responded in a comprehensible manner. Children should not be given the test beyond the point where the comprehension level is exceeded. Non-English speaking children will take an average of five minutes for testing, while Limited and Fluent English speakers will take longer depending on their skills.

When students were enrolled in school parents completed a Home Language Survey. If the parents indicated the
primary language used in the home was anything other than English, the student was evaluated using the Pre-IPT: English. The test was administered by the ESL teacher who was trained in the process. The teacher interpreted the score and placed the student in an ESL class if the student was within the guidelines. These specific written records were not required for this study, but were already being used in this school for monitoring and evaluation.

Data Analysis

Analyzing data in qualitative research is usually inductive. Data are not used to prove or disprove hypotheses at the outset of the study. By analyzing data this way new theories and hypotheses for future research can be developed from investigations (Bogden & Biklen, 1982).

Parent surveys. Information from parent surveys was used to determine (a) which students have had previous computer experiences, and (b) if previous knowledge influences students' behavior at the computer center. These experiences outside the classroom may have affected the students' behavior at the computer center. Also, the survey allowed the researcher to determine some pre-conditions of family life, such as how many adults were in the family, how many children were in the family, if computers were available to the children, and if parents worked in jobs that required knowledge of computers.

Video recordings. After video recordings were
collected they were used to determine what types of interactions were present between the students at the computer center. Interactive episodes which began with verbal and or physical contact and ended when children broke physical proximity, were identified and tabulated. Transcripts were written of every episode to determine how each child participated in the center. A file was created for each participant that included all transcripts. Transcripts were highlighted to identify when the subject participated in the interactive episode, and to enable the researcher to tabulate those episodes. This indicated whether the subject had a high or low level of participation. The video recordings were reviewed to identify (a) the number of interactive episodes between ESL and EPL students and (b) the social strategies and language behaviors exhibited by the students.

**Subject interviews.** The results of the subject interviews were analyzed by comparing data with the other sources of data. This process allowed the researcher to investigate the consistencies and patterns in students' perceptions of their computer experiences. The researcher used this information to determine how student's attitudes about the computer according to their answers on the interview, corresponded to their behavior at the computer center. The information was also used to characterize the group according to their likes and dislikes regarding
Two psychological indices can be created by summing related items (Knezek & Miyashita, 1993). Computer importance refers to the perceived value of knowing how to use computers. Students' answers to item numbers 4, 6, 7, 8, and 9 indicated how important they thought it was to use computers at school. These items were chosen because they reflected the students' high regard for using computers in school or if they viewed it as just another activity in pre-kindergarten. Computer enjoyment is the pleasure received from using computers. Item numbers 1, 2, 3, and 7 are related to this subscale. These items were chosen because they reflect the students' enthusiasm or apathy toward using computers.

Written records. Information from the developmental checklist, the PPVT-R test and the Pre-IPT: English test was used to determine: a) level of vocabulary development, b) amount of English usage, and c) the overall development of the student. This information provided an accurate description of the students' abilities in these areas.

Summary of Methodology

Qualitative research focuses on the natural setting as the direct source of data using the researcher as a key instrument. Because qualitative researchers are concerned with context, they go into the setting which is being studied. Observing action in the setting in which it occurs
gives researchers a more meaningful understanding. Often qualitative researchers use only a pad and a pencil as their instruments while spending considerable amounts of time at the setting. When other equipment, such as video cameras, are used the data are collected on site and are supplemented by the knowledge gained by being on location (Bogdan & Biklen, 1982).

The subject group that was examined for this study was a rarely observed population, in that it combined ESL and EPL students in a pre-kindergarten classroom. The setting was also unique because it was a public school that utilized current technology in an early childhood program.

Because qualitative research is often descriptive, the data are collected predominantly in words rather than numbers. With all of its richness this data is analyzed as closely as possible to the form in which it was recorded. Nothing is trivial during this data analysis and everything has the potential for becoming evidence that will bring about a more comprehensive understanding of what is being studied (Bogdan & Biklen, 1982).

The qualitative researcher never relies on a single observation, instrument, or approach, but strengthens the work by the use of triangulation. Triangulation is a method of cross checking multiple methods and multiple sources of data in a qualitative study. Qualitative research does not seek to prove or disprove hypotheses, but to use this
triangulation process to produce grounded theory (Wolcott, 1988). The goal of this study was to use the data collected from video recordings, subject interviews, parent interviews, and written records, to develop theories that will lead to recommendations for future research.
CHAPTER IV

RESULTS

The video recordings and transcripts analyzed for this study revealed information related to students’ language and behavior at the computer center. The amount of time students spent at the center was studied and interactions were tabulated. Interactions were also examined with regard to what software the students used. This information was organized according to the two research questions that directed this study, and the sources of the data.

1. What types of social strategies and language behaviors are used among English as Second Language (ESL) and English as Primary Language (EPL) pre-kindergarten students during cooperative Computer Assisted Instructional (CAI) experiences?

Parent Surveys

This study began with a parent survey given to each parent as they came for a conference with the teacher. This survey was designed to provide the researcher with information related to the students’ previous computer experiences, parent’s computer experiences, and information regarding family composition (see Appendix A).
The survey revealed that five of the total subject group had computers at home, but only four replied that their pre-kindergarten children used the computer. Two of them had software designed for their pre-kindergarten children.

Parents also indicated how much time their child used the computer. Two parents stated that their pre-kindergarten child used the computer one hour per week. Also, two parents stated their students used the computer two hours per week. Two of these parents also said that siblings helped the pre-kindergarten student, and three parents said they helped their child on the computer.

Besides home, some students may be allowed to use computers in other places such as day care, or a relative’s or friend’s home. Three parents replied that their pre-kindergarten student had this opportunity. One student used a computer at day care, one at a neighbor’s home, and one at a relative’s home. None of these students were from the group that owned computers.

The final question inquired about the parent’s computer experiences. Four parents stated that they used a computer at work only, and three parents stated they used a computer at home only. In addition to these, two parents indicated that they used a computer at home and at work. This survey revealed that very few students in this subject group had previous experiences with computers. This unfamiliarity
with computers raised students' interest in participating in the computer center and resulted in experimentation and discovery learning. Students were observed looking under the tables and behind the computer as if they were trying to discover what made it function. Students also manipulated other buttons and knobs and observed the effects. This elicited questions and comments about what was happening, as in this example:

DeShawn: I can't even see. (after turning the monitor brightness control)

Dominique: Hey, you cut it off.

DeShawn: Uh uh. (reaching around the monitor to turn the control again)

Dominique: Ooh, it's comin' on. How you do that?

DeShawn: Do that and it come on and come off. I'm doing it again.

As students became familiar with the computer hardware they seemed to concentrate more on the software and their activities with it.

Three of the five students who had a computer at home spent more than 100 minutes at the computer center. The other two students had low totals. A consistent pattern regarding computer ownership and minutes spent in the computer center was not revealed.

Video Recordings

Eighteen hours of video tapes were transcribed and
analyzed to provide descriptive information about computer use in this pre-kindergarten classroom. These transcripts were used to determine: (a) the amount of time each student spent in the computer center, (b) the number of interactions that occurred in the computer center, (c) the amount of time students spent with other students, and (d) a description of the language used, and the social behavior observed at this center.

**Time spent in the computer center.** The time students spent in the computer center was tabulated two ways. The total number of minutes each student spent in the center and the number of minutes spent with other students was determined.

After calculating the total number of minutes for each student, it became evident that boys spent more time in the center than girls (see Tables 2 & 3). The boys in the morning class spent a total of 962 minutes in the computer center, and the girls spent a total of 776 minutes there. When averaged, each boy spent 137 minutes at the computers and each girl spent 86 minutes at the computers (see Table 2). The total minutes for the boys in the afternoon class was 1053, and the girls spent a total of 501 minutes in the computer center. The average time for each boy was 117 minutes, and the average time for each girl was 62.6 minutes (see Table 3). When students worked at the computer center they usually worked in pairs -- two at each computer.
Students went to the center together, intending to work together. When a new student entered the center, other students would move around so that they could sit by their friend. This behavior indicated that students had a preference for whom they wanted to work with, although it was not always possible to work with the student of their choice (see Tables 4 & 5). The following conversation occurred when a new student joined the group and decided who she wanted to work with:

Alyssa: Can I come here?
Kalan: Sit my me, Alyssa!
Nakeda: Yeah! Me, me, me!
Tony: Ok, I'll go with you. (to Kalan)
Alyssa: Tony, you go with Nakeda. I'll go with Kalan.
Tony: No.

Interactive Episodes

Interactive episodes are social exchanges between two or more peers. In this study, interactive episodes were determined by a conversation of common interest between the peers. When the conversation changed topics or shifted to another peer group it was considered a separate interaction. Analysis of the transcripts from the video recordings revealed a total of 590 interactive episodes.
Table 2

**Total Minutes Spent in the Computer Center - AM**

<table>
<thead>
<tr>
<th></th>
<th>EPL Students</th>
<th>ESL Students</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Males</td>
<td>Females</td>
</tr>
<tr>
<td>M1</td>
<td>218</td>
<td>F1 158</td>
</tr>
<tr>
<td>M2</td>
<td>205</td>
<td>F2 156</td>
</tr>
<tr>
<td>M3</td>
<td>167</td>
<td>F3 130</td>
</tr>
<tr>
<td>M4</td>
<td>164</td>
<td>F4 126</td>
</tr>
<tr>
<td>M5</td>
<td>41</td>
<td>F5 109</td>
</tr>
<tr>
<td>M6</td>
<td>22</td>
<td></td>
</tr>
<tr>
<td><strong>Total minutes</strong></td>
<td><strong>817</strong></td>
<td><strong>679</strong></td>
</tr>
<tr>
<td><strong>Mean</strong></td>
<td><strong>137</strong></td>
<td><strong>135.8</strong></td>
</tr>
<tr>
<td>M7</td>
<td>145</td>
<td>F6 35</td>
</tr>
<tr>
<td>M8</td>
<td></td>
<td>F7 30</td>
</tr>
<tr>
<td>M9</td>
<td></td>
<td>F8 16</td>
</tr>
<tr>
<td>M10</td>
<td></td>
<td>F9 16</td>
</tr>
<tr>
<td><strong>Total minutes</strong></td>
<td><strong>145</strong></td>
<td><strong>97</strong></td>
</tr>
<tr>
<td><strong>Mean</strong></td>
<td><strong>145</strong></td>
<td><strong>24.25</strong></td>
</tr>
</tbody>
</table>

**EPL Total = 1496**

**EPL Mean = 136**

**ESL Total = 242**

**ESL Mean = 48.4**
Table 3

**Total Minutes Spent in the Computer Center - PM**

<table>
<thead>
<tr>
<th></th>
<th>EPL Students</th>
<th>ESL Students</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M8  238</td>
<td>M13  132</td>
</tr>
<tr>
<td>Males</td>
<td>M9  129</td>
<td>M14  127</td>
</tr>
<tr>
<td></td>
<td>M10  121</td>
<td>M15  64</td>
</tr>
<tr>
<td></td>
<td>M11  107</td>
<td>M16  63</td>
</tr>
<tr>
<td></td>
<td>M12  72</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total Minutes = 667</td>
<td>Total minutes = 386</td>
</tr>
<tr>
<td></td>
<td>Mean = 133.4</td>
<td>Mean = 96.5</td>
</tr>
<tr>
<td>Females</td>
<td>F10  150</td>
<td>F17  20</td>
</tr>
<tr>
<td></td>
<td>F11  111</td>
<td></td>
</tr>
<tr>
<td></td>
<td>F12  61</td>
<td></td>
</tr>
<tr>
<td></td>
<td>F13  53</td>
<td></td>
</tr>
<tr>
<td></td>
<td>F14  41</td>
<td></td>
</tr>
<tr>
<td></td>
<td>F15  36</td>
<td></td>
</tr>
<tr>
<td></td>
<td>F16  29</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total Minutes = 481</td>
<td>Total Minutes = 20</td>
</tr>
<tr>
<td></td>
<td>Mean = 68.7</td>
<td>Mean = 20</td>
</tr>
<tr>
<td></td>
<td>EPL Total = 1148</td>
<td>ESL Total = 406</td>
</tr>
<tr>
<td></td>
<td>EPL Mean = 95.6</td>
<td>ESL Mean = 81.2</td>
</tr>
</tbody>
</table>
Table 4
Time Spent Interacting With Other Students at the Computer Center - AM

<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th>M</th>
<th>M</th>
<th>M</th>
<th>F</th>
<th>F</th>
<th>M</th>
<th>F</th>
<th>F</th>
<th>F</th>
<th>M</th>
<th>F</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>1</td>
<td>2</td>
<td>7</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>M2</td>
<td>30</td>
<td>39</td>
<td>11</td>
<td>33</td>
<td>0</td>
<td>9</td>
<td>16</td>
<td>15</td>
<td>5</td>
<td>29</td>
<td>0</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>M1</td>
<td>39</td>
<td>87</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>24</td>
<td>3</td>
<td>20</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>15</td>
<td>7</td>
</tr>
<tr>
<td>M3</td>
<td>11</td>
<td>2</td>
<td>27</td>
<td>20</td>
<td>54</td>
<td>16</td>
<td>10</td>
<td>9</td>
<td>3</td>
<td>11</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>M4</td>
<td>33</td>
<td>6</td>
<td>20</td>
<td>28</td>
<td>5</td>
<td>6</td>
<td>18</td>
<td>11</td>
<td>6</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>F1</td>
<td>15</td>
<td>20</td>
<td>9</td>
<td>19</td>
<td>0</td>
<td>32</td>
<td>0</td>
<td>25</td>
<td>17</td>
<td>21</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>F2</td>
<td>9</td>
<td>24</td>
<td>16</td>
<td>6</td>
<td>26</td>
<td>5</td>
<td>0</td>
<td>20</td>
<td>28</td>
<td>16</td>
<td>6</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>M7</td>
<td>16</td>
<td>3</td>
<td>10</td>
<td>18</td>
<td>18</td>
<td>0</td>
<td>32</td>
<td>0</td>
<td>21</td>
<td>0</td>
<td>15</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>F3</td>
<td>0</td>
<td>12</td>
<td>54</td>
<td>4</td>
<td>0</td>
<td>26</td>
<td>9</td>
<td>17</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>F4</td>
<td>5</td>
<td>0</td>
<td>4</td>
<td>6</td>
<td>0</td>
<td>28</td>
<td>21</td>
<td>15</td>
<td>14</td>
<td>33</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>F5</td>
<td>21</td>
<td>2</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>16</td>
<td>0</td>
<td>6</td>
<td>33</td>
<td>14</td>
<td>0</td>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td>M5</td>
<td>0</td>
<td>0</td>
<td>11</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>15</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>6</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>F6</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>12</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>F7</td>
<td>7</td>
<td>7</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>M6</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>15</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>F8</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>9</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>F9</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>10</td>
<td>6</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Boldface times represent minutes spent alone at a computer. Students are in time rank order.
Table 5

**Time Spent Interacting With Other Students at the Computer Center - PM**

<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th>F</th>
<th>M</th>
<th>M</th>
<th>F</th>
<th>M</th>
<th>M</th>
<th>M</th>
<th>M</th>
<th>M</th>
<th>F</th>
<th>F</th>
<th>F</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>M8</td>
<td>20</td>
<td>48</td>
<td>14</td>
<td>32</td>
<td>2</td>
<td>15</td>
<td>33</td>
<td>15</td>
<td>10</td>
<td>14</td>
<td>14</td>
<td>0</td>
<td>14</td>
<td>5</td>
</tr>
<tr>
<td>F10</td>
<td>48</td>
<td>11</td>
<td>17</td>
<td>12</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>8</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>19</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>M13</td>
<td>33</td>
<td>0</td>
<td>29</td>
<td>0</td>
<td>9</td>
<td>11</td>
<td>9</td>
<td>14</td>
<td>12</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>M9</td>
<td>35</td>
<td>12</td>
<td>3</td>
<td>0</td>
<td>16</td>
<td>43</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>10</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>M14</td>
<td>15</td>
<td>0</td>
<td>0</td>
<td>43</td>
<td>11</td>
<td>16</td>
<td>11</td>
<td>1</td>
<td>6</td>
<td>0</td>
<td>7</td>
<td>0</td>
<td>17</td>
<td>0</td>
</tr>
<tr>
<td>M10</td>
<td>11</td>
<td>5</td>
<td>0</td>
<td>3</td>
<td>65</td>
<td>8</td>
<td>0</td>
<td>3</td>
<td>5</td>
<td>18</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>F11</td>
<td>2</td>
<td>0</td>
<td>69</td>
<td>0</td>
<td>6</td>
<td>0</td>
<td>9</td>
<td>9</td>
<td>11</td>
<td>3</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>M11</td>
<td>15</td>
<td>11</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>19</td>
<td>2</td>
<td>0</td>
<td>14</td>
<td>2</td>
<td>10</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>M12</td>
<td>10</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>1</td>
<td>5</td>
<td>12</td>
<td>14</td>
<td>1</td>
<td>11</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>M15</td>
<td>14</td>
<td>0</td>
<td>18</td>
<td>12</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>3</td>
<td>12</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>M16</td>
<td>14</td>
<td>9</td>
<td>2</td>
<td>0</td>
<td>5</td>
<td>7</td>
<td>0</td>
<td>10</td>
<td>0</td>
<td>12</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>F12</td>
<td>0</td>
<td>19</td>
<td>0</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>24</td>
</tr>
<tr>
<td>F13</td>
<td>14</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>17</td>
<td>11</td>
<td>6</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>F14</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>24</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>F15</td>
<td>2</td>
<td>11</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>F16</td>
<td>0</td>
<td>22</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>F17</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Boldface times represent minutes alone at a computer.

Students are in time rank order.
Social behaviors. Transcripts were analyzed according to the social behavior exhibited. The interactions were labeled as exhibiting onlooker, solitary, parallel, associative, or cooperative behavior (see Table 6).

Onlooker behavior was evident when a student stood near others, but was usually observing. Students exhibited onlooker behavior if they came to the computer center when two other students were already working at each computer. There was a total of 74 interactions involving onlooker behavior. An example of an interaction with Nakeda as the onlooker follows:

Horace: Nakeda! Tony know how to do it.
Nakeda: I’m just gonna watch.
Horace: Look. He said if you put it up like that ...
Nakeda: A light bulb. (actually a hot air balloon)
Tony: A parachute.

Solitary play involves the activities of a child playing alone. There was only one instance when a child was observed playing alone at the computer. After a short time alone, he solicited input from the teacher:

Cyril: I want to make something. Mrs. S., Mrs. S. I want to do a different game.
Teacher: You need to stay on that, now.
Cyril: I don’t want to do that no more.
Teacher: Go to another center.
In this study, parallel behavior was noted when a student from one computer interacted with a student at the other computer, but was not acknowledged or the response was unrelated. There were 63 instances of parallel behavior during this study. This is an example of parallel behavior with Brandy and Joey at one computer and Femi at another:

Femi: Look Joey. I'm beatin' you. Joey, I don't have too much to go.
Bridget: Anyways I was doing a puzzle. Joey I was back to the airplane!
Femi: Look Joey. Look what they puttin' out.
Joey: I got to the kid.

Although all of these students were working close together, they each had their own interests. Often they did not even respond when another student initiated an interaction.

During associative behavior, usually more than two students were in the group and they entered and exited the group freely. In this study, associative behavior was evident when students interacted with each other regarding the same activity, but not necessarily having the same goal. Associative behavior was also evident when students switched back and forth between the computers and more than two students were working together.
Table 6

**Interactions Categorized by Social Behavior and Software**

| Social Behaviors | Software | | | | | | |
|---|---|---|---|---|---|---|
| | Playroom | Magee | Dot | Match | | | |
| EPL Subjects | | | | | | | |
| Onlooker | 34 | 9 | 13 | 4 | 13% | | |
| Solitary | 0 | 1 | 0 | 0 | <1% | | |
| Parallel | 21 | 12 | 12 | 6 | 11% | | |
| Associative | 87 | 30 | 28 | 11 | 34% | | |
| Cooperative | 103 | 47 | 24 | 24 | 42% | | |
| **Total Interactions** | 466 | | | | | | |
| **Average Interactions per EPL Student** | 20.3 | | | | | | |
| ESL Subjects | | | | | | | |
| Onlooker | 11 | 1 | 2 | 0 | 11% | | |
| Solitary | 0 | 0 | 0 | 0 | 0% | | |
| Parallel | 12 | 0 | 0 | 0 | 10% | | |
| Associative | 20 | 2 | 20 | 4 | 37% | | |
| Cooperative | 26 | 11 | 8 | 7 | 42% | | |
| **Total Interactions** | 124 | | | | | | |
| **Average Interactions per Student** | 12.4 | | | | | | |
The following example shows three students working together but they each have their own goals:

Joey: No. Only 4 people.
Tracy: Not that one.
Bridget: He's asleep.
Tracy: I want one.
Tracy: I wanna do it. I wanna do it. I wanna see the mouse fall down. Make the mouse fall down.
Joey: He do it again.
Tracy: You make him fall? You did?
Tracy: Go out.
Joey: Takin' a bath. Look, Bridget.
    Takin' a bath.
Bridget: 1,2,3,4,5,6,7,8,9,10.

It was common for students to switch from one computer to another or just to lean over to the other computer and participate in that conversation for a few minutes. Associative behavior was observed 202 times in this study. Cooperative behavior is organized and the participants seem to have a common goal. This behavior had the highest occurrence in this study with 250 interactions that were similar to this one:
Femi: I'm going to the computer. What start with your name, Hungo?
Hungo: H.
Femi: Where's H?
Hungo: This is H.
Femi: This?
Hungo: Uh huh.
Femi: This one, ok.
Hungo: Now U.
Hungo: N.
Femi: N? Where's N?
Hungo: Let me look. Right here. G. (this continued until they had spelled Hungo's first and last name)

Language behaviors. Borgh and Dickson (1986) studied the verbal and social interactions between preschool students at a computer. They identified the following categories of language used at the computer: turntaking, awareness of right and wrong answers, teaching, hypothesizing, and interacting with the computer itself. Other categories emerged during analysis and these categories were expounded by the researcher to include: describing, soliciting teacher input, irrelevant, and interrupting. These categories were used to determine the language behaviors of the pre-kindergarten students in this study while they used
computers.

When the transcripts were analyzed each interaction was labeled with one of the Borgh and Dickson categories or one of the four categories that were added by the researcher. Teaching/instructing had the highest occurrence with 161 interactions. This accounted for 27% of the total interactions (see Table 7). Interacting with the computer occurred the least (13) and hypothesizing was next lowest with 14 incidences.

Students did not receive any training with the software except for showing them how to move around with the mouse. The teacher responded and gave assistance when asked, but the majority of the time students asked each other for help. This resulted in a high incidence of teaching/instructing interactions such as this one:

**Joey:** Guys how do you get that?

**Femi:** Do this. Now press that. The pink one. The red one. The red one. Press it. The red one. Go down.

**Hungo:** Go down.

**Femi:** All of them, do all of 'em. Look what we got, Joey.

**Joey:** Guys how you....

**Femi:** Just get the magic wand.

**Joey:** What?
Femi: Get the magic wand. Go back and get the magic wand.

Joey: How?

Femi: Go back and get the magic wand. Get the magic wand and then...

Hungo: Then you get that.

Femi: Pick this.

Joey: Here? Do it from here?

Femi: This. It’s this. He’s on the telephone. Yeah.

This interaction is typical of the peer teaching that occurred in the computer center. Students attempted to verbalize the directions and sometimes had to demonstrate when the verbal message was not understood or the student did not know how to do what was required. Problem-solving and cooperation was also important in accomplishing the desired task.

The turntaking and interrupting categories were observed in 115 interactions each. Turntaking was most common at the beginning of the study when students were eager to spend as much time as possible in control at the computer. As time went by, students still discussed whose turn it was but they were not as aggressive about it. The following is an example of students determining whose turn it is:

Cyril: Hey, Horace, I got an idea. We can share this computer. When you get one, then I get one.
Horace: No.
Cyril: I won't be your friend.
Horace: You don't supposed to do it like that.
Cyril: Yes you can. I can do it?
Horace: Ok. We got this one, Alyssa. Hooray, hooray.
Yeah!
Cyril: Wow. Watch out! Ok, your turn. Do it 2
times. You have to get 2 turns 'cause that's
C'mon! Yeah! Go man! Oooh, look he fell.

Interrupting was a common language category observed
when onlookers became involved in the action at the
computer. This happened when there were six students at the
center - four in chairs, and two as onlookers.
Interruptions also came from students at the other computer.
This is an example of an interruption with Cyril and Nakeda
as onlookers:

Rizwan: My turn after Cendall.
Cyril: This is going to be a doll.
Rizwan: After Cendall it's my turn.
Nakeda: Hurry, they're winning. Hurry, hurry!
Cyril: Hurry, hurry!

Students focused on determining right/wrong answers
during 46 interactions. Students discussed whether specific
answers were right or wrong and they discussed winning, when
they got all answers correct. This is an instance of discussing specific answers:

Dominique: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12. 12. (counting objects on the screen)

Joey: Pick 1.

Dominique: It's not 1.

Joey: What's that?

Dominique: 1, 2, 3, 4, 5. 1. (counting objects again)

Joey: Huh, cool! 2. Her workin' up the stuff! 1, 2, 3. They blast off. Do this.

They talk.

Describing, irrelevant, and soliciting teacher input were very close in total interactions. Describing occurred throughout the study, but as the study continued, irrelevant and soliciting teacher input seemed to diminish. Toward the end of the study, students usually called the teacher to help them change a program. Here, Charlie and Hungo describe what is on the screen:

Hungo: Look.

Charlie: Look at all....

Hungo: That, that....Unicorn, that's a unicorn. (laughs) That's a dinosaur. Go in that hole.

Charlie: A girl.

Hungo: A dragon. Do that and you get to yes.
Next, an example of a discussion that was irrelevant to the activities in the computer center:

Charlie: Hey, look. Look man, it's rainin'. Look man, rainin'.

DeShawn: Now you can't go outside 'cause it's raining.
Charlie: I hate that.

These students were soliciting the teacher to change programs for them:

Kalan: Teacher, we wanna do Magee.
Maria: Teacher, we wanna do Magee. I wanna do Magee.
Kalan: I'm doing it.
Maria: Teacher, I want do Magee.

Categories observed the least, were hypothesizing and interacting with the computer. The following is an example of hypothesizing:

Femi: I think it touched the water.
Hungo: Whoa, the dragon's comin'. Whoa, the dragon's comin'!
Femi: Put him right there.
Hungo: I put him right there.
Femi: Put that black thing on him, then he'll stay up there.
Hungo: Ooh, he's in the water.
Femi: Who?
Hungo: Him.

The software featured in the next example involves a boy and
a mother talking to each other. These students are interacting with the computer:

Nakeda: Ok, Mommy.
Kalan: I love you, Mommy. Do, "good mornin'".
Kalan: No, no, no, kitty.

Software interactive language. The interactions at the computer center were labeled according to the language used and the social behavior exhibited. According to Borgh and Dickson (1986), the type of software used has an effect on preschool children's verbal interactions. To understand these effects, the interactive episodes were also coded according to the software that was being used (see Tables 7 & 8).

The Playroom software was a favorite among the students and consequently was involved in more interactions. This software is characterized by creative, open-ended activities that do not have a right or wrong answer. The activities and the processes used to complete them varied. Language used to teach or instruct was used more than any other type of language when Playroom was used.
Table 8

**Interactions Categorized By Language Behavior and Software - ESL**

<table>
<thead>
<tr>
<th>Language Behaviors</th>
<th>Software</th>
<th></th>
<th></th>
<th></th>
<th>Interactions %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Playroom</td>
<td>Magee</td>
<td>Dot</td>
<td>Match</td>
<td></td>
</tr>
<tr>
<td>Turntaking</td>
<td>14</td>
<td>2</td>
<td>10</td>
<td>4</td>
<td>24%</td>
</tr>
<tr>
<td>Right/Wrong</td>
<td>2</td>
<td>0</td>
<td>9</td>
<td>0</td>
<td>9%</td>
</tr>
<tr>
<td>Teach/Instruct</td>
<td>14</td>
<td>8</td>
<td>4</td>
<td>4</td>
<td>24%</td>
</tr>
<tr>
<td>Hypothesize</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.8%</td>
</tr>
<tr>
<td>Interact</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0%</td>
</tr>
</tbody>
</table>

with Computer

<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Describe</td>
<td>8</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>10%</td>
</tr>
<tr>
<td>Irrelevant</td>
<td>5</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>7%</td>
</tr>
<tr>
<td>Solicit Teacher</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>7%</td>
</tr>
<tr>
<td>Interrupt</td>
<td>20</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>18%</td>
</tr>
<tr>
<td>Totals</td>
<td>69</td>
<td>13</td>
<td>30</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Interactions (%)</td>
<td>56%</td>
<td>10%</td>
<td>24%</td>
<td>10%</td>
<td></td>
</tr>
</tbody>
</table>

**Average Interactions per Student** 12.4
There were 103 interactions involving teaching/instructing with Playroom. Also, cooperative behavior was exhibited more than any other with 129 interactions. This indicates that peer teaching occurred frequently as students worked together to accomplish a goal, as in this example:

Amber: Do princess. Push this if you want it to print. Ok?
Laretta: What is this? Here it is.
Amber: Ok now. You push this. Let me do it for you, ok?
Laretta: No.
Amber: You’re supposed to push that. Now it’ll print it. Now it’ll print. You don’t hafta push nothin’. Teacher, she wants to print something. It doesn’t print.

Magee software also produced a significant amount of peer teaching. The language category used most with Magee was teaching/instructing (38) and the social behavior used most was cooperative (58). Magee produced more interactions involving interacting with the computer than any other software. Magee featured a boy and a mother who talked to each other and the students could often be heard talking back to them as Nakeda is doing here:

Nakeda: Not yet. No, Mommy. No I don’t want to. I don’t want to, Mommy. Can I leave it on?
Morning Mommy.
The software featuring dot-to-dot activities produced more language related to awareness of right and wrong answers than any other language category, and the total of 33 interactions was higher with dot-to-dot than any of the other software. When this software was used students frequently competed to get the right answer first and therefore "win". Lots of cheering was heard when the students "won", and arguing occurred as students disagreed about who was the winner:

Rizwan: We beat her!
Kalan: Yeah! We got....
Rizwan: Yeah! We’re champions!! So we beat you first. Go faster, go faster!

The majority of the interactions with the matching software encouraged turntaking language (17) or teaching/instructing language (16). This software was harder for the students to manipulate and they frequently required help, as in this example:

Dominique: Right here, right here. Albert, click on it. That one. Over, over.
Albert: The circle, the same. Click.

The language category used more overall was teaching/instructing. This suggests that the computer center is an ideal environment for peer teaching. Peer teaching encourages verbal expression, problem-solving and cooperation. The social behavior used more than any other
during this study was cooperative behavior. This could be a result of the way the computer center was set up to encourage several children to participate at once.

Subject Interviews

Each student was given a portion of the Young Children's Computer Inventory (YCCI) developed by Dr. Keiko Miyashita (1992). The YCCI was given to this class to determine how they perceived their computer experiences in the classroom (see Appendix B).

Statements 1, 2, 3, and 7 were designed to determine computer enjoyment (see Table 9). The responses of the subject group to these questions indicate a high level of enjoyment. All 33 subjects answered "yes" to statement 1, stating they enjoyed doing jobs on the computer. Twenty-five (25) subjects answered "no" when asked if they were tired of using the computer, and twenty-six (26) answered "yes" when asked if they concentrate while using the computer. Statement 7 is also consistent with the high level of enjoyment indicated by previous statements. This became evident when 32 subjects answered "yes".

Computer importance was measured with statements 4, 6, 7, 8, and 9. The majority of the students (26) answered "yes" to statement 4 which reads: I would work harder if I could use computers more often. The other statements that measured importance (6, 7, 8, 9) each had at least 30 "yes" answers, therefore this subject group places a high level of
importance on using computers at school.

Statements 5 and 10 were independent and did not measure importance or enjoyment. Statement 5 resulted in a high occurrence of yes (17) and no (13) answers. When asked if computers are very easy to use (statement #10), 32 students answered yes.

The YCCI provided the researcher with information about the students perceptions of their experiences at the computer center. The purpose was to determine if their answers were consistent with their behavior at the center.

When students worked at the computer center they had positive experiences and most students chose that center first if it was available. These actions seem to affirm that students enjoyed computer activities and were motivated to participate in that center.

Written Records

The written records used to characterize the group included the Peabody Picture Vocabulary Test: Revised (PPVT:R) and the Pre-school Inventory of Oral Language Proficiency: English (Pre-IPT: English), and a developmental checklist. Pre- and post- test scores for the PPVT:R and the Pre-IPT: English were determined (see Tables 10 & 11).

Scores of the PPVT:R ranged from 2 years 2 months to 5 years 11 months on the pre-test. The post-test scores ranged from 3 years 5 months to 7 years 1 month.
Table 9

**Summary of YCCI Responses**

<table>
<thead>
<tr>
<th>Statement</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Computer Enjoyment</strong></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>33</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>26</td>
</tr>
<tr>
<td>7</td>
<td>32</td>
</tr>
<tr>
<td><strong>Computer Importance</strong></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>26</td>
</tr>
<tr>
<td>6</td>
<td>30</td>
</tr>
<tr>
<td>7</td>
<td>32</td>
</tr>
<tr>
<td>8</td>
<td>30</td>
</tr>
<tr>
<td>9</td>
<td>30</td>
</tr>
<tr>
<td><strong>Independent</strong></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>17</td>
</tr>
<tr>
<td>10</td>
<td>32</td>
</tr>
</tbody>
</table>

This test was given only to students who indicated that English was their primary language (EPL). The scores indicate a wide range of vocabulary development for this age group. The post-test scores resulted in a difference of 3 years 8 months from the lowest to the highest score.
Consistent patterns relative to high test scores and minutes spent in the computer center were not evident. Three EPL boys spent over 200 minutes in the center (238, 218, and 205). Although their total minutes were high, their test scores were not among the highest. The post-test scores, reported in years and months, (4-4, 3-11, 3-10) do not correspond to their chronological ages of: 5-1, 5-1, and 5-5. The Pre-IPT: English test has five scoring levels. They range from A - Non-English Speaker, through E - Fluent English Speaker. This test is given to students whose parents have indicated that their primary language is something other than English (ESL). Nine out of the ten ESL students scored at a higher level on the post-test than on the pre-test. Six of these students had post-test scores at level D or E, which is considered fluent English speaker (FES).

Three ESL students spent more than 100 minutes in the computer center (145, 132, and 127). These were the highest totals for ESL subjects, but they did not correspond to high test scores.

The developmental checklist is divided into five major areas (see Appendix C). These include communication, cognitive development, motor development, fine arts and social-emotional development. Reviewing each students' checklist revealed that all students seem to be within average developmental levels for this age.
Table 10

Test Gains From Pre- and Post- Tests - EPL Students

<table>
<thead>
<tr>
<th></th>
<th>Pre</th>
<th>Post</th>
<th>Differential</th>
</tr>
</thead>
<tbody>
<tr>
<td>M1</td>
<td>2-2</td>
<td>3-11</td>
<td>1-9</td>
</tr>
<tr>
<td>M2</td>
<td>3-5</td>
<td>3-5</td>
<td>0-0</td>
</tr>
<tr>
<td>M3</td>
<td>3-3</td>
<td>3-9</td>
<td>0-6</td>
</tr>
<tr>
<td>M4</td>
<td>3-6</td>
<td>3-11</td>
<td>0-5</td>
</tr>
<tr>
<td>M5</td>
<td>2-9</td>
<td>3-5</td>
<td>0-8</td>
</tr>
<tr>
<td>M6</td>
<td>3-9</td>
<td>3-11</td>
<td>0-2</td>
</tr>
<tr>
<td>M8</td>
<td>3-4</td>
<td>4-4</td>
<td>1-0</td>
</tr>
<tr>
<td>M9</td>
<td>3-11</td>
<td>4-8</td>
<td>0-9</td>
</tr>
<tr>
<td>M10</td>
<td>3-7</td>
<td>3-10</td>
<td>0-3</td>
</tr>
<tr>
<td>M11</td>
<td>4-1</td>
<td>5-9</td>
<td>1-8</td>
</tr>
<tr>
<td>F1</td>
<td>5-11</td>
<td>4-4</td>
<td>-1-7</td>
</tr>
<tr>
<td>F2</td>
<td>4-1</td>
<td>4-5</td>
<td>0-4</td>
</tr>
<tr>
<td>F3</td>
<td>3-9</td>
<td>3-9</td>
<td>0-0</td>
</tr>
<tr>
<td>F4</td>
<td>2-8</td>
<td>3-8</td>
<td>1-0</td>
</tr>
<tr>
<td>F5</td>
<td>3-9</td>
<td>6-4</td>
<td>2-7</td>
</tr>
<tr>
<td>F14</td>
<td>4-1</td>
<td>4-8</td>
<td>0-7</td>
</tr>
<tr>
<td>F11</td>
<td>4-3</td>
<td>7-1</td>
<td>2-10</td>
</tr>
<tr>
<td>F16</td>
<td>3-7</td>
<td>4-5</td>
<td>0-10</td>
</tr>
<tr>
<td>F12</td>
<td>5-5</td>
<td>6-6</td>
<td>1-1</td>
</tr>
<tr>
<td>F13</td>
<td>5-6</td>
<td>5-7</td>
<td>0-1</td>
</tr>
<tr>
<td>F10</td>
<td>3-9</td>
<td>4-4</td>
<td>0-7</td>
</tr>
<tr>
<td>F15</td>
<td>4-5</td>
<td>4-3</td>
<td>-0-2</td>
</tr>
</tbody>
</table>

Scores are reported in years and months.
Table 11

Test Gains From Pre- and Post- Tests - ESL

<table>
<thead>
<tr>
<th></th>
<th>Pre</th>
<th>Post</th>
<th>Differential</th>
</tr>
</thead>
<tbody>
<tr>
<td>M7</td>
<td>A-NES</td>
<td>C-LES</td>
<td>2 Levels</td>
</tr>
<tr>
<td>M13</td>
<td>B-LES</td>
<td>D-LES</td>
<td>2 Levels</td>
</tr>
<tr>
<td>M14</td>
<td>A-NES</td>
<td>E-FES</td>
<td>4 Levels</td>
</tr>
<tr>
<td>M15</td>
<td>C-LES</td>
<td>E-FES</td>
<td>2 Levels</td>
</tr>
<tr>
<td>M16</td>
<td>A-NES</td>
<td>D-FES</td>
<td>3 Levels</td>
</tr>
<tr>
<td>F6</td>
<td>C-LES</td>
<td>D-FES</td>
<td>1 Level</td>
</tr>
<tr>
<td>F7</td>
<td>B-LES</td>
<td>D-FES</td>
<td>2 Levels</td>
</tr>
<tr>
<td>F8</td>
<td>C-LES</td>
<td>C-LES</td>
<td>0 Levels</td>
</tr>
<tr>
<td>F9</td>
<td>C-LES</td>
<td>D-FES</td>
<td>1 Level</td>
</tr>
<tr>
<td>F17</td>
<td>B-LES</td>
<td>E-FES</td>
<td>3 Levels</td>
</tr>
</tbody>
</table>

Scoring levels are described in Appendix D.

(2) What language and social differences exist between English as Second Language (ESL) and English as Primary Language (EPL) pre-kindergarten students during Computer Assisted Instruction experiences?

Parent Surveys

When the parent surveys were analyzed the questions were tallied according to the answers. The answers were then divided according to ESL or EPL students. Analyzing the survey responses revealed that five students had computers
survey responses revealed that five students had computers at home. Two of these students were ESL and three of them were EPL.

One ESL parent and two EPL parents indicated they owned software designed specifically for their pre-k children. Two ESL parents and two EPL parents indicated their children used the home computer. None of the ESL students had assistance from their siblings, although two ESL parents indicated they helped their children at the computer.

Two ESL parents stated they used the computer themselves at home, and two different ESL parents indicated they used a computer at work. Five EPL parents used the computer at home and seven used the computer at work. Two ESL students and two EPL students other than the ones that owned computers had experiences with computers at a relative's or neighbor's house. Therefore, a total of four ESL students and seven EPL students had experiences with computers other than at school.

One girl and one boy ESL student owned a computer at home. The girl student spent the least amount of time at the center than anyone else during the entire study. However, the other ESL student that had a computer at home, spent more time in the center than any other ESL boy. Only 4 EPL boys spent more time in the center.

Two EPL boys owned a computer and one EPL girl owned a computer. Consistent patterns regarding the amount of time
not evident, since some had high levels of participation and some did not. The only consistency seemed to be that the two girls that owned a computer had low total minutes in the center (20 and 29 minutes).

**Video Recordings**

The video tapes were analyzed to determine how much time each student spent in the computer center. This also allowed the researcher to make comparisons between ESL and EPL students.

Over a period of four weeks, the ESL students in the morning class spent a total of 242 minutes in the computer center, which is an average of 48.4 minutes per student. The EPL students spent a total of 1605 minutes in the center which is an average of 145.9 minutes per student.

The total time spent in the computer center by ESL students in the afternoon class was 406 minutes, and for EPL students it was 1148 minutes. These averages of 81.2 minutes per ESL student and 95.6 minutes per EPL student are much closer than the morning class. Four out of five of the ESL students were boys.

When individual total minutes were analyzed some stood out. Three students had totals over 200 minutes: 238, 218, and 205. These were all EPL students. Several students had totals less than 36 minutes: 35, 30, 29, 22, 20, 16, and 16. All of these students were ESL, except one. Further analysis revealed that all boys had the high totals, and the
analysis revealed that all boys had the high totals, and the
low totals were held by all girls except one. All of the
girls with low totals were ESL students. The pattern
revealed is EPL boys have the high totals and ESL girls have
the low totals for minutes spent in the computer center (see
Table 12).

Girls in the morning class used the computer center
more than the girls in the afternoon class. All of the EPL
girls in the morning class had totals of 100 minutes or
more. The afternoon class had two girls with totals over
100 minutes, the others ranged from 29-61 minutes.

The EPL boys in the morning class had totals that
ranged from 22-218 minutes. They had a wide range of
participation, but four boys dominated the center. The
totals for the boys in the afternoon class ranged from
238-72. Excluding the boy who spent 238 minutes, the totals
were relatively close and ranged from 132-72 minutes.

Students’ time spent at the computer center was also
analyzed to determine whom they spent their time with (see
Tables 4 & 5). Analyzing these numbers revealed that three
students in the morning class spent their largest amount of
time working alone at one computer while other students
worked at the other computer. The same was true for two
students in the afternoon class.
Table 12

**Participation Levels of Students in the Computer Center**

<table>
<thead>
<tr>
<th></th>
<th>ESL Girls</th>
<th>ESL Boys</th>
<th>EPL Girls</th>
<th>EPL Boys</th>
</tr>
</thead>
<tbody>
<tr>
<td>M8</td>
<td>145</td>
<td></td>
<td>238</td>
<td></td>
</tr>
<tr>
<td>M1</td>
<td>132</td>
<td></td>
<td>218</td>
<td></td>
</tr>
<tr>
<td>M2</td>
<td>127</td>
<td></td>
<td>205</td>
<td></td>
</tr>
<tr>
<td>M3</td>
<td>35</td>
<td></td>
<td>167</td>
<td></td>
</tr>
<tr>
<td>M4</td>
<td>30</td>
<td></td>
<td>164</td>
<td></td>
</tr>
<tr>
<td>F1</td>
<td>145</td>
<td>158</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F2</td>
<td>132</td>
<td>156</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F10</td>
<td>127</td>
<td>150</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M7</td>
<td></td>
<td>129</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M13</td>
<td>132</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M9</td>
<td></td>
<td>129</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M14</td>
<td>127</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F4</td>
<td>127</td>
<td></td>
<td>126</td>
<td></td>
</tr>
<tr>
<td>M20</td>
<td></td>
<td>122</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M11</td>
<td></td>
<td>111</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M5</td>
<td></td>
<td></td>
<td>107</td>
<td></td>
</tr>
<tr>
<td>F15</td>
<td></td>
<td></td>
<td>73</td>
<td></td>
</tr>
<tr>
<td>M15</td>
<td>64</td>
<td></td>
<td>63</td>
<td></td>
</tr>
<tr>
<td>M16</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M10</td>
<td></td>
<td>61</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F13</td>
<td></td>
<td>53</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F14</td>
<td></td>
<td>41</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M5</td>
<td></td>
<td></td>
<td>41</td>
<td></td>
</tr>
<tr>
<td>F15</td>
<td></td>
<td></td>
<td>36</td>
<td></td>
</tr>
<tr>
<td>F6</td>
<td>35</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F7</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F16</td>
<td>29</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X6</td>
<td></td>
<td></td>
<td>22</td>
<td></td>
</tr>
<tr>
<td>F17</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F8</td>
<td>16</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F9</td>
<td>16</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Two distinct partnerships existed at the computer center in the morning class. The afternoon class had four mutual partnerships. These partnerships, including the morning class, did not seem to be exclusive regarding gender. However, they were exclusively ESL-ESL and EPL-EPL partnerships.

Social behaviors. The social behaviors were labeled according to Parten's (1932) play categories. The total interactions for each category was tabulated and was also identified and tabulated according to the software being used.

When the interactions were tabulated, cooperative behavior had the highest total for the EPL subject group (198). The ESL subject group also participated in more cooperative behavior in the computer center than any other category (52).

All of the software programs elicited more cooperative behavior than any other type of behavior, except for dot-to-dot. Cooperative behavior accounted for 42% of EPL and ESL students' interactions.

Solitary behavior was only observed once with the EPL students and did not occur at all with ESL students. Onlooker behavior occurred with all software types for the EPL students, but did not occur when ESL students used the matching program. The matching program required students to click on all objects that fit in the same category or to
click on an object and move it to the top of the screen and then find the identical object and put it beside the first one. The typical onlooker behavior was characterized by observing and questioning what was happening at the computer or what the students were doing. Onlookers moved back and forth between the two computers and sometimes stayed until there was an empty chair. Approximately 13% of the EPL students' total interactions were labeled as having onlooker behavior, and 11% of the ESL students' interactions were in this category.

Parallel behavior was present in approximately 11% of the total interactions for the EPL subject group. These interactions would seem like two separate conversations, each student interested in what they were doing. Ten percent of ESL students' total interactions exhibited parallel behavior. All of the ESL students' parallel behavior occurred when they worked with the Playroom software.

Associative behavior usually involved more than two students. This could include an onlooker who was actively involved in the conversation and in what was happening at the computer. It could also include a student from the other computer who was participating in the conversation, sometimes moving closer to help with the current activity. Associative behavior accounted for approximately 33% of the EPL students' interactions and 42% of the ESL students'
interactions. Dot-to-dot was the only software that produced more associative behaviors than any other behavior.

**Language behaviors.** Interactions were tabulated for each language category as a whole group and for ESL students only. The ESL students participated in 124 interactions and the EPL students participated in 466. Each ESL student participated in an average of 12.4 interactions and each EPL student averaged 20.3 interactions.

When these interactions were labeled according to language categories, the ESL students were involved more in turntaking (30) and teaching/instructing (30) than in any other category. This is an example of two ESL students discussing turntaking:

Jason: Kevin, he not let me.

Kevin: I did. No, no, do two things. Ok, my turn.

Jason: One time, then my turn, ok?

Kevin: Ok. Yeah! Here. I like that.

The following is an example of an ESL student teaching an EPL student:

Tatianna: I need a helper over here.

Rizwan: What?

Tatianna: I need help.

Rizwan: Go the rug.

Tatianna: Uh! I can’t do it. I can’t make him go upstairs, Rizwan.

Rizwan: There.
Tatianna: No.

Rizwan: Get the Mama. Get over here. Need help?

    Don't press like that.

Tatianna: Not TV. Go upstairs. Right there, right there.

Rizwan: Now don't do down again.

Tatianna: Uh!

Rizwan: Don't press this one.

The lowest categories for ESL students were interacting with the computer (0) and hypothesizing (1). The teaching/instructing category was the highest for the EPL students (136), and interrupting was next (93). The following is an example of teaching/instructing:

    Cyril: Push it, push this.
    Cindy: I want to... Ok.
    Cyril: Yeah, yeah, do this one.
    Tony: Where did it go?
    Cyril: Click it.
    Cindy: See what's in that one.
    Tony: You have to go in there first.
    Cyril: Push that mouse down.
    Cindy: In there.
    Tony: Oooh! Look, a maze!
    Cindy: Hey, guys. Look! (to students at other computer)
    Cyril: Get down there. Let him walk on here all the way.
Cindy: Aaah, see what this is.
Tony: These are dice.
Cyril: Ok. Let me show you what to do. Put it on here. Do it here, do it here.

This sample transcript shows Joey as the interrupter. He is watching while Hungo and Femi are sitting at the computer:

Femi: Do the song.
Joey: Do the bear. Do the bear. The bear can do something.
Hungo: laughs
Femi: In there. Pop that balloon.

Interacting with the computer and hypothesizing were the lowest categories for EPL students, accounting for 13 interactions each.

The interactions were also characterized by the software being used. Playroom was the most popular for ESL and EPL students. It was used more and therefore had more interactions. Playroom software elicited the highest total responses in each language category except for awareness of right/wrong answers and interacting with the computer.

Interacting with the computer was observed most with Magee, and awareness of right/wrong answers was observed most with dot-to-dot. The ESL subject group followed the same pattern for their highest and lowest interactions using Playroom. The language category used most often with Playroom was teaching/instructing (103) and the least-used category was
interacting with the computer (2).

Magee software also encouraged more teaching/instructing than any other category. The students were often heard telling each other where to take Magee. The least-used category with Magee was awareness of right/wrong answers (0). This software had no correct answers. The students could move anywhere in the program and receive a positive response, therefore it was not necessary to discuss right or wrong answers or who was winning. Magee also encouraged more teaching/instructing behavior from ESL students than any other language category. However, there were four categories that were not observed when ESL students used Magee, which were interacting with the computer, hypothesizing, awareness of right/wrong answers, and irrelevant.

The category that was observed the most when EPL students used the dot-to-dot software was awareness of right/wrong answers. When students used this software there often was competition between the students at different computers. Students were frequently heard saying "we won" or "we beat", indicating they got the right answers first. For example:

Cendall: Ooooh!
Cyril: We almost beatin' you.
Cendall: Yeah!
Rizwan: We beat you!
Cyril: We beat ya'll.

Cendall: Quit!

Rizwan: Cendall, They're beatin' you. C'mon they're most through, c'mon!

Cendall: C'mon, I gotta take my time.

For the ESL students the dot-to-dot software encouraged the most language in turntaking. A frequent comment was "after this it's my turn". Also many times the conversation evolved into arguments over whose turn it was. The dot-to-dot software did not encourage any interacting with the computer involving EPL students or ESL students, and ESL students were not involved in hypothesizing when using dot-to-dot.

When EPL students used the matching software their language reflected turntaking more than any other category. This was followed closely by teaching/instructing. These two categories were most-used by ESL students also. This software required students to click on an object, hold and drag the object to a specific place and then find the identical object and place it beside the first one. This process required the use of new skills and students were frequently heard giving directions and suggestions for how to accomplish this task. The familiar comments about whose turn is next were also heard often. EPL students did not hypothesize or interact with the computer when using the matching program. Only one interaction involved describing.
There was no hypothesizing, interacting with the computer, interrupting, or discussing right/wrong answers when ESL students used matching. Matching was the least-used software by either group of students.

The language category with the highest total for the entire subject group was teaching/instructing. Most of these interactions involved one student manipulating the mouse or keyboard, while another student directed and gave suggestions on what to do next. Some cases of modeling the behavior were evident, but many times the student in control did not want to give up the mouse for a demonstration because they feared losing their turn.

The language category that had the lowest total for the entire subject group was interacting with the computer. The ESL students did not interact with the computer at all in this study and the EPL students interacted (talked) with the computer 13 times.
CHAPTER V

CONCLUSIONS

Pre-kindergarten students enjoy using computers and prefer to use them in a social context. Making computers accessible to pre-kindergarten students in a center and allowing them to choose when they can participate can be an effective way to encourage social and language interactions between English as a Second Language (ESL) and English as a Primary Language (EPL) students.

(1) What types of social strategies and language behaviors are used among English as Second Language (ESL) and English as Primary Language (EPL) pre-kindergarten students during cooperative CAI experiences?

Social behaviors. The computer center is an active center that encourages a variety of social behaviors. The video recordings of the computer center revealed that students participated in social interactions that ranged from onlooker to cooperative behavior. These interactions are the same type of behavior found in other pre-kindergarten centers. This is parallel with Swigger and Swigger's (1984) report that having a computer in an early childhood classroom would not interfere with existing social patterns.
Although a variety of behaviors were observed, the social behavior exhibited the most in the computer center was cooperative. The physical set up of the computer center allowed four students to work simultaneously with computers. Reviewing the video recordings revealed that students preferred using computers in groups or pairs. During the entire study there was only one brief time when one student was at the computer center alone. This trend of students using computers in groups or pairs is consistent with other research reports that young children actually prefer the social use of computers (Clements 1985a; Shade et al. 1986; Swigger & Swigger, 1984;). These conclusions tend to dispel the concerns of computers inhibiting the social interaction of young children (Barnes & Hill, 1983; Swigger & Swigger, 1984).

A pattern of participation in the computer center emerged when the video recordings were analyzed. EPL boys spent the most time in the computer center. EPL girls and ESL boys formed the middle level of participation. The group that participated the least amount of time in the computer center was the ESL girls (see Table 12). Boys may have spent more time in the center because they were more aggressive. They were observed going to the center and asking for a turn even when the center was full. When the center was full, and no one would give up their turn, boys would participate as onlookers. They moved from one
computer to another, adding to the conversation. When a chair did become empty, they would be near enough to be the first one to take over.

Girls would approach the center and ask for a turn. If no one agreed to let them have a turn, they chose another center. Once they became involved in another center, they sometimes forgot about the computer center. Most ESL girls would not approach the center if they could see it was full already, or they would just stand back and observe. This observation is related to the equity problem presented by offering computers to young children. In Beeson and Williams' (1985) study boys younger than five used the computer more than girls of the same age. Other studies revealed that girls and boys used computers equally (Muller & Perlmutter, 1985; Shade, Nida, Lipinski, & Watson, 1986). Research literature is not in agreement about whether girls use computers less than boys, but it is important to give girls early, positive experiences with computers so that they are not conditioned to believe computers are for boys.

Extracurricular experiences (i.e., home, day care) did not influence the amount of time spent in the computer center. The students who owned computers or used them anywhere besides school did not spend more time in the computer center than those who did not own a computer. Research literature does not discuss the influence of extracurricular computer experiences on preschool students'
In the current study students were observed taking turns, helping each other, resolving conflicts, and encouraging each other. These behaviors were reported in Muller and Perlmutter's (1985) study that compared the social play of a puzzle activity to a computer activity. Children worked together more at the computers and were observed taking turns at the computers. Borgh and Dickson (1986) observed preschoolers using computers and found that they spontaneously taught and helped each other. In Shade, Nida, Lipinski, and Watson's (1986) study, four-year-old's behavior changed from positioning for a turn to assisting each other over a four-week period. While using computers children gave and received information. They also confronted problems by helping each other resolve them (Genishi, McCollum, & Strand, 1985).

Cooperation was evident in the computer center when children were observed taking turns and teaching each other how to manipulate the mouse. Having a computer center facilitates behavior that is in agreement with the goals of preschool education, such as increased social and language development (Clements, 1991).

Language behaviors. The computer center encouraged a variety of language among ESL and EPL pre-kindergarten students. After analyzing the video recordings it became evident that the computer center truly was a "chatterbox" as
Swick (1989) referred to it. Muhlstein and Croft (1986) reported that when the computer was compared to other activities in an early childhood classroom, it was the only activity that facilitated high levels of language development and cooperative play. This is consistent with the current study. The findings in this study were consistent with Borgh and Dickson's (1986) report and revealed that a computer center set up for use by several children provides a setting for rich language exchanges. Students in the current study were observed discussing what is happening and why, asking and answering questions, giving directions, resolving arguments, encouraging and critiquing. Students even talked to the computer. These language behaviors are consistent with behaviors reported by Borgh and Dickson (1986). When Borgh and Dickson recorded the activities at a computer they discovered when two preschool children shared the same computer substantial amounts of language was devoted to turntaking and peer teaching.

The language category exhibited the most in the computer center was teaching/instructing. This is consistent with Borgh and Dickson's (1986) observations that students spontaneously and effectively teach and help each other in computer environments. Students did not have prior training with specific software, therefore they had to teach each other. Borgh and Dickson (1986) reported that students spontaneously taught each other when working at a computer.
Another factor in the high occurrence of teaching-instructing language would be the software that students chose the most elicited this type of language.

The categories with the second highest occurrences were turntaking and interrupting. Turntaking language tended to diminish later in the study. This seemed to be a result of the students becoming familiar with the computer and realizing that it would be available for use everyday.

Interrupting occurred more at the beginning of the study, also. Limiting the students to four at the computer center was difficult because they all were eager to participate. When more than four students were at the center, interruptions were more frequent.

Awareness of right and wrong answers, soliciting teacher input, irrelevant, and describing occurred between 36 and 46 times. These categories tended to be dependent on the software being used. Each of these categories had high occurrences with one software type, and low occurrences in the other three software types.

Borgh and Dickson (1986) described hypothesizing and interacting with the computer as non-social language. Students do not have to interact with anyone else when involved in these language categories. The computer center has been observed as being highly social, therefore non-social language behaviors of hypothesizing and interacting with the computer had the lowest totals.
The software used by the students affected their language behaviors. The more open-ended and creative the software, the more teaching/instructing language occurred. Playroom and Magee allowed students opportunities to interact with the software without choosing right or wrong answers. Students created pictures, moved objects around and created movement and sounds by clicking on certain objects. Different combinations of choices created different responses. Students tended to instruct others on what to do and how to do it when they used these two software packages. Students also exhibited more language focused on teaching/instructing.

Software that required specific answers, such as matching and dot-to-dot, encouraged more language involving turntaking or right/wrong answers. Matching activities included finding identical pictures from a group and moving them to the top of the screen, side by side. Another matching activity required students to choose all the like objects by clicking on them. Dot-to-Dot activities required students to move the mouse to each dot in numerical order eventually forming a picture. If students didn’t choose the correct dot the line would not "stick". Borgh and Dickson (1986) stated that software characteristics had a great influence on verbal communication. However, the findings in this study are not consistent with Borgh and Dickson’s findings that more structured programs encouraged more
teaching and turntaking. Although the structured programs in this study encouraged turntaking, they did not encourage more teaching. Teaching was observed more with open-ended programs.

(2) What language and social differences exist among English as Second Language (ESL) and English as Primary Language (EPL) pre-kindergarten students during cooperative Computer Assisted Instruction (CAI) experiences?

Social behaviors. The most notable difference among ESL and EPL pre-kindergarten students’ computer use was the time spent in the center. The results indicate that ESL students spent less time and participated in 1/4 as many interactions with computers as EPL students. It was unclear whether this was due to differences in social skills or language differences. Research literature does not compare ESL and EPL preschool students’ computer use.

Although ESL students spent less time in the computer center, their social interactions were similar to those of the EPL students. ESL students exhibited more cooperative behavior than any other type of behavior. They worked together, took turns, and gave directions in ways similar to EPL students. ESL students preference for social use of computers became evident as they were observed using computers in pairs or groups.

Although ESL and EPL students were grouped together in the computer center, ESL students tended to spend more time
with another ESL student at their computer. When analyzing the number of minutes students spent with other students, the high totals for each student involved more ESL-ESL or EPL-EPL partnerships. Just as McLaughlin (1985) advocates balancing classes with native and non-native speakers, it would benefit the ESL students to spend more time directly with EPL students when working at the computer.

**Language behaviors.** Another difference that existed among ESL and EPL students while using the computers was the dominant language category. Results indicated that ESL students’ language focused on turntaking and teaching/instructing more than any other category. Being concerned with whose turn is next is common when computers are introduced into a classroom and seems to be the only negative social behavior. Although Campbell and Schwartz (1986) reported that this behavior diminishes with time, the ESL students in this study remained focused on turntaking throughout the study.

ESL students were involved in more interactions involving teaching/instructing than any other language category. This involved the ESL student as the teacher, in many cases. According to Johnson (1988) empowering ESL students to teach their peers is an effective way to create functional and successful second language learning environments by promoting the social use of language and developing vocabulary. Therefore, involving ESL and EPL
students in cooperative CAI experiences is a language intensive environment for ESL students to become peer teachers. The environment should be structured to facilitate this interaction.

Other language behaviors used by ESL students during computer experiences were similar to EPL students. They participated in interactions involving all of the language categories used except interacting with the computer. The totals for each category were in the same order as the EPL totals with little variation. ESL students were observed giving and receiving information, asking questions, and describing what occurred on the monitor. The computer center provided ESL students with the rich linguistic environment that McLaughlin (1985) described as promoting second language learning. McLaughlin reported that having native and non-native speakers working together to solve problems greatly increases the language input that non-native speaking children receive. Involving ESL and EPL students together at the computer is an effective way to facilitate this learning.

High computer users were EPL boys and EPL girls. These EPL boys did not own computers at home and only one of them had previous computer experiences other than at school. High computer users had PPVT:R post-test scores lower than their chronological age. According to their Young Children’s Computer Inventory responses they enjoy computer
use and think it is important. One of the EPL girls in the high computer use group owned a computer. These girls also had post-test scores below their chronological ages. This indicated that high computer users have little or no previous experience with computers and have language development scores below their chronological ages. These students all participated in more cooperative behavior than any other language category, and their language focused on teaching/instructing.

The group that had a medium level of computer use was a mixed group. The same amount of EPL boys and girls were in this group. This group had one computer owner, therefore, they had little previous experience with computers. The PPVT:R post-test scores were low to average for this group. The only ESL students in this group were boys, and they increased at least two levels on the Pre-IPT: English post-scores.

Low computer users tended to be girls. Two of these students own computers, therefore have had previous computer experiences. One EPL girl made significant gains on the PPVT:R post-test. Others were low or moderate gains. The ESL students in this group varied in their test scores.

**Recommendations for Future Research**

Recommendations for future research can be made relative to the findings from this study of ESL and EPL students' language and social behaviors during CAI.
experiences. The findings from the present study cannot be
generalized to other subject groups because of the small
subject group and the limits of ethnographic research.
Research hypotheses are suggested as recommendations for
future research. They are based on the observations from the
present study and the previous research concerning preschool
children and computer use.

**ESL students' computer use is dependent on language and
social skills.**

Existing literature does not examine ESL students' computer use. Future studies should be done involving ESL
students' CAI experiences over extended time periods.
Students should be video taped at least once a week for an
entire school year so that differences from the beginning of
the year to the end of the year can be examined. Emphasis
should be placed on determining why ESL students spend less
time in the computer center than EPL students.

**Drill and practice software encourages different
language behaviors among ESL and EPL students than
simulation software.**

The results from the present study concerning the
influence of software on students' language differed from
previous studies, therefore further research is required.
Because software has a significant influence on the language
and social behaviors of preschool students, it is important
that future studies carefully research software that is
available for this age group. Comparative studies should be done using drill and practice and simulation software to determine the effects of each on students' language. Recommendations could be made concerning what type of software is more appropriate for preschool students, relative to the results. A similar study should be done to determine if ESL students would benefit from the same types of software.

ESL students and girls will spend more time in the computer center as peer teachers if they are taught specific computer activities.

To encourage more ESL students and girls to use the computer, future investigations should consider teaching these students how to use specific software and allow them to instruct the other students. Johnson's (1988) research study paired ESL students that had been taught an art, cooking, or science project, with EPL students. The ESL students were to act as the teacher and communicate in English to the EPL students how to do the activity. It is important to empower the ESL students to serve as peer teachers to develop functional language. Future studies should involve ESL students and girls in teaching other students how to perform a computer activity. This would encourage verbal communication and allow these students to feel in control and able to contribute to the process. This would encourage ESL students and girls to use computers
more, but still allow students to choose who they work with. The research study would determine if this type of activity affects the amount of time ESL students and girls spend in the computer center.

The teacher's presence in the computer center influences ESL students' language and social behaviors. Studies have been completed that examined the effects of a teacher's presence at the computer center (Shade et al. 1986). There seemed to be an increase in assisting behaviors when the teacher was present and a decrease in frustration. Since ESL students focused more on turntaking than any other language behavior and this is the only negative behavior mentioned concerning computer use, future studies should be done to determine if the teacher's presence has an effect on ESL students' language behaviors. ESL students are involved in less teaching/instructing than EPL students when using computer.

More research should be done comparing ESL and EPL students' language behaviors during computer use. A comparative study involving ESL and EPL students spending the same amount of time in the computer center, with the same software, could determine if ESL students act as peer teachers less than EPL students.

Extracurricular computer experiences do not influence students' computer activities at school.

Future studies should examine the types of computer
experiences students are involved in outside of school. These activities could be compared to experiences at school to determine consistencies and patterns.

**Summary**

The present study concerning ESL and EPL pre-kindergarten students' language and social behaviors suggests that the computer center is a very social center and an environment that produces a variety of language behavior. This is consistent with Clements (1985b) report that young children prefer the social use of computers. Thirty-three pre-kindergarten students in this study exhibited the same prosocial behaviors of helping, cooperating, and encouraging that other researchers have reported (Borgh & Dickson, 1986; Clements, 1985b; Genishi et al., 1985; Muller & Perlmutter, 1985; Osborne, 1986).

Eighteen hours of video recordings were transcribed and analyzed according to language behaviors and social strategies. Each interaction was coded with one of Borgh and Dickson's (1986) language categories which included: turntaking, awareness of right/wrong answers, hypothesizing, teaching/instructing, and interacting with the computer. The categories of describing, irrelevant, soliciting teacher input, and interrupting were added by the researcher. Interactions were also coded according to the social strategies used and were labeled according to Parten's (1932) categories of social play. These included
onlooker behavior, solitary behavior, parallel behavior, associative behavior, and cooperative behavior. These interactions were coded and they were also categorized according to the software that was used.

The effects of the software on students' language were evident in this study. Structured software encouraged language focused on right/wrong answers and turntaking. The open-ended software produced a higher incidence of teaching/instructing language. Borgh and Dickson's (1986) study of two preschoolers at a computer revealed that structured software produced more teaching/instructing language. These results differed from the results of the present study.

When ESL and EPL students' language behaviors were compared they were similar in occurrences, except for the highest total. EPL students' highest language total was teaching/instructing, and ESL students' highest language total was turntaking. Future research is needed to determine why these differences exist. Current research does not compare ESL and EPL preschool students' computer use. The social behavior used the most by ESL and EPL students was cooperative. The other social behaviors were consistent between the two groups.

The most notable difference between ESL and EPL students' computer use was the amount of time they spent in the center. EPL students participated in four times more
interactions than ESL students. Future research is needed to determine what factors contributed to this difference.

Many studies have been completed involving preschool children using computers, but none have examined how ESL students use computers and the effects computers may have on their behavior. Since it has been determined that software has a significant effect on language, emphasis should be placed on how ESL students respond to software which could lead to the development of appropriate software for preschool ESL students. Future studies should include descriptive and comparative studies investigating other effects computers could have on ESL students' development.
APPENDIX A

PARENT COMPUTER SURVEY
Parent Computer Survey

Your Name__________________________________________

Child's Name________________________________________

Brother's/Sister's Name_________________________________ Age_____

Name_________________________________ Age_____

Name_________________________________ Age_____

Please answer the following questions:

1. Do you have a computer at home?

2. If you do have a computer at home, what type of computer do you own?

4. Do you own computer software that is specifically for your Pre-K child?

5. Does your Pre-K child use the home computer?

6. How often does your Pre-K child work on a computer each week?

7. Does your Pre-K child work with brothers/sisters on a computer?

8. Do you help your Pre-K child with computer activities?

9. Does your Pre-K child have access to a computer other than at home? (day care, relatives home, neighbor, etc.)

10. Do you use a computer? at home? at work?
APPENDIX B

YOUNG CHILDREN’S COMPUTER INVENTORY
YOUNG CHILDREN'S COMPUTER INVENTORY

NAME: ____________________________

1) I enjoy doing jobs which use the computer.

2) I am tired of using a computer.

3) I concentrate on a computer when I use one.

4) I would work harder if I could use computers more often.

5) I think that it takes a long time to finish when I use a computer.

6) I can learn many things when I use a computer.

7) I enjoy lessons on the computer.

8) I believe that the more often teachers use computers the more I will enjoy school.

9) I believe that it is very important for me to learn how to use a computer.

10) I think that computers are very easy to use.
# PREKINDERGARTEN FINAL CHECKLIST

<table>
<thead>
<tr>
<th>Name</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher</td>
<td>School</td>
</tr>
</tbody>
</table>

## Key:
- [x] Accomplished
- [✓] Developing

## COMMUNICATION:
- Listens
- Follows directions
- Makes needs known
- Speaks clearly
- Uses single words
- Uses phrases
- Uses sentences
- Names objects
- Remembers names
- Tells what happens
- Responds to stories, books and songs
- Participates in pretend play
- Talks with other children
- Recognizes name in print
- Knows difference between print and pictures
- Reads environmental print
- Produces message by drawing, scribbling, or writing
- Knows where to start reading
- Enjoys books
- Predicts outcomes in stories

## COGNITIVE:
- Points to body parts
- Names body parts
- Recognizes colors
- Recognizes Basic shapes
- Demonstrates an understand of position words `top`, bottom, in, out, over, under, behind
- Recites daily routine
- Explores math materials
- Sorts objects by appearance
- Plays imaginatively
- Solves problems
### MOTOR:
- Works puzzles
- Uses drawing/writing tools with control
- Uses scissors with control
- Uses art materials with control
- Uses climbing equipment with ease
- Runs with control over speed and direction
- Jumps with two feet

### FINE ARTS:
- Listens to music
- Sings with group
- Moves to music
- Distinguishes loud and soft
- Draws self
- Creates with art materials
- Acts out stories
- Takes part in fingerplays

### SOCIAL-EMOTIONAL
- Participates in group activities
- Keeps hands and feet to self
- Enjoys being at school
- Answers when spoken to
- Plays alone
- Plays with friends
- Accepts and respects authority at school
- Takes care of personal needs
- Makes activity choices independently
PRE-IPT LEVEL SUMMARY

At Level A:
A child can do less than half the skills listed in Level B.

At Level B, a child can:
1. tell name.
2. demonstrate knowledge of age and gender.
3. identify family members, basic body parts, and pets.
4. identify common foods and household objects.
5. answer simple "yes/no" questions appropriately.
6. follow simple directions involving basic positions in space.

At Level C, a child can:
1. identify basic colors and foods.
2. understand number concepts of one and two.
3. name basic body parts.
4. demonstrate knowledge of basic prepositions.
5. understand and use common adjectives.
6. identify adjective comparatives: small/smaller.
7. demonstrate knowledge of possessives.

At Level D, a child can:
1. name common animals and clothing.
2. use plurals of nouns.
3. use possessive pronouns: my/mine.
4. use present progressive verb tense.
5. understand relationships involving location.
6. discriminate between two and three.
7. understand functions conveying action.
8. repeat simple sentences.

At Level E, a child can:
1. understand and name simple opposites.
2. follow 3-stage command.
3. predict the outcome of a simple story.
4. comprehend and remember major facts of a simple story.
5. answer "why" questions.
6. use possessive: his/her.
7. describe a person or experience in sentences.

(Williams, Ballard, & Tighe, 1987)
REFERENCES


