PRESCHOOL DISCOURSE SKILL IMPROVEMENT WITH COMPUTER-ASSISTED INSTRUCTION

by

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(ABSTRACT)

The primary purpose of this study was to determine whether commercially available software, modified with enhanced dialogue from instructors, could improve discourse skills in Head Start students over improvements obtained without enhanced instructor dialogue, and over improvements of ordinary classroom instruction. Additional information about modifying software or designing new software to improve discourse skills was investigated.

Ninety-three students in five Head Start classes of 4-year-olds were tested on the Preschool Language Assessment Instrument (PLAI) and the Peabody Picture Vocabulary Test-Revised (PPVT-R). Students within each of the five classes were matched on scores from the PLAI and the PPVT-R and then randomly assigned to one of three conditions: (a) software with enhancement, (b) software alone, or (c) control condition. Five student speech-language clinicians worked with the students assigned to the computer-aided conditions. The

third group of students received normal instruction from the Head Start staff.

Following a treatment period of 3 months, a repeated measures analysis of variance (ANOVA) was used to analyze pretest/posttest PLAI and PPVT-R scores of the Head Start students (N=78). No significant group differences were found for treatment. Significant group differences were found for time.

Qualitative analysis from anecdotal records and a user response survey provided additional information about the computer-assisted program and the speech and language of the students in the two computer conditions. The records and clinician survey also suggested how the software could be modified or new software designed to improve discourse skills in young children.

The concept of scaffolding was applied to the two computer-aided conditions used in this study. Selected examples from the spontaneous speech of students during computer training sessions demonstrate the relationship between scaffolding instruction and the computer-assisted condition, software with enhancement (CAI+). A theoretical framework which follows from this relationship is suggested. Implications for the use of software with enhancement by non-communication specialists with the speech-language clinician in the role of consultant are provided.

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Introduction

This chapter provides an overview of preschool discourse skill improvement with computer-assisted instruction. This includes information on the Head Start program, a model of classroom language, classroom discourse assessment, and microcomputer applications. It also includes theoretical perspectives on microcomputers use in preschool, and the purpose/objectives of this study.

Project Head Start

Project Head Start, launched in 1965, was designed to provide preschool children of low-income families with a comprehensive program to meet their needs. This federally funded program presently serves over 450,000 children between the ages of 3 and 5 years and their families (Head Start Bureau, 1990). The aim of Head Start is to bring about a greater degree of social competence in children who may be economically or educationally disadvantaged. This implies helping Head Start children become more effective in coping with their environment and the responsibilities they will face in the future. Recognizing that there is a relationship between cognitive and intellectual development, physical and mental health, and nutritional needs, the Head Start programs use a developmental approach to assist students in achieving social competence (Stone Canyon Press, 1989).

Children in Head Start programs are served through home-based and center-based programs. In the Roanoke Valley there are 12 centers. These center-based programs in combination with the home-based program serve a total of 600 children. Each student receives medical, dental, speech, hearing, vision and a developmental screening early in the year. As a result of these screenings, the students receive whatever follow-up service is needed. Students identified as speech and/or language impaired receive special education services as provided under P.L. 94-142 as amended. The remaining students receive language enrichment in their classrooms.

One of the major objectives of the Head Start program is to encourage children to communicate. Communication enables children to impart ideas and facts and to control the actions of others (Flavell, 1985). With language as the essential medium of exchange in classrooms (Blank, Rose, & Berlin, 1978a), the importance of communication skills cannot be overestimated. Blank (1973) stated:

> It is almost impossible to overestimate the importance of dialogue in learning and hence the disastrous intellectual consequences that can result should such a pattern of non-participation emerge. It seems likely that a vast percentage of all higher level learning- whether it be between the individual and his teacher, the

individual and a machine, or the individual and a book-is an extension of the principles of dialogue (p. 31).

A Model of Classroom Language

Because dialogue is important in learning, it is essential to help Head Start students improve the conversational skills they need in communicating with their classroom teachers. Blank et al. (1978a) have developed a model of classroom language or system of discourse that is confined to the interaction between the teacher and the preschool-age child. For example, classroom teachers place demands on children that require varying levels of abstraction. These levels are determined by the degree of distance that exists between the material available to the student and the language the student must understand and use in dealing with the material.

In the Blank et al. (1978a) model of classroom language, four levels of perceptual-language distancing typically found in dialogues between preschool students and teachers are identified. They are: Level I, Matching Perception (e.g. "What is this?" or "Find me a ..."), Level II, Selective Analysis of Perception (e.g. "What color is this?"), Level III, Reordering Perception (e.g. "Find one that is not red?"), and Level IV, Reasoning about Perception (e.g. "What will happen if...?").

In order to assess young children's skills, ages 3 to 6 years, in dealing with the language demands of the teaching situation, the Preschool Language Assessment Instrument (PLAI), a test based on a model of classroom discourse, was designed (Blank, Rose, & Berlin, 1978b). This test is based on the Blank et al. (1978a) model of classroom discourse.

In 1987, Lehrer and deBernard conducted a study to validate the PLAI's ability as a diagnostic tool for differentiating language impaired preschooler's ability to use language processes to represent and communicate increasingly complex ideas. Their results indicated that the PLAI is a valid instrument in the assessment of the preschool language impaired population.

Research Investigating Discourse Skill Improvement

In a companion study, Lehrer and deBernard (1987) investigated the use of the PLAI for measuring instructional change in 38 of the 120 preschool, special-needs students from their original study. The students, mean age 3 years and 11 months, were assigned to three treatment conditions designed to facilitate the development of communicative competence. The three conditions were the following: an object-oriented, story-telling environment that included LOGO software; other commercially available software environments; and a teacher-directed, question and answer control condition. Instruction took place for 12.5 weeks, three times a week for approximately 25 minutes for these students. They found that children who received instruction in the LOGO programming language demonstrated significantly higher levels of perceptual-language skills on the PLAI following the instruction period compared with those students who participated in a second software environment or were in the control condition. They concluded that the LOGO software was most effective because it provided the students more opportunity for conversation that required more complex reasoning skills. Their analysis of commercially available preschool software, available when they did their study, indicated that most programs emphasized labeling or matching of objects on the screen (Level I skills) or identifying differences and recalling characteristics of items displayed on the screen (Level II skills) rather than more advanced discourse skills as found in Level III and IV.

Though useful, LOGO is a programming language and is not considered commercially available software. Furthermore, to use LOGO an individual must have training beyond that required for ordinary computer use. There is a need for commercial instructional software which addresses all levels of discourse and is relatively easy for the novice to use. The software programs Words & Concepts, Words & Concepts II, and Words & Concepts III (hereafter referred to as Words & Concepts Series), relatively new programs, are commercially available user friendly program which use animated graphics, synthesized speech, and the touch window as an alternative input device (Wilson & Fox, 1987; Wilson & Fox, 1988). These programs were designed to provide receptive vocabulary and concept training. However, examination of these software packages indicate they also provide some receptive training relating to the first three levels of discourse skills according to the Blank et al. (1978a) model of classroom language.

Microcomputer Applications

The use of the microcomputer as a teaching tool is well established. The benefits of using the microcomputer for general education students (Eisele, 1980), students who are in special education (Kossiakoff, Hazan, & Panyon, 1984; Behrmann, 1984; Marozas & May, 1988), and students who are in preschool (Ziajka, 1986) are addressed in the professional literature.

Application of microcomputer technology is also found in the field of communication disorders. For example, the microcomputer has been used for language remediation (Cochran & Zemmol, 1986; Larson & Steiner, 1985; Myers, 1984; Russell, 1986; Schetz, 1986) and language enrichment (Schetz, 1989).

Theoretical Perspective for Microcomputer Use

Applications of the microcomputer as a teaching tool abound. However, a theoretical basis for microcomputer use, specifically in preschool, has only recently been addressed. For example, Shade's (1988) theoretical perspectives on microcomputer use in the preschool population are drawn from three major theoretical frameworks. Based on Piaget and Papert (cited in Shade, 1988), he suggests that computers can be used as objects with which to think; based on Erickson (cited in Shade, 1988) computers can be used as tools to enable development; and based on the Instrumental Competence Model computers can be used as tools to develop competence. Using this theoretical framework, Shade recommends microcomputers be used as one of a variety of exploratory activities in preschool classrooms.

Outline of the Study

Focusing on the effectiveness of using the microcomputer for language enrichment, this study investigated the use of commercially available computer software with adaptations to improve discourse skills in the Head Start population. There are differences between this study and the previously mentioned study by Lehrer and deBernard (1987). For example, this study used software that incorporates questions in learning new vocabulary and concepts and software programs with synthesized speech and a touch window as an input device. In addition, this study provides a learning environment in which computer software is enhanced by a student speech-language clinician interacting with two students for an entire 20 minute session. The students in this study are Head Start students instead of preschool handicapped students.

The purposes of this study were:

1. To determine whether commercially available software (Words & Concepts Series), modified with enhanced dialogue from instructors, could improve discourse skills in Head Start students over improvements obtained without enhanced instructor dialogue, and over improvements of ordinary classroom instruction.

2. To determine how such software might be modified or new software designed specifically to improve discourse skills in the preschool population.

To accomplish the first objective, this study measured Head Start students' discourse skill progress from pretest/posttest scores on the PLAI (Blank et al, 1978b) and the Peabody Picture Vocabulary Test-Revised (PPVT-R) (Dunn, L.M, & Dunn, L.M., 1981). A comparison was made between intervention through normal classroom enriched activities versus intervention that adds an additional activity- the use of computer software. The software, Words & Concepts Series, teaches an understanding of nouns and concepts. It was used in this study under two training conditions. In the first condition, software with enhancement, student speech-language clinicians (hereafter referred to as clinicians) instructed the Head Start students to express their responses. For example, students were expected to give verbal responses (e.g. words, phrases, and sentences) to the questions asked in the software programs along with a pointing response. In addition, questions important for improving discourse skills, but not included in the software packages, were asked by the clinicians. Appropriate responses to such questions were provided by clinicians when necessary to teach students to respond verbally to these questions. In the second condition, software alone, the Words & Concepts Series was used as intended for receptive understanding of nouns and concepts.

In addressing both the first and second objectives, anecdotal records were kept by the clinicians during the treatment phase for both conditions. These records allowed the speech-language clinicians to include comments under the following categories: software/hardware, training procedures, student speech and language, and miscellaneous. The clinicians recorded the speech and language (phonetic transcription when necessary) used by the students other than that used in responding specifically to the software instruction. In addition, they recorded their observations about the software/hardware, training procedures and any other miscellaneous comments relevant to the software and the training. Toward the end of the training phase, the clinicians completed a user response survey. The purpose of this was to provide an overview of clinician observations concerning the software/hardware, training procedures, and the computer-aided training program itself.

If the objectives of this study were met, this was to suggest that computer software with minimal assistance could be effective in developing discourse skills. This is important since individuals who are noncommunication specialists, such as school volunteers or teacher aides, may be interacting with students using the software (Schetz, 1989; Lehrer & deBernard, 1987). Ultimately, the aim of this research was to provide a vehicle that non-communication specialists could use to enhance discourse skills.

In addition to satisfying the primary objective of this research, evidence for a theoretical framework applicable to the software with enhancement condition was explored. Possible application from the work of Vygotsky (1978), Bruner (1983), Wood, Bruner, & Ross (1976), Greenfield, (1984), and Rogoff (1984) was investigated. For example, the use of computer-assisted instruction with enhancement supports the concept of scaffolding. Scaffolding refers to the teaching-learning context in which student and teacher collaborate in negotiating and constructing a desired learning activity. In this research, the adult, the student, and the computer engage in a 3-way interaction. With the computer as a tool and the software as the learning activity, it was speculated that the adult (tutor) acts to provide scaffolding for students to improve language.

The research hypothesis of interest was whether the three treatment conditions- software with enhancement, software alone, and classroom environment- would yield meaningful mean differences on the dependent variables, the PPVT-R and the PLAI.

Chapter 2

Preschool Discourse Skill Improvement
With Computer-Assisted Instruction

Introduction

Chapter one provided an overview of preschool discourse skill improvement with computer-assisted instruction. This chapter reviews literature which addresses topics specific to this study: theoretical perspectives on child development, learning, and computer use in early childhood; computer-assisted instruction; computers in the preschool population; and discourse.

Theoretical Perspectives:
Child Development, Learning, and Computer Use

Theoretical Perspectives on Child Development and Learning

Various theoretical perspectives on child development and learning are presented to provide background for this study. This includes a brief discussion of the work of Vygotsky; Brunner; Wood, Brunner, and Ross; Greenfield; and Rogoff.

Vygotsky (1978) developed a theory of child development which is an interactionist theory. He views development as a result of the relationship or interaction between the biological bases of behavior and the social conditions in and through which human activity takes place. The key concept representing this interaction is learning which depends on the child's biological endowments and the tools and signs of the society into which the child is born. Vygotsky believed learning should be geared toward developmental levels which are emerging, and, consequently, to be effective should be in advance of development. An essential feature of learning is that it creates the zone of proximal development: that is, learning awakens a variety of internal developmental processes that are able to operate only when the child is interacting with people in his environment and in cooperation with his peers. Once these processes are internalized they become part of the child's independent developmental achievement" (Vygotsky, 1978, p.90). Interactions essential to learning, however, must be with a peer or adult who is more capable or skilled within a specific domain of knowledge.

While Vygotsky emphasized learning in general, Bruner (1983) was particularly interested in language learning. Viewing language as both a vehicle and product of cultural transmission, Bruner believed that language results from the interaction between a child's predisposed language-learning capacity and a language acquisition support system. It is the adult which frames or structures the input of language to the child's innate language-learning capacity. In the early stages it is the mother who is pivotal in providing the support system. One feature of this support is joint attention, which is first seen in the eye contact with vocalization in early mother-infant interaction and continues in object play formats and book reading. The routines and accompanying language between mother and child change as the child develops. Mothers, for example, add more to the routines (e.g. asking more questions, speaking in larger sentences, explaining more) and begin to require more of a response from their children.

As children develop, the support system for language learning goes beyond mother-child interactions. The tutorial process comes into play. This process, discussed by Wood, Bruner, and Ross (1976), is another type of support system. It is relevant to childrens' interactions in school settings.

The tutorial process is a process by which early problem solving by the developing child is assisted by others (tutors) through scaffolding strategies. In an interactive system of exchange, the tutor uses scaffolding strategies with the child to recruit attention, to reduce degrees of freedom in a task to manageable limits, and to maintain direction in problem solving. For example, the tutor gets the child's attention, simplifies the task, and keeps the child on the task. The tutor also uses scaffolding functions with the child to mark critical features, to control frustration, and to demonstrate solutions when the child can recognize them. Tutors, for example, point out relevant features of the task, help to minimize frustration, and model solutions to the task (Wood et al., 1976).

Elaboration on the role of the teacher in the scaffolding process is provided by Greenfield (1984).

> Initially in the learning of language or other skills, the teacher carries the greatest responsibility in the activity, erecting a scaffold for the child's limited skills. As the child's learning and development progress in a given domain, the scaffold gradually diminishes, the roles of learner and teacher become increasingly equal, and the point is finally reached where the child or learner is able to do alone what formerly could be done only in collaboration with the teacher (Greenfield, 1984, p. 117).

Interaction, structured by the teacher, builds on what the learner can do. Through scaffolding the gap is closed between the task requirements and the learner's skill level. The task in all cases is held constant, while the learner's role is simplified through graduated teacher intervention (Greenfield, 1984). Other terms, referring to the concept of scaffolding, are found in the literature. For example, Rogoff (1984) uses the term guided participation, a term with emphasis on problem solving. In her conceptualization, "adults arrange the occurrence of children's activities and facilitate learning by regulating the difficulty of tasks and by modeling mature performance during joint participation in activities" (Rogoff, 1984, p. 27-28).

Theoretical Perspectives on Classroom Use

While the theories discussed above are being proposed for application to microcomputer use as implemented in this study, there is information in the literature which specifically applies theory to microcomputer use in early childhood classrooms. For example, Shade (1988) formulated a theoretical framework for including computers in early childhood environments. He draws on several theoretical perspectives to formulate his conclusions. From Piaget and Papert (cited in Shade), Shade postulates that computers can be considered objects with which to think. From Erikson's (cited in Shade) theory of psychosocial development, he suggests that computers can be considered tools to enable development. Extending the best concepts of Piaget and Eriksons' theories, he maintains that computers fit the instrumental competence model of development in the following way: (a) serving in a supporting role as consultant, (b) helping children explore diverse situations and object relationships, (c) exposing children to hidden cause and effect relationships, (d) encouraging task completion, (e) developing a metacognitive awareness of causality, and (f) helping children connect different ways of knowing (Shade, 1988).

<u>Summary</u>

Extending the theoretical assumptions of Vygotsky and Bruner, this study proposes that the microcomputer as a tool in our culture should be used for learning. Additionally, the microcomputer under adult guidance should be used with young children to present material that is in advance of development. With colorful graphics and speech, it is an ideal medium for presenting instructional material that can awaken internal developmental processes and is also an ideal focus for joint attention routines.

The theories on scaffolding and guided participation (Wood et al.,1976; Greenfield, 1984; Rogoff, 1984) might also be applied to the use of microcomputers with young children. For example, when the microcomputer is used with adults as tutors the process of scaffolding is maximized. This suggests that the three-way interactive process between adult, child and computer can assist early language acquisition, as well as later language development in preschool children.

A connection between scaffolding and microcomputers was suggested by Myers (1987). She used the microcomputer as a beginning communication device and language acquisition aid for severely physically handicapped nonoral toddlers. In software that she designed, children can touch colored pictures on an overlay covering membrane keyboard which results in the computer saying the vocabulary for that picture and producing an identical graphic on the computer monitor screen. The computer is used in this example as a scaffold to allow language-disabled toddlers to participate in the normal process of beginning language learning. Myers also designed software as a language scaffold for children just beginning to read and write. This has allowed language-disabled children who have not mastered the formal prerequisites skills to begin to produce their own meaningful text. In Myer's interpretation, however, the microcomputer itself is used as a scaffold.

Although Shade (1988) developed a theoretical framework for microcomputer use based on the work of Piaget, Papert, and Erickson, his framework is applicable only to the use of the microcomputer as one of a variety of exploratory activities in preschool classrooms. The theoretical work of Vygosky, Bruner, and Wood et al., Greenfield, and Rogoff, which place emphasis on the social interaction in the learning process, suggest a more appropriate theoretical model for learning which highlights the interaction between teacher and student.

Computer-Assisted Instruction

A theoretical framework for microcomputer use was presented. Also important to this research is a review of the definitions, advantages, and effectiveness of computer-assisted instruction.

Definition

Computer-assisted instruction (CAI) is an instructional tool that uses the computer to achieve educational goals. CAI "...is capable of introducing knowledge and skill (tutorial), developing fluency (drill and practice), and providing opportunities to apply or generalize knowledge and skill to realistic situations (simulation and problem solving)" (Behrmann, 1988, p. 11). The student and the computer in CAI are generally involved in a 2-way interaction in which the computer program informs the student when mistakes are made (Behrmann, 1988).

Cochran (1987) makes a distinction between the use of the microcomputer for language therapy in open-ended, client-centered activities and more traditional computer-as-instructor activities. She suggests that using the computer as a context for therapy, produces a 3-way model of interaction between the child, the computer, and the adult. Computer programs such as Logo and flexible software are recommended with this approach. She views the use of the computer as instructor as a 2-way model of interaction between the child and the computer. The computer software in a 2-way model of interaction, provides information, questions, and answers for computer-assisted-instruction (CAI). This method is the more traditional of the two.

Advantages

Besides defining CAI, the professional literature delineates the benefits of using the microcomputer for instruction. Marozas et al. (1988) discusses the non-threatening quality of the microcomputer, its built in motivational quality, and its ability to individualize instruction as important benefits for special education students. For preschool children, Ziajka (1986) proposes that computers may foster fine-motor skills and eye-hand coordination, provide another avenue to engage in symbolic representation, and have value for a child's emotional and social development (e.g. develop autonomy, increase attention span). For the communication disorders specialist, Lasky (1984) lists 10 advantages for microcomputer use:

1. The learning situation can be readily **adapted** to the specific needs of the individual learner.

2. Activities can be **self-paced**.

3. **Branching** tasks can be added.

4. Immediate **feedback** is provided.

5. The computer is infinitely **patient.**

6. **Interaction** with the computer is highly motivating.

7. Engaged **time-on-task** is increased.

8. **Stimuli** can be increasingly varied.

9. Use of **examples** and analogies can be increased.

10. Fine motor **control** and eye-hand control can be developed through a number of computerized activities (p.9).

The discussion above simply provides information concerning the advantages of CAI. There are, however, studies that address computer effectiveness.

Effectiveness

Kulik et al. (1983) used a meta-analysis to integrate the findings from 51 independent evaluations of computer-based teaching in grades 6 through 12. Their results indicate that computer-based teaching raised students final exam scores, improved their attitudes toward computers and toward their courses, and reduced learning time.

Niemiec and Walberg (1987) examined 16 literature reviews of CAI to synthesize what was known about CAI at all levels of implementation. The levels of instruction included in their review were elementary, secondary, college, and special education. A summary of their results found that CAI was a moderately effective instructional intervention. The typical effect of CAI was to raise outcome measures moderately by 0.42

standard deviation units which placed the average student at the 66th percentile of the control group distribution. In addition, they found CAI was particularly effective with special populations and younger students.

Effectiveness studies using the microcomputer with young children in the field of communication disorders have also been conducted. Generally, these studies were interested in comparing microcomputer use and other more traditional modes of speech-language assessment and management in addressing the question of effectiveness.

In 1986, Shrieburg, Kwiatkowski, and Snyder investigated the use of the microcomputer for a picture-naming articulation test. Twenty-one preschool children with moderate to severe speech delays were randomly assigned to three separate phases of a study which compared booklet-presented pictures to microcomputer-presented graphics for articulation testing. They found microcomputer testing of articulation had certain control advantages in motivating students during repeated trials of word level speech targets, but may take longer than booklet testing. Computer novelty effect and computer graphics, if they are not easily identified by the children being tested, were suggested reasons for an increase in test administration time.

In another study, Shriberg, Kwiatkowski, and Snyder

(1989) compared tabletop management with comparable computer-assisted activities for speech management. Two of the 18 subjects in their study were 8-year olds, the remaining subjects were 3, 4, and 5 year-olds. Each tabletop and computer condition had four sequential tasks designed to improve the speech sound errors of children in the stabilization phase of their speech program. Their results indicated that the two intervention modes were equally effective, efficient, and engaging for improving speech sound errors of students in the articulation stabilization phase of treatment.

In 1990, Shrieburg, Kwiatkowski, and Snyder completed a third in a series of microcomputer studies with speech-delayed children. In this study, the subjects were 20 children (M = 4.4 years) in the response (e.g. initial phase) phase of their speech program. Comparisons were made between tabletop management at early and late stages of the response development phase of articulation training with two comparable computer-assisted drill-and-practice activities. The computer modes were identical except for the addition of fantasy involvement in one of the modes. Their results indicated the three modes were equally effective, efficient, and engaging for articulation therapy of students in the response development phase of articulation training. In addition, the microcomputer software for articulation training showed excellent potential to engage the children when the target sound was stimulable, yet limited usefulness when the specific articulatory behaviors needed to be cued.

While the Shrieburg et al. studies addressed the application of the microcomputer to articulation, other studies have considered language. Harn's (1986) study compared the effects of three nonlinguistic stimuli- ongoing action, computer animation, and pictures- on children's ability to acquire subject-verb utterance forms. His subjects were twelve children, age 24-41 months with no diagnosed handicapping condition or characteristic. All subjects, pretested to verify that they were not using subject-verb constructions at the beginning of the study, were randomly assigned to one of three conditions: (a) ongoing action where the experimenter carried out an action, (b) computer animation of an action, and (c) action depicted in pictures. Results indicated that the children acquired the subject-verb utterance forms more readily when they were exposed to the actual event. While the posttest scores for the computer animation and the enactment group (ongoing action) were similar, the scores for the picture group were considerably lower.

O'Connor and Schery (1986) compared a computer-based approach to a traditional intervention approach to language therapy for eight severely handicapped toddlers with a mean age of 29 months. Graduate students in speech-language pathology, who conducted the treatment sessions, saw each child individually. A different set of vocabulary was assigned to each of the two language treatment conditions-traditional language intervention and computer-aided intervention. Each child was exposed to each intervention mode. Both modes were considered interactive modes since the instruction was guided by trained professionals. Results indicated that the subjects made notable progress regardless of the treatment condition received. They concluded that the microcomputer, used in an interactive mode, does facilitate language growth in handicapped toddlers.

Summary

Benefits of using CAI for special education students, preschool students, and students with communication disorders are identified in the literature. Research with general education students indicates its effectiveness for students in grades 6 through 12. Studies which look at levels of instruction indicate CAI is particularly effective with special populations and young students. In the field of communication disorders, CAI has been found at least equally effective compared to traditional measures for speech and language testing and therapy of young children.

Computers in the Preschool Population

Computers in Preschool Classrooms

Much of the literature on computers in the preschool population centers on its use in the preschool classroom setting. A sample of this information, which includes suggestions for appropriate implementation and examples of model programs using the microcomputer, are reviewed.

Based on research studies, Davidson (1989) suggests computers in the preschool and kindergarten classroom can be used independently by children, can encourage social interaction, stimulate imaginative play, and provide a medium for problem solving. The information she provides about using computers in the classroom includes how to set it up in a classroom, methods/activities to use for developing computer skills, activities to support the use of specific software/hardware, and means to integrate it into the early childhood curriculum.

Buckleitner and Hohmann (1987) consider quality and initiative to be top priorities for early childhood programs. Based on these priorities and their experience with the High/Scope curriculum program, they believe in integrating the computer into a developmental program for the purpose of supporting curriculum goals. Specifically, they found that computers inspire practice of important skills, stimulate thinking, and help children use symbols.

Anselmo and Zinck (1987) suggest optimal ways to use computers with 3 and 4-year-olds based on a program they implemented between a university and a private, nonprofit school with 1 preschool and 1 kindergarten class. First the school's teachers enrolled in a university course on LOGO in the classroom. When teachers were considered ready, computers were introduced to their classrooms as another interest area. Initially, children were shown individually and in groups how to use the computers. The children were subsequently allowed to use them freely. Teachers made themselves available to assist children, but avoided extended individual sessions. The software chosen emphasized thinking skills. Based on this program, Anselmo and Zinck (1987) recommend substantial amounts of adult feedback, guidance, and encouragement for 3-year-olds, and more individual or small group interaction for 4-year-olds when computers are used in classrooms.

Shade (1988) also discusses the appropriateness of using the microcomputer in preschool education. In an extensive review of information on this topic, he delineates and responds to the concerns regarding microcomputer use in preschool education. In conclusion, Shade states the following:

1. Young children can become safe, competent computer

operators.

2. The microcomputer does not reduce social interactions or displace important activities.

3. Children as young as 3 years have the capacity to learn from computer graphics.

4. Young children are not in the wrong state of cognitive development to use microcomputers.

5. Microcomputers do not require more, rather than less intellectual development to be used safely.

6. Young children do not need to be programmers to use microcomputers.

7. Most software is not merely programmed learning.

8. Microcomputers can be considered valuable early educational material as are blocks, paints, and crayons.

Besides recommending appropriate implementation of the microcomputer in preschool settings, a specific example of a model program using the microcomputer is found in the literature. Cohen and Blackwell (1988) describe an exploratory computer program they developed for 4-year-old Head Start students and their teachers. The purpose was to provide opportunities to Head Start teachers and children as well as parent volunteers to learn about computers, and to provide a field experience for undergraduate early childhood students. Two groups of children, a morning and an afternoon group, participated for one hour once a week for six weeks. The activities for the sessions included an awareness of computers in daily living, introduction to computer terminology, presentation of computer software with hands on participation, and discussions. Their goal for the Head Start children was computer literacy which was measured in a pretest/posttest matching activity that required students to identify computer parts. A comparison of the Head Start computer group and a control group of 4-year-old Head Start children who did not participate in the program indicated that the children with the computer experience were able to recognize a majority of the computer parts on the posttest. The control group showed little change on this dimension. The authors suggest their program provided a positive experience for the children, staff, and volunteers (student's mothers) who participated.

Computer Software/Hardware

While information is available on appropriate use and model implementation programs, studies about computer software and hardware features for young children is another dimension of interest for this population. Calvert, Watson, Brinkley, and Bordeaux (1989) discuss the software determinants that increase children's ability to recall information. This research, comparing a computer and a felt board condition, presented 40 children in preschool and kindergarten with 24 objects with and without action and verbal labels. The investigation revealed that regardless of the medium in which the information was presented, action and labels increased the recall of verbal information.

A study by Battenberg and Merbler (1989) looked at the touch screen versus the keyboard in comparing task performance of young children. Their study had 40 developmentally delayed and 40 non-delayed kindergarten children complete an alphabet matching task and a spelling task under counterbalanced treatment conditions. Their results indicated that the touch-sensitive screen generally improved the performance of both groups of children. They speculated that the naturalness of the touch screen was the key to an increase in performance.

Summary

The integration of computers into preschool classrooms is recommended in the literature. A model program with 4-year-old Head Start students suggested the implementation of the computer into a Head Start setting was positive for the students and others who participated in the program. The literature also provides information about software and hardware features recommended for young children. For example, one research study indicated that action regardless of the medium appeared to increase the recall of verbal information. In another study, a touch sensitive screen generally improved performance of student responses.

Discourse

A review of the literature on discourse is the last topic. Studies which provide information or research relating to the definition of discourse, a model of discourse, testing discourse and improving discourse are presented.

Discourse: Definitions and Models

The dictionary defines discourse as the verbal exchange of ideas, particularly conversation (Mish, F.C., 1983). From mother-child research studies, discourse is,"... any sequence of two or more utterances produced by a single speaker or by two or more speakers who are interacting with one another..." (Ochs, E. & Schieffelin, B.,1983, p.69). Language/learning disability research has also added meaning to this term. Stillman's (1984) model of discourse looks at discourse in terms of four interrelated components: conversational acts or speech acts, turns in speaking, conversational sequences, and episodes or exchanges which bring about social events.

Blank, Rose, and Berlin's (1978a) model of discourse developed from their interest in the specific conversational skills or dialogue that occurs between preschool children and their teachers. Their model contains three components: a. speaker-listener dyad, b. topic, and c. level of discussion. The speaker-listener relationship they confine to the interaction between teacher and child, while the topics component involves perceptually based experiences a child is able to understand. The third component, level of discussion, relates specifically to stimulating children's intellectual development. They see the instructional process in the classroom at the preschool level as a special form of communication exchange which stimulates this development.

Level of Discussion

The teacher-student dialogue in the preschool classroom particularly centers on questions and requests in which the listener, the child, must offer a response. " According to the way it is formulated, the teacher's language can be quite close to or quite removed from the material....As the distance between the material and the language widens, increasingly greater demands are placed on the children to abstract the information from the material that is available to them." (Blank et al., 1978a, p.13). This concept is called perceptual-language distance, with perceptual referring to the material and language referring to the teacher's language. To specify the increasing demands for abstraction in this dialogue and to qualify the perceptual-language distance that exists in different types of student-teacher dialogue, Berlin et al. (1980) present the following four level scale: matching perception, selective analysis of perception, reordering perception, and reasoning about perception.

In matching perception, "the child must be able to apply language to what he or she sees in the everyday world (identifying, naming, or imitating);" in selective analysis of perception, "the child must focus more selectively on specific aspects of material and integrate separate components in a unified whole (describing, completing a sentence, giving an example, or selecting an object by two characteristics);" in reordering perception, "the child must restructure or reorder perceptions according to constraints imposed through language (excluding, assuming role of another, or following directions in correct sequence);" and in reasoning about perception, the child is required "...to go beyond immediate perception and talk about logical relationships between objects and events (predicting, explaining, or finding a logical solution)" (Berlin, Blank, & Rose, 1980, p.52). The first level, matching perception, may require a gesture (e.g. pointing) or a simple one word response from a child. Movement from level one through two, three, and four demands responses that are predominantly verbal and require more complex expressive language skills. The four levels of discourse (Blank et al., 1978a) provide a framework for qualifying the language in teacher-child dialogue in preschool settings.

Home/School Discourse

Differences have been identified between the language of the classroom and the home environment. Creaghead and Tattershall (1985) look at the dialogue between teacher and child at school as a subset of adult-child communication outside school. Specifically, school dialogue has more stringent rules attached to it. For example, in school the message involves more content and procedures, the teacher generally is the initiator, and the medium focuses on written as well as oral language. Furthermore, Nelson (1984) points out that home language for young children is more context bound and operates within a system of shared communicative assumptions. When children enter school, less of the meaning in language is available in the surrounding context. This again suggests the concept of distancing in which a child is separated cognitively from his immediate environment (Sigel & Cocking, 1977). Fundamental to communicating is the ability to express intentions adequately and to interpret the intentions of others (Ochs & Schieffelin, 1983). As children leave home and enter the school environment, they must adjust to the language-cognitive demands that are expected of them.

Testing Discourse Skills

The PLAI was based on a research study by Blank et al. (1978a) in which 288 children, from 3 to 5 years, were administered a comprehensive test of discourse skills. The purpose of this study was the following: a.) To determine if preschool children possess the language skills needed for verbal exchange with their teachers, and b.) To determine the extent and the equivalency of these skills in preschool-age children from middle and lower-class backgrounds. They concluded that preschool-age children are able to cope effectively with the different aspects of the teacher-child dialogue exchange as specified in their four levels of discourse skills. This is true even though they found differences in performance according to age and social class background. Based on the comprehensive test of discourse skills used in their study, the PLAI was designed. It assesses the same range of discourse skills, but is more manageable in an average school setting (Blank et al., 1978a).

Improving Discourse

Berlin et al.(1978a) suggest their model of discourse skills is applicable with instructional models in preschool education. The instructional models, Development of Initial Competence and the Accommodation to Different Skills model, are two models in particular suggested as operable with their discourse skill model. The Development of Initial Competence emphasizes helping children develop mastery of weak areas, while the Accommodation to Different Skills model emphasizes the need for schools to adapt to the skills that children already possess. Berlin et al. believe that these two models can be blended together within any teacher-child exchange. For example, during the teacher-child exchange, dialogue skills can be enhanced and, while being enhanced, can serve as the medium for improving a child's general knowledge.

Two techniques for improving discourse skills have been suggested. Some authors have recommended the use of story-telling and recall with preschool children (Morrow,1985). This has been attempted particularly to improve higher level thinking skills (Wilson, Lanza, Barton, 1988; Abrahamsen & Adams, 1990) involving the use of questions.

With the introduction of computers in the classroom, the use of computer software to enhance perceptual-language skills has also been attempted. Lehrer and deBernard (1987) compared three conditions to determine which one was most effective in facilitating communication competence. The conditions were: (1) a LOGO condition (e.g. instruction in the LOGO programming language), (b) a condition that used commercially available software, and (c) a teacher directed question and answer condition. They concluded that LOGO was most effective in facilitating communication competence. They speculated that the LOGO environment provided more opportunity for student conversation that required more complex reasoning skills.

Summary

A model of discourse as dialogue that occurs between preschool children and their teachers was highlighted. An assessment measure to test and techniques to improve this model of discourse were presented. The use of computer software to enhance discourse skills was one method suggested for improving these skills.

Summary and Conclusions

Although a theoretical framework based on the work of Piaget, Papert, and Erickson has been developed for microcomputer use in preschool classrooms (Shade, 1988), this study suggests the conceptual framework of Vygotsky (1978), Bruner (1983), Wood et al. (1976), Greenfield (1984), and Rogoff (1984), because it is postulated that microcomputer learning is enhanced using structured software and a 3-way interaction approach between an adult, a child and a computer. From this viewpoint, learning is a shared construction which involves the collaboration of an adult and a child in a mutually determined activity. In contrast to Myers (1986), it is the adult (tutor) rather than the computer that provides the scaffolding. This scaffolding helps students to improve language using the computer as a tool and the software as the learning activity. Evidence from the findings in this study will be explored to determine the feasibility of the theoretical framework that is proposed.

CAI is considered beneficial for special education students, preschool students, and students with communication disorders. It has been established as an effective instructional tool with regular education students in grades 6 through 12, and found particularly effective with young children and special populations.

A need exists for a study to explore the effectiveness of the microcomputer to improve language in preschool children. In a review of the literature, Goodwin et al.(1986) point out that very little information on the use of the microcomputer with preschoolers is empirically based. Schwartz (1989) in an article that looked at the needs of microcomputer applications in the 1990's stressed the need for empirical research on microcomputer applications in speech and language. The effectiveness studies that have been conducted in speech and language with young children have concluded that the microcomputer is at the least equally effective, engaging, and motivating (Shrieburg et al., 1989; Shrieburg et al., 1990; Harn, 1986; O'Connor & Schery, 1986). These studies compared instructional modes in which an adult provided training using different instructional methods.

This research will investigate the effectiveness of computer-assisted instruction to improve discourse skills in preschool Head Start children. CAI+ in this study will be defined as a three way interaction between students, clinician, and computer. This is a departure from traditional CAI which typically means an interaction between computer and student. It differs from the work of Bull and Cochran (1987) because the interaction in this research occurs using software that is structured and geared for a 2-way instructional format. The objective of using the software programs, Words & Concepts Series, was to expose the students to new vocabulary and concepts for the purpose of developing discourse skills. Due to the young age of the students and the instructional objectives of this study, additional interaction from speech-language clinicians was critical.

CAI is used in two ways in this study. In the software alone condition, the speech-language clinician interacts with the students only in assisting them to maximize the instructional training of the software. The instructional training objectives were to develop a receptive understanding of new vocabulary and concepts. This condition more closely simulates the concept of a 2-way interaction in which the computer is primarily the instructor- the condition in which the concept CAI is traditionally used. In software with enhancement, there is more interaction between the students, speech-language clinician, and the computer. The training objectives in this condition were to improve discourse skills which involve receptive and expressive development of language. This necessitated more teaching from the clinicians (e.g. asking additional questions and providing additional information) and expressive responses (e.g. verbalization) as well as receptive responses (e.g. pointing) from the students. This condition is referred to as CAI +.

Studies have provided information and support for implementing computers into preschool classrooms. These studies typically use computers in preschool classrooms where they are included as additional center activities for exploration. Information needs to be provided for using computers for more structured learning. This research study will provide information for computer training of 4 to 5-year-old preschoolers in small group interaction with the computer (e.g. two students and clinician). In order to ensure exposure to all the vocabulary and concepts in the software packages that are used, additional assistance from the speech-language clinicians is needed. To simply use an exploratory learning strategy would not met the objectives of this study.

Software that provides action and a touch sensitive screen for imputing responses has been shown to be appropriate and effective with young children. A touch window and software that incorporates action and labels is used in this study to maximize the learning potential of the microcomputer.

If children are to succeed in school, they must be able to handle the increased demands of classroom language. The use of the computer to enhance discourse skills is one method suggested for meeting these increased demands. The only study to date that investigated the use of the microcomputer to improve discourse skills, the study by Lehrer and deBernard (1987), concluded that LOGO was effective in improving discourse skills with young children. It is not realistic, however, that a teacher and/or a trained professional (e.g. speech-language pathologist) will have the time to spend with individual children who may only need language enrichment. If studies indicate that the microcomputer is engaging and motivating, and can be used to help children learn, then it is important to investigate the language goals and the method for teaching these goals that non-communication specialists can use with the preschool population.

The software packages used in this research study, Words & Concepts Series, were not available at the time of the study by Lehrer and deBernard (1987). With the introduction of more appropriate commercially available software, the feasibility of improving discourse skills using commercially available software warrants investigation. For purposes of this study, discourse skills referred to a preschool child's ability to respond adequately to the language of the teacher as specified in the Berlin et al.(1978a) model. This research was a step toward fulfilling the need for efficacy research on microcomputer applications using commercially available software to improve discourse skills in young children.

Chapter 3

Method

Introduction

This study was an in depth investigation into the efficacy of using microcomputers with preschool students to improve language skills, specifically discourse skills. Specifically, a comparison was made among three language enrichment conditions: (a) software with enhancement (CAI+), (b) software alone, and (c) classroom environment (control condition). This chapter includes information related to the subjects, the research design, the equipment, the relationship between the assessment measures and the software, the procedures, and the data analyses of this study.

Subjects

Subject Selection

The Head Start staff identified ninety-seven students from five center based Head Start classes of 4-year-olds eligible to participate in this study. These Head Start Classes, located in the Roanoke Valley in Roanoke, Virginia, are under the auspices of Total Action Against Poverty. Center-based Head Start Classes in the Roanoke Valley are divided into the 3 year-olds and the 4 year-olds. The 4 year-old group was chosen since it was anticipated that this group had better attending skills than the 3 to 4-year-olds and, therefore, could receive more benefit from the information presented in the software packages.

Subject Approval For Participation

Permission was granted by the Director of Head Start Programs in Roanoke, Virginia for the Head Start students to participate. The Head Start Staff was enthusiastic about the opportunity this project provided for the participating Head Start students and was interested in the information about software with enhancement (CAI+) for language enrichment as it related to Head Start students in the future (Appendix A).

Before this investigation was initiated, letters were sent to parents to inform them of the study. They were provided an opportunity to remove their children from the study if they choose (See Appendix B). This approach was used by the researcher and the Head Start Staff in accordance with TAP Head Start Policy. Confidentiality and anonymity were maintained in data collection for participants. In addition, the proposal for this research was reviewed and approved by the university committee on human subject research in accordance with guidelines for research with human subjects (Appendix C).

Subject Characteristics

All students in five Head Start classes of 4-year-olds, attending two centers from Vinton and one center from Landsdowne, Salem, and Jefferson Street, were potential participants in this research. There was a total of 97 students in the five classes. Due to absences, four children were not included. This provided 93 students for this study, 42 boys and 51 girls. The students ranged in age from 4-0 years to 5-1 years with a mean of 4-6 years and standard deviation of 3.71. Out of the 93 students, 16 students were currently receiving speech-language services.

Subject Assignment

In order to match students in each of the Head Start classes, the pretest raw scores from the PLAI and the raw scores from the PPVT-R (Form A) were summed to yield a single score only. Based on the summed scores, students within each Head Start class were assigned at random to one of the three treatment conditions. The use of summed scores is consistent with the study by Leherer and deBernard (1987) in which summed scores were used to match subjects prio to randomly assigning students to treatment conditions. However, the composite score in their study included three measures- PLAI subtest scores, a PPVT-R score, and McCarthy Scales of Children's Abilities.

Research Design

This study had one independent variable, treatment condition, and two dependent variables, the PLAI and the PPVT.

Independent Variable

The independent variable, treatment conditions, had three levels: software with enhancement (CAI+), software alone, and classroom environment (See Table 1).

In condition one, the clinician was in an active mode. In this mode, the software was used with instructor enhancement that included asking students additional questions on the four levels of discourse skills, and encouraging verbalization of responses to all questions asked by the computer and/or the clinician. It was anticipated that the children in this environment would show an increase in receptive vocabulary based on the software, and an increase in expressive language (discourse skills) based on enhancement procedures used with the software.

In condition two, the clinician was in a passive mode. In this mode the software was used as intended for receptive understanding of vocabulary and concepts. Clinicians interacted with the students in assisting them to maximize the instructional training of the software (e.g., encourage children to listen and point to appropriate pictures; repeat questions asked by computer if children were not listening or did not respond). It was anticipated that the children in this

Table 1

Research Design with Independent and Dependent Variables

Treatment Conditions: INDEPENDENT VARIABLE

	SOFTWARE WITH ENHANCEMENT (1)	SOFTWARE ALONE (2)	CLASSROOM ENVIRONMENT (3)	
	Classroom Instruction and Software with Instructor Enhancement	Classroom Instruction and Software without Instructor Enhancement	Classroom Instruction only	
	Clinician in active mode	Clinician in passive mode	No Clinician	
ANTICIPATED IMPROVEMENT	Overall language improvement Increase in receptive vocabulary Increase in expressive language/ discourse skills	Overall language improvement Increase in receptive vocabulary	Overall language improvement	
DEPENDENT VARIABLES: Assessment Measures	PLAI/PPVT-R n=32 (n=27)	PLAI/PPVT-R n=28 (n=22)	PLAI/PPVT-R n=33 (n=29)	N=93 (N=78)
	Anecdotal Records: Sp/Lang Component n=32 (n=27)	Anecdotal Records: Sp/Lang Component n=28 (n=22)		N=60 (N=49)
	Language Sample n=5 (n=3)	Language Sample n=5 (n=3)	Language Sample n=5 (n=4)	N=15 (N=10)

Note. Numbers of students within groups from the original (no parenthesis) and final sample (with parenthesis) are indicated environment would show an increase in receptive vocabulary based on the software.

In condition three, the students received language enrichment from their regular classroom instruction. The essence of the Head Start curriculum in the Roanoke Valley was to promote language development. This is accomplished by making language an integral part of all daily activities. Some of the language activities include the following: housekeeping, circle time, field trip discussions, show and tell, dramatic play, puppet and finger plays, story time, songs, rhymes and poems. In addition, classroom items are labeled to encourage vocabulary development (TAP Head Start Education Manual, 1989). In the classroom environment condition, the children did not interact with the clinicians nor with the computer. It was anticipated that the children in this environment along with the children in the first and second condition would show overall language improvement due to maturation and regular Head Start Instruction. The Head Start children in conditions one and two were also exposed to the routine language enrichment of the Head Start classroom except during the computer training (e.g. a 20 minute period, two times a week, for 12 weeks).

Dependent Variables

The dependent variables were the two assessment measures, the PLAI and the PPVT-R, which were administered to all subjects for pretesting and posttesting. A description of the two assessment measures is provided below.

The PPVT-R is an individually administered, norm referenced, wide range test of receptive vocabulary. Available in two parallel forms, it is designed for persons 2 1/2 through 40 years. It was standardized nationally on a carefully selected sample of 5,028 persons which included 4,200 children and adolescents and 828 adults. Raw score alternate-forms reliability coefficients on the PPVT-R (Forms L and M) are as follows: a) immediate retest samples were .74 (N=63) for 4-0 - 4-11 years and .80 (N=52) for 5-0 - 5-11 years, and b) delayed retest samples, anywhere from 9 to 31 day delay, were .78 (N-110) for 4-0 - 4-11 and .60 (N=92) for 5-0 - 5-11 years. Adequate representation by age, sex, occupation, and race were considerations in subject selection (Dunn & Dunn, 1981).

The PLAI is the second assessment measure. It is a test based on a model of classroom discourse that was designed to assess young children's skills, ages 3-6 years, in dealing with the language demands of the teaching situation. The 1978 version is the latest version and is still in use. Reliability information indicates a high level of agreement among raters in scoring individual items (rater reliability). In addition, correlations indicate a high level of internal consistency within each of the four groups of test items (Group I=.64;

II=.80; III=.83; and IV=.86) for split-half reliability, and stability from one administration to the next on children's scores (Group I=.73; II=.83; III=.86; and IV=.88) for test-retest reliability. Subject selection included children from both middle-class and lower-class backgrounds (Blank, Rose, & Berlin, 1978b). Research articles have referenced its use in research with young children (Dale & Cole, 1988; Lehrer & deBernard, 1987).

Equipment

Computer software and hardware were the equipment for this study. The software packages, Words & Concepts Series, are three talking software packages each of which uses a core vocabulary of 40 nouns to integrate language and concept training. The following six training units with activities are offered in each package: vocabulary, categorization, word identification by function, word association, concept-same/alike, and concept-different. All levels concentrate on receptive language development. Some of the activities contain more than one activity option. The options used in this research and the level of discourse which each option contains is shown in Table 2. The level of discourse is based on the work of Blank et al. (1978a).

Words & Concepts, the first in the Words & Concepts Series, was named the Best Special Education Program in the Software Publisher's Associations Excellence in Software 1988 competition (Staff, 1989). In three separate reviews, one for each one of the three software packages, Words and Concepts Series received a rating between good and excellent for all aspects: program description, program effectiveness, user friendliness, and support/documentation (Schwartz, Brown, & Kunicki, E, 1989).

The hardware for this study included Touch Windows, speech synthesizers (Echo II, Cricket), and Apple Computers in the Apple II series of computers with color monitors. The Touch Window is hardware that attaches to a computer monitor screen with velcro and allows the user to indicate a response choice by touching the appropriate symbol/picture on the monitor rather than the computer keyboard. The speech synthesizers are hardware that allow the software programs, Words & Concepts Series, to produce natural sounding speech.

Relationship Between Assessment Measures and Software

On the PLAI, questions from all four levels are randomly spaced throughout the test. The test items are specific to problem solving situations, often with pictures, that were developed for this test. The software packages, Words & Concepts Series, provide a structured format with specific questions for teaching nouns and concepts. Questions such as, "Which one goes with this one?", "Which two are the same?" are used, and students are asked questions with voice output from a speech synthesizer. Responses are made by pointing to the

Table 2

Software Activity, Sample Questions, and Level of Discourse

Software Activity	Sample Questions	Level of Discourse
Vocabulary		
Set 1, Set 2	"Find the_______."	I: Matching Perception
Categorization		
Inclusion With Review	"Which one is_____?"	II: Selective Analysis of Perception
Exclusion	"Which one is not ______?"	III: Reordering Perception
Word Identification by Function	"Find the one you ___from."	II: Selective Analysis of Perception
	"Which one do you ___from?"	
Word Association	"Which one goes with this one?"	III: Reordering Perception
Concept-Same/Alike		
Three Picture Word Matching	"Which two are the same?"	III: Matching Perception
Concept-Different		
Three Picture Word Matching	"Which one is different?"	III: Selective Analysis of Perception

correct picture using a Touch Window. Discourse skills require not only an understanding of language, but the expression of language in appropriate responses to questions. This aspect is not addressed in Words & Concepts Series thus, this software can not by itself be expected to improve discourse skills. Neither the format nor the vocabulary are similar to the test items on the PLAI.

The ultimate objective of this study was to provide students, not only with an understanding of words and concepts, but the capability of expressing this information in dialogue with their teachers. The software teaches nouns and concepts utilizing questions. The PLAI was used to determine if the information taught would be generalized to a different format in which discourse skills are required. The PLAI is an effective test of this ability, and it was independent of the training conditions in the project.

The PPVT-R is a test of receptive vocabulary. It contains a combination of nouns and verbs. Since Words & Concepts Series are geared to improving understanding of vocabulary (e.g. nouns) as well as concept training, a measure for receptive vocabulary was included in the assessment battery.

Procedures

Procedures included a pre-program phase, a program phase, and an evaluation phase. A timetable of the three phases is in Appendix D.

Pre-Program Phase

Contact with agencies. This study interfaced with two cooperating agencies: Radford University and the Head Start Program in the Roanoke Valley. To initiate this project, plans were finalized with the cooperating agencies to ensure a smooth transition to the assessment and training components of this research.

The Head Start program director was contacted and final arrangements were made for the following: designation of the five Head Start participating classes, appropriate placement of the computers, and a list of potential students in each of the five classrooms.

Agencies and private sources were contacted for loan of hardware and software for the project's treatment phase. Hardware and software that was not loaned along with tests and protocols were purchased.

The Department Head of Radford University's Department of Communication Sciences and Disorders designated the five clinicians who participated in assessment, scoring and training procedures. He ensured their qualifications as participants in this project. The Clinicians received practicum credit for their participation and a $450.00 stipend at the end of the research project (Appendix E). In addition, any gasoline expenses incurred for project participation were reimbursed.

Training of speech-language clinicians. Five clinicians in the Department of Communication Sciences and Disorders at Radford University were trained by the Researcher. Training covered assessment and treatment conditions of this study. During this project, the clinicians were only provided with information concerning the general nature of this study. The specific objectives were not discussed.

The PPVT-R, the PLAI, and language sample analyses were the assessment measures used with the Head Start students. Specific training was given for the use and scoring of the PLAI. Since the clinicians were already familiar with the other assessment measures, only monitoring, assistance on a need-only bases, and testing specifications relating to this research were provided for the other two measures. However, clinicians were provided experience in the administration of the primary assessment measures before actual testing. Using a format similar to test conditions used in this study, the clinicians tested preschool students at the Early Learning Program at Radford University.

The researcher provided instruction to the clinicians on the use of the software (Words & Concepts Series), hardware (speech synthesizer and Touch Window), and techniques to be utilized while implementing the language enrichment program. In addition, each clinician received practice in using the software/hardware with preschool students at the Early

Learning program at Radford University. The researcher observed each speech-language clinician during one practice session using training procedures for condition one and one practice session for condition two. This helped to determine if any additional instruction was required before the training period with the Head Start students began.

Instructional manual. An instructional manual was provided for each clinician explaining what menu selections to use within each of the three software programs and when to use them, basic instructions for using the programs, instructions for using the programs in the two software environments and the additional prompts for the software with enhancement condition (Appendix F), methods for record keeping of student attendance (Appendix G), and procedures for recording anecdotal comments while using the programs (Appendix H).

Clinician data recording procedures. Movement from one level to another, using the three types of software and activities within each, was not based on specific progress at each level. The purpose of using this software was to expose the students to new nouns and concepts providing additional language enrichment for the purpose of improving discourse skills. For this reason, specific measures of progress from session to session was not recorded. However, a record of student attendance and anecdotal records was kept during all treatment sessions. These records included comments under the following categories: software/hardware, training procedures, student speech and language, and miscellaneous. The clinicians were required to use phonetic transcription for words that were misarticulated or unrecognizable. The phonetic transcriptions suggested any deviant phonological patterns.

Pretesting. Five Head Start Classes of 4-year-olds participated in this study. All students in these classes present on testing days, plus two additional 4-year-olds served in a 3-year-old class due to overcrowding in one of the five classes, were tested by clinicians on the PPVT-R (Form A) and the PLAI. Students were assigned randomly to each clinician. The researcher supervised and monitored the testing on site 100% of the time for the two fourth year undergraduate clinicians. During 75% of the time the researcher was on site to observe the procedures and answer questions for the three graduate clinicians. The remaining 25% of the time, the graduate clinicians were able to reach the researcher by telephone for questions. The clinicians were instructed to administer the PPVT-R first. The PPVT-R is relatively easy for students. It was decided that student cooperation might be encouraged by administering the easier of the two tests first. The clinicians scored all tests.

In addition, each clinician completed a language sample analysis of three students in each of the five Head Start classes to which they were assigned. One student from each of the three conditions in each of the five classes was randomly assigned for language sampling. Using toys, playdough, and paper and markers, each clinician interacted individually with the students for the Language Samples. The interactions were audiotaped for later transcription and analysis of the language samples of the students (Stiekler, 1987).

Interrater reliability. Five clinicians were trained to score the PLAI. To establish interrater reliability, the five clinicians independently scored 10 of the same pretest protocols. This represented two protocols from each of the five clinicians. An intraclass corrrelation using the formula

$$r_I = \frac{MS_r - MS_e}{MS_r + (k-1)MS_e}$$

was computed "where MS_r = mean square or variance between rows, where each row stands for a person; MS_e = mean square for residuals, or error; and k = number of columns" (Guilford, & Fruchter, 1978, p. 270). Correlations between the five raters on the 10 protocols of the PLAI were the following: Group I: 0.97, Group II: 0.98, Group III: 0.93, Group IV: 0.93.

Treatment assignment. Following testing, the raw scores from the PPVT-R and the PLAI subtests were summed (1 score from the PPVT-R and 4 subtest scores from the PLAI) to yield a single score which served to match students in each Head Start class. Students were matched only for the purpose of ensuring comparative treatment groups. These summed scores were ordered from low to high. From this ordering, students were grouped in blocks of 3. Within each block, students were randomly assigned to one of three conditions: (a) software with enhancement (condition #1), (b) software alone (condition #2), and (c) classroom environment (condition #3).

As part of a study by Lehrer and deBernard (1987) to test the validity of the PLAI for preschool language-impaired children, correlations were computed between the four subtests of the PLAI and the PPVT-R. A significant association was found between the PLAI and the PPVT-R (. 68, PLAI I; .66, PLAI II; .54, PLAI III; .52 PLAI IV). This was justification for summing the two measures for the purpose of matching the students.

<u>Program Phase</u>

<u>Computer training with head start students</u>. Each of the five clinicians was assigned to a Head Start class. During regular morning Head Start classroom activities, students, generally paired in groups of two, were taken from their classroom to receive computer instruction. Exceptions to this occurred when one in a pair was absent, when there was an uneven number of students, when students needed to "catch up"

on instructional material, or when a student's behavior warranted taking the student alone. In such cases the clinicians served as the partner. Clinicians were encouraged, however, to pair children if at all possible. Only students participating in the software conditions, software with enhancement (condition #1) and software alone (condition #2), left the classroom for this instruction. They received instruction, according to the treatment condition to which they were assigned, for 20 minutes, two times a week for a period of 12 weeks (A break of approximately one and a half weeks for University and Head Start vacations occurred after a consecutive 10 week period). Students in the classroom environment (condition #3) continued to participate in their regular language enriched classroom activities. The computers were not kept in the Head Start classrooms during this research study. In addition, they were not used for students except during assigned treatment times. Only one of the five classes had access to a computer and this was only during the last two weeks of this research project. In this case, the classroom teacher introduced software which encouraged learning of letters of the alphabet.

Clinicians provided computer instruction for 24 sessions for students in the software conditions (software alone, and software with enhancement), except when a back-up was used. The researcher and one of the five clinicians served as backups when necessary. The difference in the two software environments was based on differences in expectations required of each group. Though the students in the software alone group could talk and ask questions, they were not encouraged nor required to verbalize their responses, and additional information and questions were not presented to them. The total amount of contact time, however, for both groups was the same.

The researcher conducted on site observation of the graduate clinicians within the first two weeks of each of the three months of the treatment phase (a total of at least 3 times for each clinician). The researcher periodically listened to audio-taped sessions from each of the three graduate clinicians during the entire training program. This allowed monitoring of the treatment sessions and ensured that training procedures were being followed. The two fourth year undergraduate students were frequently observed since the researcher or another supervisor remained on site with them during all training. In addition, all clinicians met with the researcher once a week during the treatment period.

A twelve week period of treatment similar to the period of treatment time used in the Lehrer and deBernard study (1987) was used. Such a period of time was found sufficient to show enhancement in children's acquisition of perceptual-language skills using the LOGO software environment in their study. The second half of the school year was chosen for the treatment phase because it allowed the Head Start students a period of acclimation to the school environment before treatment began.

Posttesting. At the conclusion of the treatment phase, the students were retested by the clinicians on the PPVT-R (Form B) and the PLAI. The researcher supervised and monitored the posttesting in accordance with procedures used during pretesting. Individual clinicians did not posttest students they had instructed. Each clinician was also required to complete another language sample using the original three students selected from each of the five Head Start classes for language sample analysis.

Data Analysis

Evaluation Phase

The primary objective of data analysis was to compare three methods of language enrichment among 4-year-old Head Start students. A two factor repeated measures analysis of variance (ANOVA) was used to analyze the data from the pretest and posttest scores (Howell, 1987; Norusis, 1988). The independent variables were time (pre-post) and treatment conditions which had 3 levels: software with enhancement, software alone, and classroom environment. The dependent variables were the raw scores from the PPVT-R (Dunn & Dunn, 1981) and the PLAI (Blank et al., 1978b).

Language samples from the randomly selected set of 15 students were compared before and after the software training. This represented 3 students from each treatment condition per class. Semantic (Type Token Ratio, TTR), syntactic (Mean Length of Utterance, MLU; Upper Bound Length; Lower Bound Length, LMB) and pragmatic analyses (Turntaking: initiating/responding) were conducted for the language samples following similar procedures found in Stickler (1987). Using a one-way analysis of variance, comparisons were made before and after testing on language dimensions expected for 4-year-olds (Appendix I).

Descriptive information was compiled from the anecdotal records kept by the five clinicians during the treatment phase of this research. This included samples of the speech and language used by the Head Start students other than that used in the computer responses during the treatment sessions. These samples provided an informal assessment of the speech and language of the Head Start students over the 12 week period.

The ancedotal records also provided comments about the software/hardware and the training procedures. This information suggested how such software might be modified or new software designed specifically to improve discourse skills in young children. In addition, a user response survey completed by the clinicians during the final weeks of the treatment phase provided information student speech and language, software and hardware dimensions, and the computer-aided program itself (Appendix J).

Chapter 4

Results

Data reduction and analysis are reported in five sections. They are: (a) Intercorrelation of pretest PLAI and PPVT-R scores, (b) primary analyses related to treatment, (c) secondary analyses related to treatment, (d) qualitative analysis of anecdotal records, and (e) qualitative analysis of user response survey.

Intercorrelation of Pretest PLAI and PPVT-R Scores

Table 3 shows the means, standard deviations, and Pearson product-moment intercorrelation coefficients among the four subtests of the PLAI and the total scores of the PPVT. The magnitude of these coefficients suggest there are some language dimensions in common between the subtests on the PLAI, a cognitive-language test, and the PPVT-R, a receptive vocabulary test and lend support to the following decisions:

1. Summing across all of these scores (4 subtest scores from the PLAI and 1 score from the PPVT-R) to form a single score for rank ordering students prior to assignment to treatment groups.

2. Collapsing the four subtest PLAI scores to form a composite score for analysis of the overall perceptual-language skill of each student.

Table 3

Correlation Matrix of Pretest PLAI and PPVT-R scores

Scores	1	2	3	4	5	M	SD
1. PLAI I	-	-	-	-	-	34.83	6.26
2. PLAI II	.58	-	-	-	-	23.91	8.05
3. PLAI III	.41	.68	-	-	-	15.85	7.60
4. PLAI IV	.38	.68	.61	-	-	11.31	6.89
5. PPVT-R	.44	.58	.54	.59	-	31.40	12.20

Table 4

Means, Standard Deviations for PLAI and PPVT-R Pretest and Posttest Scores

			PLAI I		PLAI II		PLAI III		PLAI IV		PPVT-R		PLAI Composite					
Group	n		Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	n	MTOS*	n	MIFS**
A	27	M	34.5	36.55	24.81	28.14	16.92	22.22	11.96	14.74	30.74	40.66	88.22	101.66	32	115.06	27	118.16
		SD	7.08	5.17	7.95	7.47	6.78	8.44	6.53	8.73	13.21	14.00	23.94	26.04				
B	22	M	35.13	37.59	23.86	28.18	13.72	21.68	10.27	14.27	31.81	41.63	83,00	101.72	28	115.50	22	114.81
		SD	6.01	3.72	7.14	7.63	6.37	8.37	7.47	9.52	9.92	13.69	21.63	23.88				
C	29	M	34.89	35.24	23.10	27.62	16.44	20.93	11.48	12.96	31.68	41.13	85.93	96.75	33	115.00	29	117.62
		SD	5.79	4.90	8.92	8.35	8.97	10.03	6.89	6.76	13.14	16.02	26.06	25.47				

A= Software with Enhancement B= Software Alone C= Classroom Environment

* mean total on pretest for original sample (N=93)

** mean total on posttest for final sample (N=78)

Primary Analysis Related to Treatment

Based on the final sample (N=78) of Head Start students, pretest and posttest means and standard deviations for each subtest by treatment group were computed (See Table 4). A mean based on the sum of all pretest scores by treatment condition was also computed in order to determine whether scores for the treatment groups in the initial and final sample of students were comparable. In the original sample (N=93), mean scores across the three treatment groups were almost identical. This is indicated in Table 4 as the mean total for the original sample (MTOS). In the final sample (N=78), mean total for the final sample (MTFS in Table 4), mean scores were more variable by treatment group, but they differed only slightly from original sample means. ANOVA source data is contained in Table 5. A 3 X 2 factorial analysis of variance (ANOVA) with repeated measures on one factor was used with the level of significance set at .05. The first independent variable, environmental condition, had three levels, software with enhancement, software alone, and classroom environment. The second independent variable, time was the repeated measures factor. Results are discussed below by dependent variable.

PLAI I

Means and standard deviations on pretest scores were similar for the PLAI I subtest. Posttest scores were similar, but slightly higher for both computer-aided treatment groups (See Figure 1). There was no significant main effect for the between subject factor, group, nor an interaction effect between time and group. There was a significant main effect for the within subject repeated measures factor, time ($F = 8.40$, $p < .005$), indicating a significant improvement from pretest to posttest on the PLAI I across all three groups (See Table 5).

PLAI II

Means and standard deviations on pretest and posttest scores were similar for the PLAI II subtest. There was no significant main effect for the between subject factor, group, nor an interaction effect between time and group. There was a significant main effect for the within subject repeated measures factor, time ($F = 34.63$, $p \leq .0001$), indicating a significant effect from pretest to posttest on the PLAI II across all three groups (See Table 5).

PLAI III

Means on pretest scores of the PLAI III subtest were similar for the conditions software with enhancement and classroom environment, but lower for the software alone condition. Posttest mean scores were similar. A noticeable increase from pretest to posttest scores was found for the software alone condition. The standard deviation was higher on the pretest and posttest for Classroom Environment. However, there was no significant main effect for the between subject factor, group, nor an interaction effect between time and group. There was a significant main effect for the within

Table 5

Analysis of Variance of Three Environments from PLAI I Pretest and Posttest Scores

Subtest	Source	df	SS	MS	F	p
PLAI I	Group	2	42.23	21.11	.42	.65
	Ss w/in groups	75	3776.83	50.36		
	Time	1	99.98	99.98	8.40	.005*
	Time X Group	2	33.24	16.62	1.40	.254
	Time X Ss w/in gs	75	892.48	11.90		
PLAI II	Group	2	35.50	17.75	.16	.85
	Ss w/in groups	75	8211.86	109.49		
	Time	1	632.95	632.95	34.63	.0001*
	Time X Group	2	10.89	5.45	.30	.74
	Time X Ss w/in gs	75	1371.01	18.28		
PLAI III	Group	2	84.81	42.41	.39	.66
	Ss w/in groups	75	8183.7	109.12		
	Time	1	1344.3	1344.23	44.39	.0001*
	Time X Group	2	79.52	39.76	1.31	.27
	Time X Ss w/in gs	75	2270.91	30.28		
PLAI IV	Group	2	43.31	21.65	.23	.79
	Ss w/in groups	75	7191.13	95.88		
	Time	1	291.67	291.67	13.71	.0001*
	Time X Group	2	40.02	20.01	.94	.39
	Time X Ss w/in gs	75	1595.95	21.28		
PPVT-R	Group	2	27.69	13.84	.04	.95
	Ss w/in groups	75	24264.06	323.52		
	Time	1	3642.66	3642.66	80.04	.0001*
	Time X Group	2	1.75	.87	.02	.98
	Time X Ss w/in gs	75	3413.15	45.51		

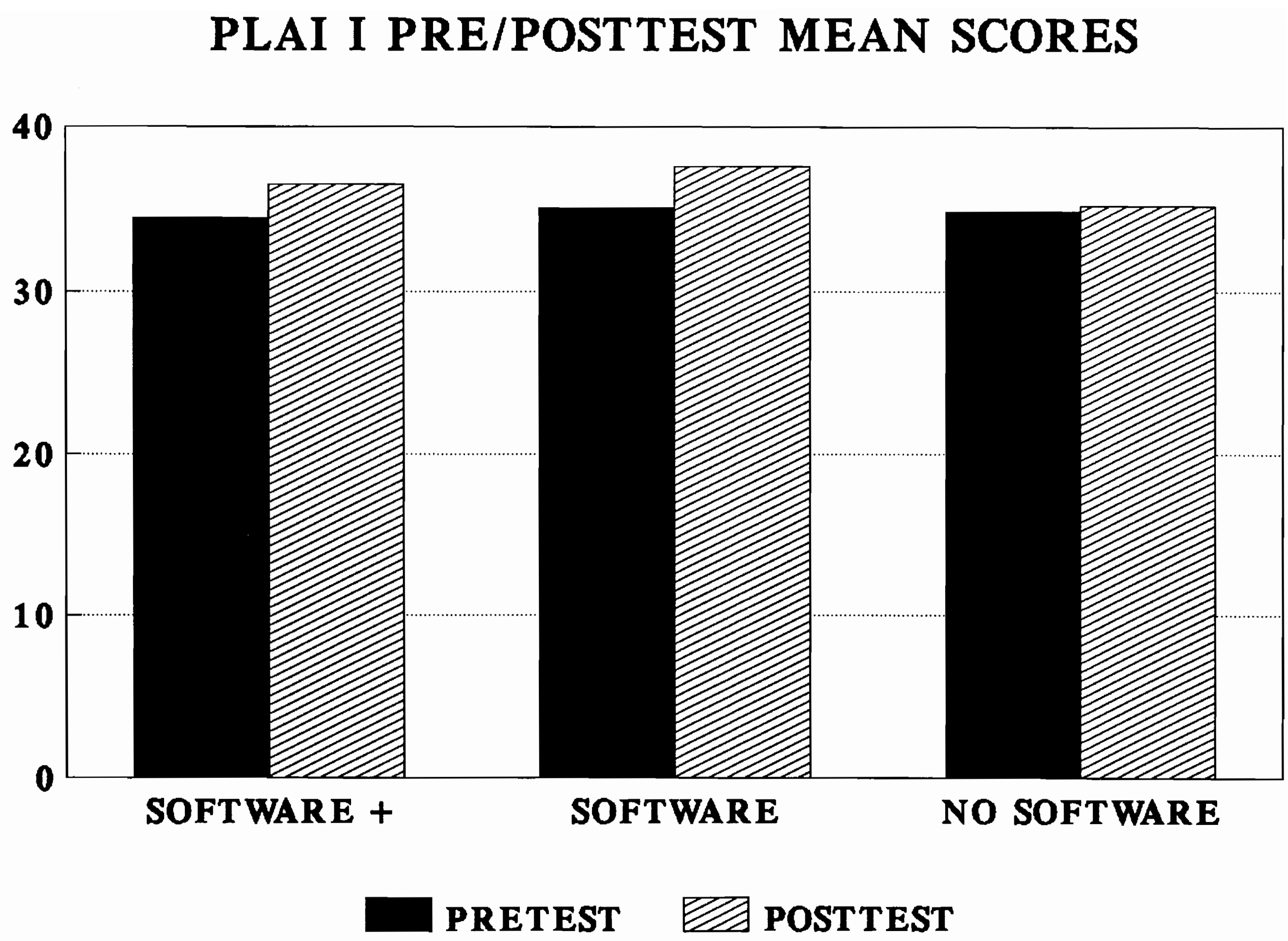

Figure 1. PLAI I pre/posttest mean scores by treatment

subject repeated measures factor, time ($F = 44.39, p \leq .0001$), indicating a significant effect from pretest to posttest on the PLAI III across all three groups (See Table 5).

PLAI IV

Means and standard deviations on the pretest scores of the PLAI IV subtest were similar. Posttest mean scores were higher for the computer-aided treatment groups compared to the control group (See Figure 2). However, standard deviations were lower for the control. There was no significant main effect for the between subject factor, group, nor an interaction effect between time and group. There was a significant main effect for the within subject repeated measures factor, time ($F = 13.71$, $p \leq .0001$), indicating a significant effect from pretest to posttest on the PLAI IV across all three groups (See Table 5).

PPVT-R

Pretest and posttest mean scores on the PPVT-R were similar. Standard deviations were also similar except for the pretest score for the software alone condition. There was no significant main effect for the between subject factor, treatment group, nor an interaction effect between time and group. There was a significant main effect for the within subject repeated measures factor, time ($F = 80.04$, $p \leq .0001$), indicating a significant effect from pretest to posttest on the PPVT-R across all three groups (See Table 5).

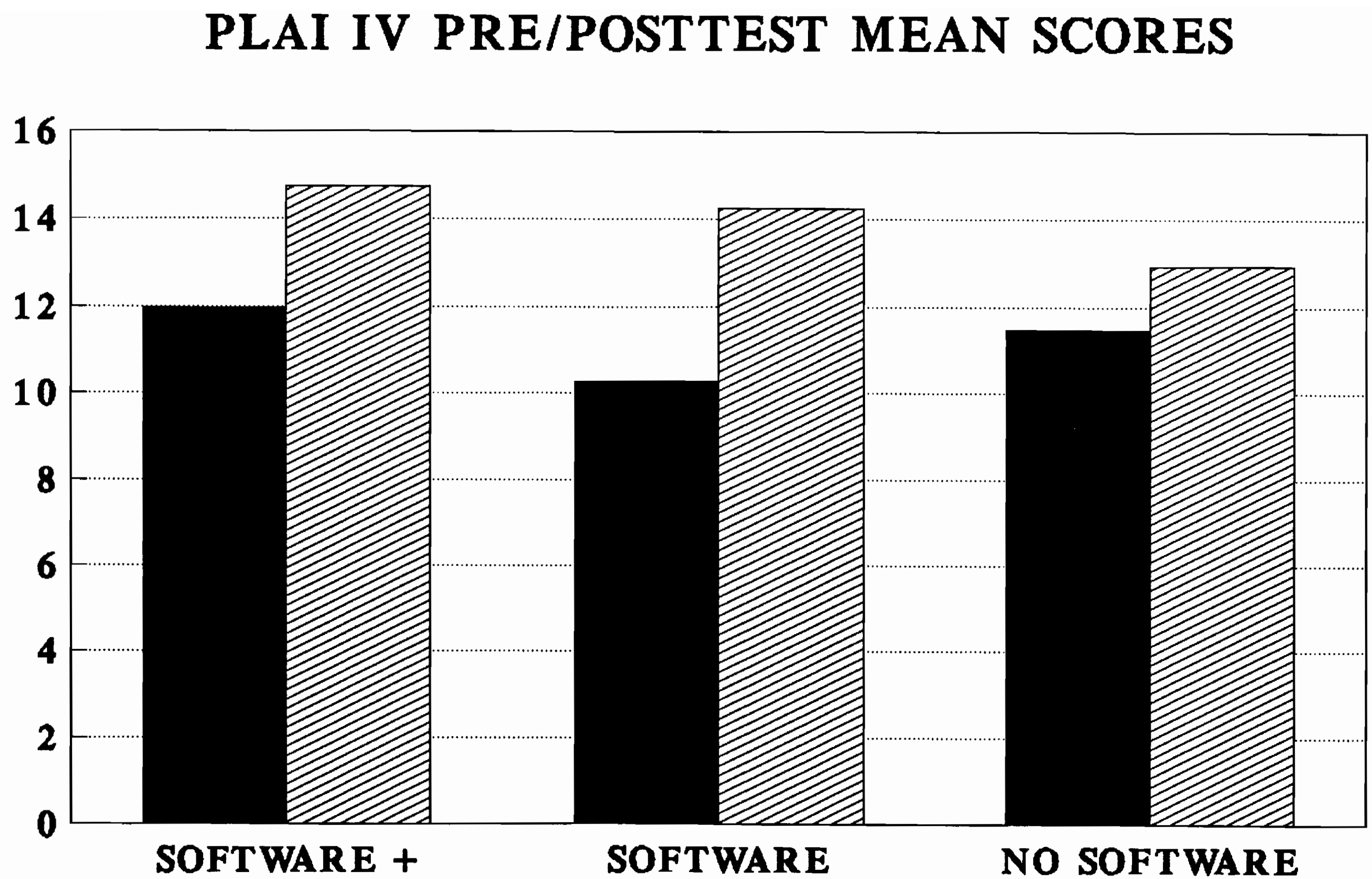

Figure 2. PLAI IV pre/posttest mean scores by treatment

PLAI Composite

Means on the pretest PLAI composite score from the four tests of the PLAI were slightly higher for the software with enhancement condition. Means on the posttest PLAI composite score were almost identical and higher for the computer-aided groups compared with the control group (See Figure 3). Standard deviations were variable between the groups from pretest to posttest scores. There was no significant main effect for the between subject factor, treatment group, or an interaction effect between time and group. There was a significant main effect for the within subject repeated measures factor, time ($F = 56.03$, $p \leq .0001$), indicating a significant effect from pretest to posttest on the PLAI composite across all three groups (See Table 5).

Secondary Analysis Related to Treatment

Students In/Out Of the Program

There was an attrition rate of 15 from the original sample of 93 students, leaving 78 students remaining for the final analysis. One student was absent during posttesting and the other 14 dropped out of the program during the three month training period. It was of interest to know if the mean scores of those who left the program were different from those who remained in the program, since this might have an affect on the results. Table 6 shows that means scores were somewhat

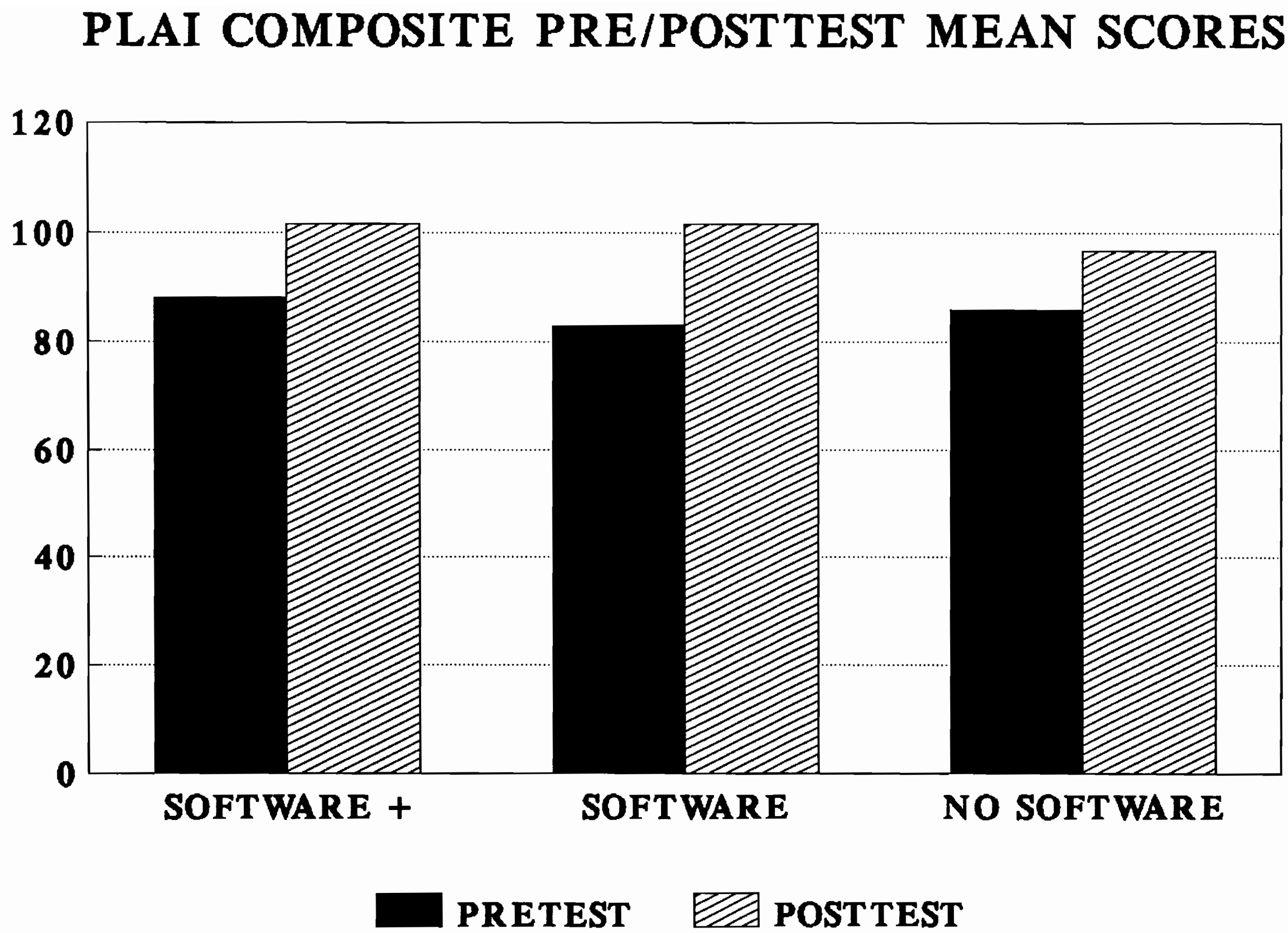

Figure 3. PLAI Composite pre/posttest scores by treatment

Table 6

Means, Standard Deviations of Pretest PLAI and PPVT-R Scores for Students Who Did and Did Not Complete Training

	Software W/Enhancement				Software Alone				Classroom Environment			
	IN (N=27)		OUT (N=5)		IN (N=22)		OUT (N=6)		IN (N=29)		OUT (N=4)	
Group	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
PLAI I	34.51	(7.08)	30.60	(9.04)	35.13	(6.01)	35.83	(3.60)	34.89	(5.79)	32.00	(5.22)
PLAI II	24.81	(7.95)	18.00	(9.53)	23.86	(7.14)	21.50	(8.11)	23.10	(8.92)	19.25	(5.05)
PLAI III	16.92	(6.78)	12.40	(6.98)	13.72	(6.37)	17.16	(8.84)	16.44	(8.97)	12.75	(6.18)
PLAI IV	11.96	(6.53)	5.80	(1.92)	10.27	(7.47)	9.50	(5.54)	11.48	(6.89)	6.25	(4.78)
PPVT-R	30.74	(13.21)	27.20	(12.07)	31.81	(9.92)	34.00	(8.74)	31.68	(13.14)	25.75	(10.27)

lower for the students who did not complete the program (OUT) compared to the students who did complete the program (IN) except for the software alone condition. In this condition, two scores, the PLAI III and the PPVT-R, were somewhat higher for the students who did not complete the program (OUT) compared to those who did.

A test for the assumption of homogeneity of variance was computed for all scores, a test which is necessary before t test results can be reported. This test was met in all cases except for the PLAI IV subtest.

A t test, used to analyze the differences between means for the students who remained in (IN) the program compared to the students who did not (OUT), indicated a significant difference in the means between these two groups of students on the PLAI IV subtest ($t = 4.04$, $p < .001$). Summing the mean scores of the students who stayed in the program compared to the mean scores of the students who did not on the PLAI IV subtest indicates the mean scores of the students who dropped out of the program (OUT) were considerably lower than those who stayed in (IN) on this subtest.

Students Receiving Speech

Within the 78 students who completed the program, 15 also were receiving speech services. There was interest in knowing whether the scores of this group of students negatively affected the results. The means and standard deviations on all test measures for those students receiving speech and language services are shown in Table 7 along with mean and standard deviations for those who were not receiving these services.

A 3 X 2 factorial analysis of variance (ANOVA) with repeated measures on the second factor was computed with the students receiving speech services removed from the analysis. No significant differences were found for the two main effects or for the interaction effect.

Student Absences Relative to Computer Training

The absentee rate of students receiving computer training in both groups was high. It was of interest to examine the relationship between absentee rate and gain scores for the computer training groups (software with enhancement and software alone). Table 8 shows the correlation between number of absences and gain scores on the pretest and posttest measures, as well as the intercorrelation of the gain scores among the subtests. Inspection of these coefficients indicate that absences did not correlate significantly with any of the test scores.

Computer Training Relative to High/Low Functioning Students

The question of whether higher functioning students benefitted more than low functioning students from the computer training was also addressed. Students were split into

Table 7

Means and Standard Deviations for PLAI and PPVT-R Pretest and Posttest Scores for Students Receiving Speech Services and No Speech Services

				PLAI I		PLAI II		PLAI III		PLAI IV		PPVT-R	
				Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Software with Enhancement	Speech	7	M	30.00	33.28	20.71	23.00	14.28	14.42	7.28	7.28	20.57	30.14
			SD	(8.85)	(4.57)	(9.34)	(4.47)	(6.77)	(5.02)	(3.86)	(1.79)	(8.73)	(10.39)
	No Speech	22	M	36.10	37.70	26.25	29.66	17.85	24.95	13.60	17.35	34.30	44.35
				(5.82)	(4.97)	(7.12)	(7.54)	(6.70)	(7.70)	(6.54)	(8.70)	(12.78)	(13.38)
Software Alone	Speech	4	M	31.50	35.00	17.25	18.50	10.50	18.50	7.75	8.75	27.25	37.00
			SD	(7.32)	(4.76)	(2.87)	(5.06)	(1.73)	(4.50)	(6.13)	(4.78)	(6.29)	(8.75)
	No Speech	18	M	35.74	38.16	25.33	30.33	14.44	22.38	10.83	15.50	32.83	42.66
			SD	(5.60)	(3.34)	(7.00)	(6.37)	(6.83)	(8.95)	(7.78)	(9.96)	(10.42)	(14.56)
Classroom	Speech	4	M	31.00	32.00	18.50	19.25	10.25	12.25	8.50	8.75	19.25	31.50
			SD	(7.83)	(2.58)	(12.50)	(4.42)	(4.99)	(3.50)	(3.87)	(4.50)	(13.02)	(17.99)
	No Speech	25	M	35.52	35.76	23.84	28.96	17.44	22.32	11.96	13.64	33.68	42.68
			SD	(5.34)	(5.01)	(8.32)	(8.09)	(9.13)	(10.06)	(7.20)	(6.88)	(12.26)	(15.53)

Table 8

Correlation Matrix Between Absences and Gain Scores

	1	2	3	4	5	6
1. Absences	-	-	-	-	-	-
2. PLAI I	.03	-	-	-	-	-
3. PLAI II	.07	.02	-	-	-	-
4. PLAI III	-.26	.09	.30	-	-	-
5. PLAI IV	-.19	.13	.38*	.42*	-	-
6. PPVT-R	-.04	.16	-.04	.00	.02	-
7. Composite PLAI	-.17	.44**	.67**	.77**	.74**	.04

* 1 tailed significance: $p < .01$

** 1 tailed significance: $p < .001$

two groups, high and low, based on a pretest total score for each student. Students who received a score greater than 116 were designated in the high functioning group, while students who received a score of less than or equal to 116 were designated in the low functioning group. Scores ranged from a low of 35 to a high of 194. Means and standard deviation for gain scores on the PLAI and PPVT-R between the high and low functioning groups are reported in Table 9. Gain scores on the PLAI I for both computer conditions compared to the control condition show substantial increases for the low functioning group (See Figure 4). Gain scores on the PLAI IV were noticeably higher in both computer groups compared to the control group for the high functioning students (See Figure 5).

A 3 X 2 analysis of variance (ANOVA) with the first factor treatment group (software with enhancement, software alone, and classroom environment), and the second factor level of functioning (high and low) was computed. Results show there was no significant main effect for group on any of the PLAI and PPVT-R test measures. A significant main effect was found for function ($F = 4.51$, $p < .03$) for the gain score on PLAI I only. No significant interaction effect was found between group and function on any of the other tests.

Table 9

Mean and Standard Deviation Gain Scores on PLAI and PPVT-R Between High and Low Functioning Groups

			PLAI I		PLAI II		PLAI III		PLAI IV		PPVT-R	
Groups	n		Hi	Low	Hi	Low	Hi	Low	Hi	Low	Hi	Low
Software with Enhancement	27	M	.85	3.30	2.92	3.76	6.78	3.69	4.28	1.15	9.85	10.00
		SD	(3.73)	(5.67)	(6.04)	(5.73)	(7.53)	(7.25)	(5.44)	(4.57)	(4.31)	(10.55)
Software Alone	22	M	-.30	4.75	4.50	4.16	8.70	7.33	5.60	2.66	7.60	11.66
		SD	(2.58)	(4.35)	(4.90)	(5.27)	(9.42)	(8.53)	(7.38)	(7.55)	(10.09)	(9.86)
Classroom Environment	29	M	.33	.35	5.73	3.21	2.66	6.42	1.33	1.64	9.66	9.21
		SD	(4.35)	(6.22)	(6.39)	(7.47)	(7.69)	(6.59)	(8.05)	(5.65)	(12.36)	(8.88)

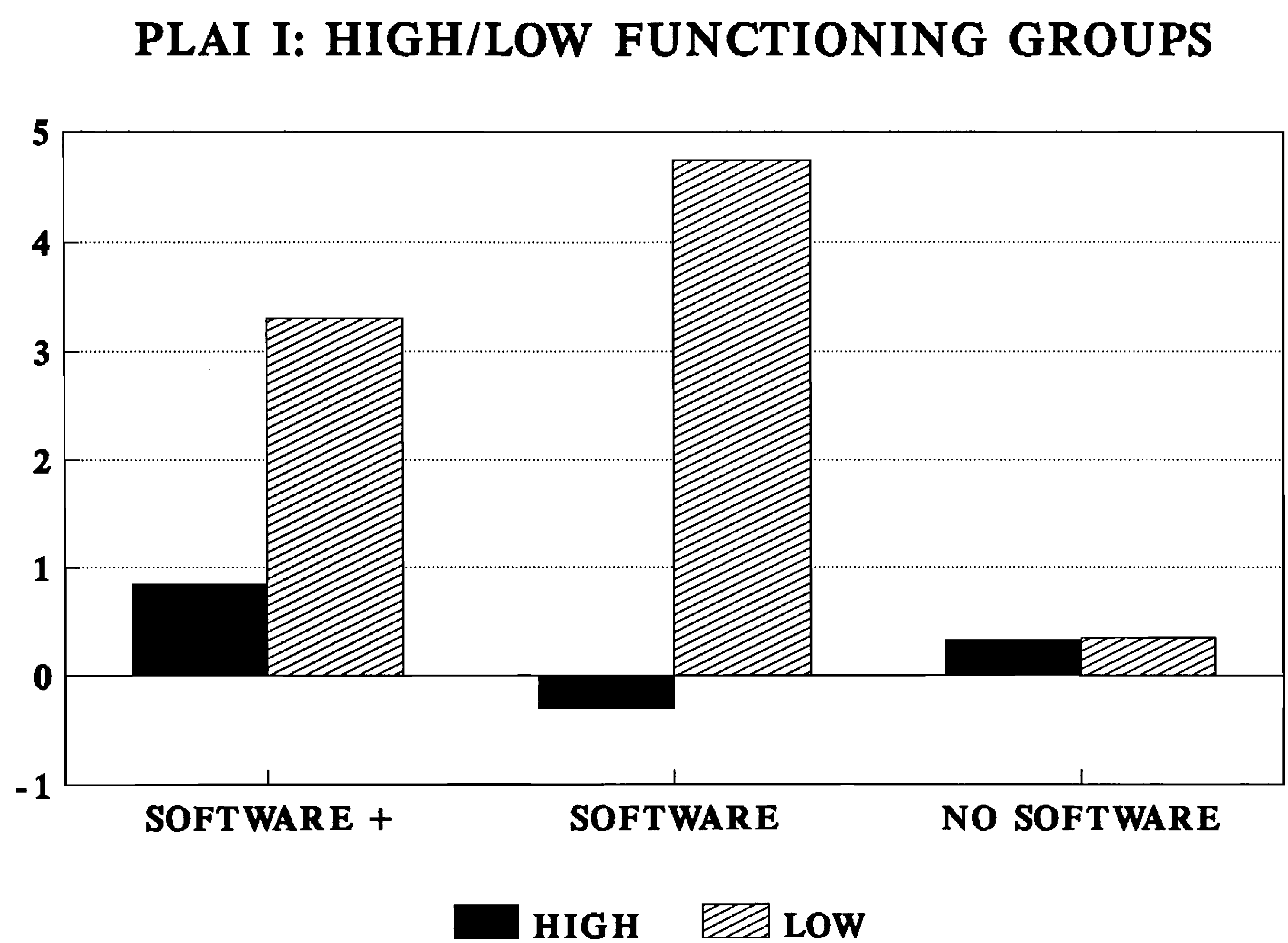

Figure 4. PLAI I mean gain scores for high/low functioning groups by treatment condition

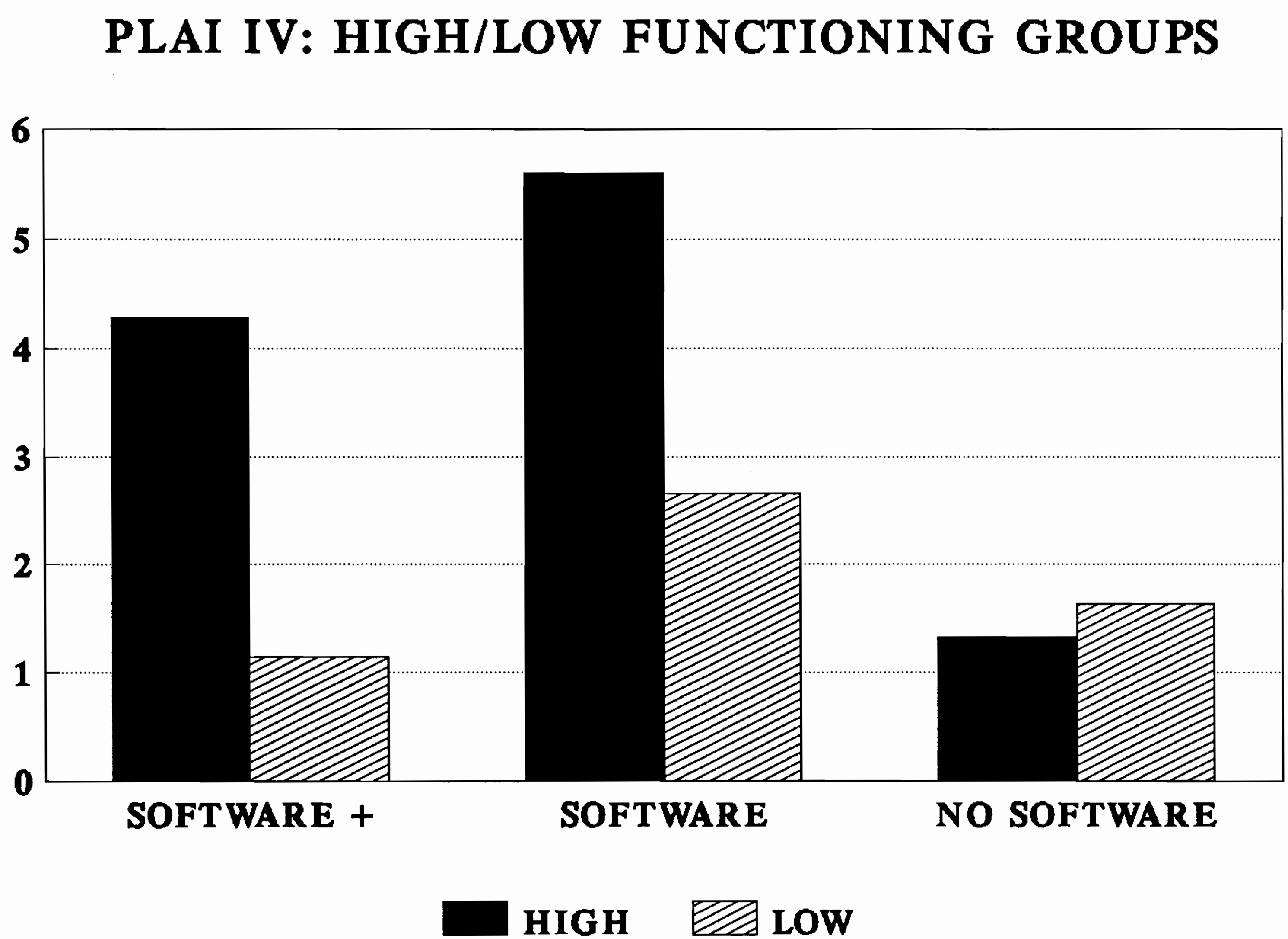

Figure 5. PLAI IV mean gain scores for high/low functioning groups by treatment condition

Analysis of Language Sample Dimensions

Language samples with 50 word utterances were analyzed. Fifty word utterances are considered adequate for language sample analysis by Cole, Mills, and Dale (1989). Table 10 shows the means and standard deviations on the pretest and posttest language sample scores (mean length of utterance - MLU; type token ratio-TTR; upper bound length-UBL; turntaking-initiating-TI; and turntaking-responding-TR), and displays means and standard deviations of the gain scores on the five language sample dimensions. The software with enhancement condition showed gains particularly in MLU, UBL, (See Figure 6) and TI compared to the other two groups. TTR increased slightly for both computer groups compared to the control group. TR was lower for the software with enhancement group. However, a one way analysis of variance computed for each individual measure found no significant difference between groups on any of the language dimensions.

Qualitative Analysis of Anecdotal Records

Anecdotal records were kept by the five clinicians during the training period using the software Words & Concepts Series. The form for these records provided space for comments about the software/hardware, training procedures,speech/language of the students, and miscellaneous information (see Appendix I). Each record was kept for an

Table 10

Means and Standard Deviations for Pretest and Posttest Language Sample Scores

Groups	n		MLU Pre	MLU Post	MLU GS	TTR Pre	TTR Post	TTR GS	UBL Pre	UBL Post	UBL GS	TI Pre	TI Post	TI GS	TR Pre	TR Post	TR GS
Software with Enhancement	3	M	3.94	4.46	.51	.46	.48	.02	13.66	20.33	6.66	.29	.37	.08	.70	.62	-.07
		SD	.31	.90	1.05	.05	.05	.07	5.03	13.57	9.07	.22	.31	.27	.22	.31	.28
Software Alone	3	M	4.92	4.04	-.88	.40	.45	.05	14.00	12.00	-2.00	.34	.31	-.03	.65	.68	.03
		SD	.78	.19	.93	.06	.04	.02	5.19	2.64	2.64	.35	.26	.09	.35	.26	.09
Classroom Environment	4	M	2.97	2.95	-.02	.54	.53	-.00	8.25	7.50	-.75	.26	.15	-.10	.73	.84	.11
		SD	.87	.96	.61	.06	.05	.04	1.70	3.31	2.63	.30	.15	.21	.31	.15	.21

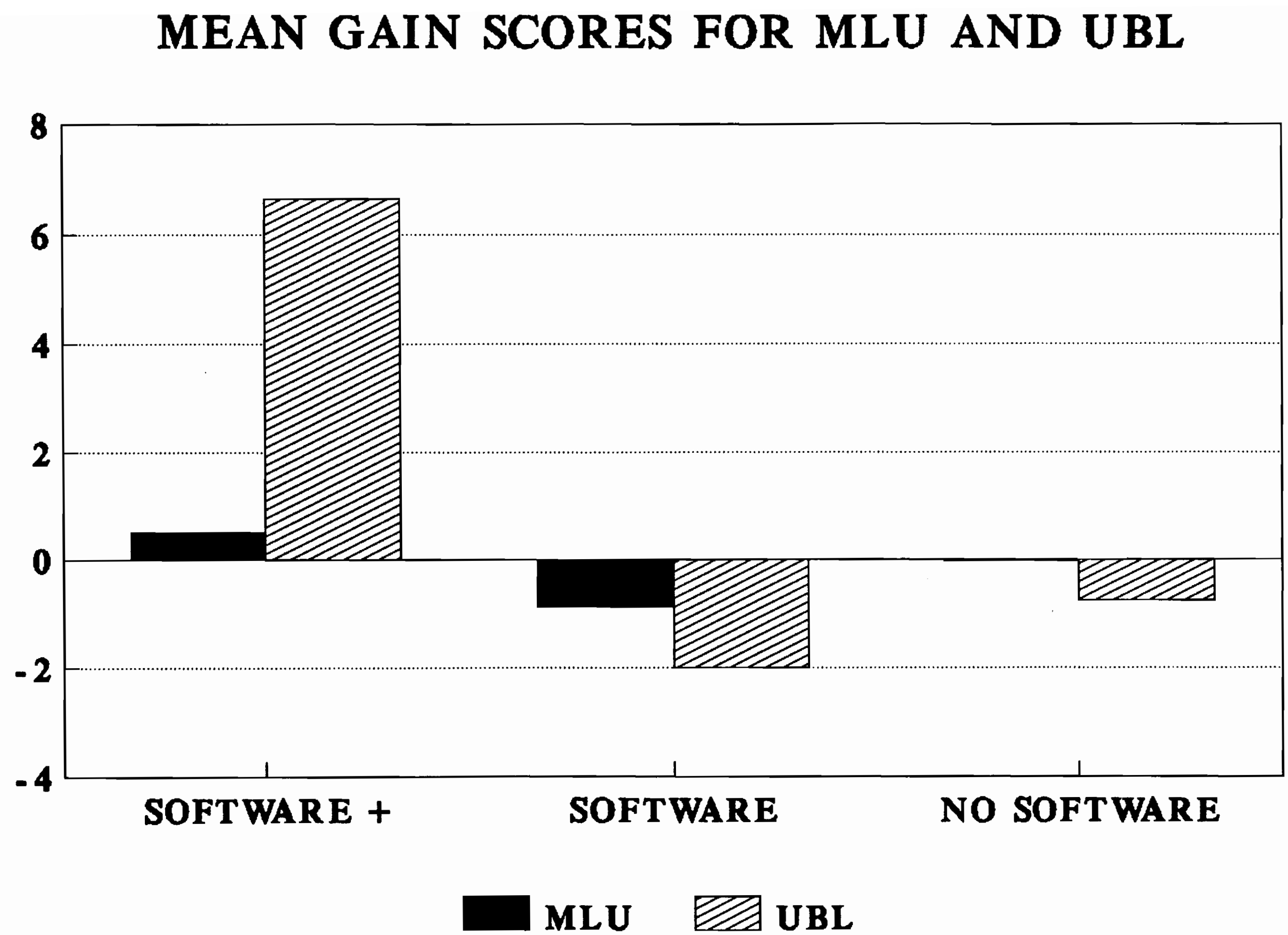

Figure 6. Mean gain scores by treatment for mean length of utterance (MLU) and upper bound length (UBL)

entire week of training or two sessions. For ease in recording, clinicians were asked to note any observations under the categories listed. Each month, during the three months of training, the anecdotal records were collected and the information was recorded under the four topic headings listed above. When the training period was concluded, clinician observations were compiled and commonalities between clinician comments were noted across sessions and software use. Appropriate headings were suggested by the data collected (Miles & Huberman, 1984). The information from the anecdotal records which follows is presented under the following topics: (a) Software and hardware, (b) training procedures, (c) student speech and language, and (d) miscellaneous.

Software/Hardware

Software/hardware comments were defined as any observation relating to the software programs (Words & Concepts Series) and/or the hardware (computer, Touch Window, speech synthesizer) used in this study. Once these observations were compiled they were categorized into those relating to software or hardware. The software comments were further subdivided into positive and negative comments and listed under related themes. Hardware observations were only listed under related themes. Responses by the researcher and/or solutions posed by the clinicians were also included, if appropriate. The software activity (Vocabulary-V, Categorization-C, Word Identification by Function- WIbF, Word Association-WA, Concept-Same/Alike-CS, Concept-Different-CD) and the software package (Words & Concepts= W & C, Words & Concepts II= W & C II, Words & Concepts III= W & C III) are identified when this information was available. Table K-1 and K-2 in the appendix display clinician observations on the software and hardware. Positive comments were made about the software's reinforcers, cuing techniques, and graphics. Negative comments related to problems internal to the software, problems with functioning of the software, problems with particular software activities, and miscellaneous software problems. Negative comments about the hardware dealt with problems related to the Touch Window and speech output from the speech synthesizer.

Training Procedures

Training procedures were defined as any clinician comments which referred to the training instructions given to the Head Start students during computer activities. These included instructions to point and to take turns for both computer groups. In addition, for the software with enhancement group, there were instructions to encourage verbalization. The comments for training procedures were divided into a category for problems (instruction related and software related), suggestions, and improvements.

Under the category, problems, were instruction related problems and software related problems. Instruction related problems referred to problems with language improvement instructions, pointing instructions, following instructions, turn taking instructions, and maintaining attention. Software related problems generally referred to specific activities that students found difficult. Solutions from the researcher/clinicians for solving these problems were included when available. Some problems were general in nature, regardless of the activity, while others were more specific to certain activities. For this reason, the activity to which the problem related was specified when possible. See Table K-3 in the appendix for a summary of problems/solutions relating to the training procedures.

As the clinicians worked with the Head Start students, they made general suggestions or comments not related to specific training problems, which they recorded in the anecdotal records. For example, it was suggested that the phrase "Show and tell me" by the clinician was helpful in encouraging the children to respond verbally, and the closure procedure was helpful in getting them to respond in phrases or sentences rather than words as the activities proceeded. Some clinicians indicated that the clinician as partner was more successful. In these cases, often due to absences, the children liked to help the clinician point and liked telling the clinician the correct answer when it was the clinician's turn in the software with enhancement group. Some clinicians indicated they were able to stimulate correct production of initial sounds with modeling while they used the activities when students uttered misarticulated sounds.

Three separate software packages in the Words & Concept Series were used for training. As training proceeded to the second software package (Words & Concepts II), the clinicians began to record in the anecdotal records improvements relating to the training goals. For example, it was noted that children began verbalizing phrases and began generalizing concepts learned (e.g.pointed to a chair in the room as a furniture item; picked out things in the room that were different). They could also see improvements in the children's ability to stay with the task and work together (e.g. child gets clinician's finger and points to picture; takes another child's finger and points to word assisting child; helps another child do what he is supposed to do; children help each other point to pictures). Toward the end of the training with Words & Concepts III, comments began to appear in the anecdotal records that reflected differences between the training groups. For example, one clinician noted that the software with enhancement group was more interested and less distracted than the software alone group. The reason for this she suggested was that the software with enhancement group was responding verbally to the computer and pointing as well. Many comments also began to appear in the anecdotal records which suggested improvements in the students. The students initially represented a wide range of abilities and behaviors. The improvements reflected individual and/or group improvements of these students. See Table K-4 in the appendix for a list of comments made by clinicians about their students.

Speech/Language

The student clinicians were asked to write down examples, when possible, of the spontaneous speech and language of the Head Start students during both computer training sessions. The speech and language samples were coded using the following definitions:

1. "Reinforcers" referred to either the various characters and their antics in the three different software packages (e.g. "Why it got a green man," " He eat it," "They come up at the same time," "He turns into a square") and/or the thermometer that recorded the responses (e.g."It went all the way up.").

2. "Game" referred to any statements made about the game such as taking turns, playing the game (e.g."I don't know

which one it is?", "I don't wanna do this no more," "Her miss one," " I got a point," "I'm winning.").

3. "Hardware" referred to either the speech synthesizer (e.g. "Wait till he tell me," "Is it a great big man in there?", or the touch window ("I see in that hole" referring to the space between the touch window and the‘monitor).

4. "Instructional vocabulary/concepts" referred to any examples in which students used the vocabulary words/concepts other than to verbalize their responses as modelled by the clinicians for the software with enhancement group; generalized the information they were learning (e.g."My Dad got me one,"referring to ribbon, "That's a baby bed," referring to crib," "Me gots earmuffs too," "Point at the two things that are exactly alike"); or asked questions about the instructional material (e.g. "What's these things").

5. "Extraneous speech" referred to speech that was not in any way related to the instruction

6. "Other" referred to speech that could not be coded because of the uncertainty of the category (e.g. What's that?) and the need to be present to make the determination.

Utterances were only counted once within a category if they appeared to be said at the same time (e.g. "You know what? My Daddy drinks pepper" or " He didn't open his eyes up. He keeped them small." Utterances were excluded from the count which were either exact replicates of the computer voice (e.g. "Which one is food?") or in the software with enhancement group, attempts made to verbalize as modeled by clinicians.

Table 11 is a summary of the information from the coded speech/language samples. This information suggests that the software with enhancement group (28.6%) conversed more about instructional vocabulary than the software alone group (16.8%). The software alone group (26.6%) appeared to talk more about aspects of the game than the software with enhancement group (21%). Other aspects were fairly similar for both groups. According to Tager-Flusberg (1989), 5 year-olds are using simple sentences, questions, negatives, and imperatives, and are beginning to use more complex grammatical constructions. See Table K-5 for selected examples of the spontaneous speech of the Head Start students recorded in the anecdotal records. These samples show simple sentences, questions, negatives, imperatives, and complex constructions as would be expected. Observation of these samples indicate the children were generally speaking to each other, to the clinician, or to the computer. Common grammatical errors found within the language samples were the substitution of "got" for "has" or "have" and the substitution of "ain't" for "isn't." Phonological problems on words among those students who were not receiving speech services was indicated by some of the clinicians (e.g., b/v in envelope; cluster reduction in words such as nest and basketball). Clinicians had been asked to phonetically record the speech sound errors of their students. Errors that were recorded were not unusual for students in the four to 5 year-old range.

Miscellaneous

The miscellaneous category was primarily for clinician observations about student behavior and solutions to problems they encountered. In this category were attention and lack of interest problems, behavior and emotional problems, and miscellaneous problems which clinicians had to address. See Table K-6 for a detailed list.

Qualitative Analysis of User Response Survey

A user response survey (Appendix K) was completed by the clinicians during the final weeks of training. The survey asked specific questions about the software/hardware, training procedures, student speech and language, and the software training program. This information helped to corroborate information from the anecdotal records and provide additional information on the program.

Table 11

<u>Summary of Information from Coded Speech/Language Samples in Anecdotal Records</u>

Groups	N	Reinforcers		Game		Hardware		Instructional Vocab/Concepts		Extraneous		Other	
		n	%	n	%	n	%	n	%	n	%	n	%
Software with Enhancement	500	102	20.4	105	21	9	1.8	143	28.6	96	19.2	45	9
Software Alone	480	117	24.3	128	26.6	17	3.5	81	16.8	80	16.6	57	11.8

Software/Hardware

Clinicians were given an opportunity to express positive and negative aspects about the software and hardware, to delineate the most difficult activities for the students in the software packages, and to recommend any changes for the software and hardware.

Overall, comments about the software were positive. clinicians specifically commented on the excellent vocabulary, the educational nature of the software programs, and the appealing reinforcement characters. The negative comments were that the software occasionally hung up and that there was not enough time to expand language between turns. Other observations related to changes clinicians recommended. These changes included the following: making the software secure so that it would not fall of its jacket, providing an activity that combined some of the skills from all the activities, adding a pause button so the program could be momentarily interrupted, and allowing easier access from one activity to another.

Clinicians were also asked which software activities were more difficult for the students. The clinicians noted that the activity categorization, particularly category exclusion, as the most difficult for all students. The activity, word identification by function and word association, followed closely behind in difficulty level.

The clinicians indicated the Touch Window provided a quick, effective, easy, and motivating response mode for young children. The use of a touch-sensitive screen was found in the Battenberg and Merbler (1989) study to improve learning in young children. The clinicians expressed concern, however, about the two buttons on the bottom of the Touch Window and the gap between the Touch Window and the monitor which were distracting to the students. Additional problems noted were the ease with which students could remove the Touch Window, and the necessity to clean it often to be assured of its performance. They recommended making the touch window harder to take off and removing the gap between the Touch Window and the monitor. Improving the intelligibility of the speech on some words was recommended for the speech synthesizer.

Training Procedures

Clinicians were asked to give positive and negative comments about the training procedures with suggestions for possible changes. Their comments included observations about the instructions in general, the instruction/outcome as it related to the two computer training groups, the optimal time frame for training, and the optimal student number per session for training.

The training instructions in general were reported to be adequate. For example, they were clear and precise with the learning objectives readily understood. The majority of the clinicians said the would not change the instructions. One clinician did suggest, however, that the training instructions should emphasize the need for students to listen for cues. Some differences, however, were reported by the Clinicians between the two computer groups.

Two clinicians suggested that the students in the software with enhancement group became bored easier. One clinician noted that it was more difficult for this group; these students were expected to verbalize as well as point. On the contrary another clinician commented that the software alone group became bored quicker.

Another clinician noted that the software with enhancement group attended less to the computer voice. The clinician indicated that she would repeat the instructions and she suggested that the students were relying on her instead of the computer. In the software alone group, a clinician suggested that the students enjoyed the reinforcement more because they were not busy paying attention to saying the words, phrases, or sentences. See Table 12 for a summary of these observations.

Some clinicians observed that the instructions for the software with enhancement group made treatment more effective.

It was their impression that the students in this group had a better understanding of the words. For example, it was suggested that the software alone group did not really know the words, but instead were only associating pictures. One clinician felt that too much structure was required from the software with enhancement group, while the software alone group did not have enough and were more distractable. A compromise between full instruction and no instruction was suggested by another clinician who suggested that less talk and instruction by the clinician would allow the students to learn.

Clinicians were asked for an optimal time period of instruction. Twenty minutes was noted by one clinician to be sufficient, while the others considered 20 minutes too long a time for training. Suggestions ranged from 15 minutes to 17 minutes as optimal for this age group.

The clinicians were also asked about working with two students in a group. Clinicians felt that working with two students together was good for competition, was more fun for the students, provided a sufficient number of opportunities for participation, and was positive for stimulating language interaction. However, with two students, clinicians had less control and more problems with discipline. Some preferred one-on-one because they could give more attention and direction.

The clinicians generally believed that the students did better alone.

In terms of specific changes in the training procedures, suggestions were to remove other distractors in the immediate environment, allow reinforcement randomly (e.g. stickers), and shortening the benefit time.

Program Benefits

Clinicians were asked to provide information as to the benefits of the computer-aided training. Clinicians indicated that it was a great language enrichment opportunity. One clinician commented, " ...it opens the door for new vocabulary learning and for new ways of presenting instructions and directions." Another said, "...I feel that my students have been enriched by this program. They are all more verbal now than twelve weeks ago."

The clinicians also listed benefits in addition to language improvement for computer-aided training. These included: learning turntaking, cause and effect, task focusing; developing maturity, self confidence/esteem; and increasing social interaction skills.

Chapter Summary

Highlights of the primary analysis indicate that there were some posttest mean score differences by treatment group

Table 12

Summary of Observational Differences Between the Software with Enhancement Group and the Software Alone Group for Each of the Five Clinicians

Clinician	Software With Enhancement	Software Alone
1	-less attention problems	-more easily distracted
2	-tended to get bored sooner; discussed more program related topics	-enjoyed reinforcement more; discussed more non-program related topics
3	-attended less to computer voice	-attended more to computer voice
4	-enjoyed coming more	-got bored quicker
5	-got bored faster	-didn't get bored as fast

which favored the two computer-aided groups over the control group. Analysis of variance (ANOVA) for the separate PLAI and PPVT-R scores, and for the PLAI composite score, however, showed no significant main effect or interaction effect. The evidence was not sufficiently strong to reject the null hypothesis for the main effect of treatment and the interaction effect between treatment and time. A significant main effect was found in both analyses for time. Separate analyses which considered the effect of students who left the program, students receiving speech services, and student absences provided no significant information to challenge the results of the primary analysis.

In the secondary analysis, when high and low functioning students were compared, mean gain scores were noticeably higher on the PLAI I for low functioning students and on the PLAI IV for high functioning group for both computer groups. Using an analysis of variance, a significant effect of computer training on the PLAI I score was found for low functioning students. Mean gain scores on the language sample dimensions favored the software with enhancement condition for MLU, UBL, and TI, while the software alone condition was favored for TTR.

The qualitative analysis in this study considered the anecdotal records and a user response survey. The clinicians recorded comments about different aspects of the computer-aided program in anecdotal records. Observations were made about the software/hardware, training, student speech and language, and student behavior. In addition, a user response survey provided information about the total computer-aided program and its impact on the Head Start Students.

Chapter 5

Summary, Discussion, and Conclusions

This study investigated the effectiveness of using microcomputers with preschool students to improve language skills, specifically discourse skills. It also examined how software could be modified or new software designed to improve these skills. Chapter five contains a summary of results from this research followed by a discussion of results. Statistical and clinical significance of this study are presented in the conclusion section of this chapter.

Summary

The primary purpose of this study was to determine whether commercially available software, modified with enhanced dialogue from instructors, could improve discourse skills in Head Start students over improvements obtained without enhanced instructor dialogue, and over improvements of ordinary classroom instruction. Additional information about modifying software or designing new software to improve discourse skills was investigated. A summary of all data analyses are presented below.

Pretest PLAI and PPVT-R Scores

The magnitude of the intercorrelation coefficients among the four subtests of the PLAI and the total scores of the PPVT-R suggest there are some language dimensions in common between the subtests on the PLAI, a cognitive-language test, and the PPVT-R, a receptive vocabulary test. This was true also in the Lehrer and deBernard (1987) study. However, the intercorrelations of the pretest PLAI and PPVT-R scores ($R = .52-.82$) in their study were even higher than those found in this study.

Primary Analysis Related to Treatment

Posttest mean scores were similar by treatment group for PLAI II, PLAI III, and the PPVT-R, while they were slightly higher for both computer groups on PLAI I and IV. A 3 X 2 factorial analysis of variance (ANOVA) used for the four PLAI subtest and PPVT-R scores found no significant main effect for group, nor a significant interaction effect. A significant main effect was found only for time, which was interpreted to mean that all three groups improved over the three month period.

When means and standard deviation were computed for a composite PLAI score, there were similar increases on posttest scores for both computer training groups compared to the control group. However, the analysis of variance showed no significant main effect for group, nor an interaction effect. Only a significant main effect was found for time.

Secondary Analysis Related to Treatment

Secondary analyses of this study addressed the following:

(a) whether pretest scores of those students who remained in the program were different from pretest scores of those who did not complete the program, (b) whether the results would differ if those receiving speech services were removed from the analysis, (c) whether the number of absences correlated significantly with gain scores on the language tests (d) whether there was a significant difference between high and low functioning students compared with low functioning students on language measures, and (e) whether there was a significant difference among treatment conditions on language sample dimensions. Each secondary analyses is summarized below.

Mean pretest scores were somewhat lower for students who did not complete the program compared to the students who did complete the program. The exception was for students in the software alone group who did not complete the program. Their scores were higher than students who did not complete the program in the software with enhancement and the control conditions. For the students who stayed in the program, significantly ($p < .001$) higher mean scores were found on the PLAI IV pretest.

An increase in mean scores on the PLAI I was found for those students receiving speech services and computer training compared to those students who were only receiving computer training. When students receiving speech services were excluded for the analysis, an analysis of variance on pretest and posttest scores for the remaining students showed no significant effect by treatment group.

When intercorrelation coefficients were computed among student absences from the two computer training groups and the four PLAI subtest and PPVT-R mean gain scores, no significant correlation was found among absences and gain scores. The same was true when the PLAI composite score was correlated with absences.

High and low functioning students were separated by a median split prior to computing a 3 X 2 factorial analysis of variance. No significant main effect was found by group and no interaction effect was found between group and functioning level for any of the language measures. A significant effect was found for level of functioning, but only for the PLAI I. The mean gain scores on the PLAI I in both computer conditions showed that the low functioning students made substantive improvement compared to the high functioning students. The mean gain scores on the PLAI IV in both computer conditions showed the high functioning students made considerable improvement compared to the low functioning students.

The analysis of the gain scores on the language sample dimensions show that the software with enhancement condition was slightly higher for mean length of utterance (MLU), upper bound length (UBL), and turntaking-initiating (TI), and lower for turntaking-responding (TR) than the software alone or classroom environment condition. The type token ratio (TTR) score for the software with enhancement group was higher than the classroom environment condition, but not as high as the software alone condition. At the same time, the standard deviation for the software with enhancement group was larger on all dimensions. Although differences were noted between the software with enhancement condition and the other two conditions as indicated, these differences were not significant based on a one way analysis of variance which analyzed the mean gain scores for all the language sample dimensions by group.

Qualitative Analyses

The qualitative analysis in this study was based on information from the anecdotal records and a user response survey. Clinicians recorded comments about different aspects of the computer-aided program in anecdotal records. They made some of the following observations about the software/hardware, training procedures, student speech and language, and student behavior:

1. Software/hardware. Observations about the software were both positive (e.g. student enjoyed reinforcers) and

negative (e.g. students were confused with some graphics and the recording of an incorrect response when a long delay in responding occurred; clinicians wanted to be able to suspend the program to provide additional instruction). Comments about the hardware tended to be negative (e.g. speech from synthesizer unclear, Touch Window easily becomes detached).

2. Training procedures. Problems were indicated that were instruction related (e.g., student(s) unable to use expressive language required, not using correct pointing response, not following instructions, not paying attention, and not taking turns) and software related (e.g., category-exclusion, word identification by function; and word association most difficult for students). Suggestions were provided for encouraging student verbalization and participation.

3. Student speech and language. Differences in content of verbalization was found among students receiving CAI training (e.g. software with enhancement group talked more about instructional vocabulary; software alone group talked more about aspects of the game). Spontaneous language of students receiving CAI training was found to contain simple sentences, questions, negatives, imperatives, and more complex grammatical constructions.

4. Student behavior. Students were observed to have problems related to attention, behavior, and distractibility.

Observational comments about the software/hardware, training procedures, and student language were also obtained from a user response survey. Some examples of this information follows:

1. Software/hardware. There were positive comments about the software (e.g., excellent vocabulary, educational nature of the software programs, and the appealing reinforcing characters), and negative comments (e.g., lack of time during activities to expand vocabulary, and problems with the program getting hung up). General improvements were suggested, and specific activities more difficult for the students were identified (e.g. category-exclusion, word identification by function, and word association). Comments were expressed about the hardware components, the Touch Window and the speech synthesizers.The Touch Window was indicated as a quick effective, easy, and motivation response mode, but due to some design parameters was sometimes distracting to students (e.g., buttons on the bottom of the Touch window, gap between the Touch Window and the monitor, ease of removal). Some words were indicated as unclear from the speech synthesizer.

2. Training procedures and student speech and language. The clinicians observed their training instructions were adequate. They recommended a more optimal training time period of 15 to 17 minutes, and suggested that two students in a

group was workable and preferable in some cases (e.g. good for competition, positive for stimulating language interaction). Differences noted between students in the two computer-assisted conditions was not consistent among clinicians for the two separate conditions, software with enhancement and software alone.

In addition to the above information, the user response survey provided information about the benefits of the computer-assisted program. The CAI program was considered by the clinicians to be beneficial for language enrichment as well as an assistance to students for learning turntaking, cause and effect, and task focusing; developing maturity, and self confidence/esteem; and for increasing social interaction skills.

Discussion

Primary Analysis Related to Treatment

Post-instructional scores. Observations of both the PLAI subtests and the PLAI composite score indicate mean score increases post-instructionally for both computer-aided groups in discourse skills. Specifically, the increases for the individual subtests of the PLAI were for PLAI I, matching perception, which applies to activities that require identification, naming, or imitation; and PLAI IV, reasoning about perception, which involves activities that predict, explain or find logical solutions. These increases suggest that changes were occurring, which may have required a longer period of treatment time to reach significance on the PLAI. For example, a study which extends over an entire school year. The PPVT-R scores post-instructionally were similar for all three groups. This suggests that the PLAI was more sensitive to increases than the PPVT-R, and any increases, therefore, were more specifically related to discourse rather than vocabulary skills per se.

In an analysis of variance used for the four PLAI subtests, PPVT-R, and the PLAI composite, a significant effect was found for time. This represented a period of approximately three and a half months. Improvement from pretest to posttesting over time would have been anticipated for all students due to maturational changes of the students over this time period.

Although a significant effect was found for time, the analysis of variance showed no significant main effect for group, nor an interaction effect. Some of the problems encountered in this research may have contributed to nonsignificant results. For example, this study was conducted under less than ideal circumstances. The students were from Head Start programs. Though staff and teacher cooperation was outstanding, the facilities were less than ideal (e.g., noise, numerous distractions in the rooms where computers were located, and crowding in the rooms). Other difficulties such as equipment break downs, four different location sites to monitor, and three different teachers over the three month period for one class, were additional problems encountered. It is impossible to measure these precise effects, but it can be speculated that some of these variables may have negatively affected the results.

Pre/posttest scores compared to norms. It was of interest to examine how mean posttest scores of students in this study compared with what would be expected for students of a similar age. The mean posttest scores in this study on the PLAI and the PPVT-R for a student 4 years 7 months (mean age for students in this study) were, in fact, compared with what would be expected of a student of this age on the PLAI and the PPVT-R (Blank et al., 1978b; Dunn & Dunn, 1981).
Scores are provided on the PLAI according to age and socioeconomic background. Posttest mean scores for the two computer trained groups were the same or higher on the PLAI, but still within standard deviations, than expected scores for students between 4.6-4.11 years from low socioeconomic groups. One exception was the PLAI III score for the software with enhancement condition which was a point higher for students from low socioeconomic groups. PLAI III, reordering

perception, involves activities that require excluding, assuming the role of another or following directions in sequence. In the software with enhancement condition, following directions (e.g. point and verbalize) and excluding (e.g. categorization-exclusion) both by identifying the excluded item and verbalizing the result were emphasized. This may account for some slight increase on this subtest in the software with enhancement condition. Posttest mean scores for the control condition were high but within standard deviations for PLAI II and III, and lower but within the standard deviation for PLAI I and IV. On the PPVT-R, pretest to posttest score increases represent a change from scores classified on the PPVT-R as "moderately low" to scores classified as "low average" for all groups of students. Based on these comparisons, all students generally received scores post-instructionally that would be expected for students of a similar socioeconomic class on all PLAI subtests but one (e.g., the PLAI III was higher for the software with enhancement condition) and on the PPVT-R.

Comparison between studies. Table 13 shows that the mean scores from the PLAI composite pretest scores of this study were nearly identical to the pretest scores in the Lehrer and deBernard (1987) study, yet there was a difference in posttest

Table 13

Means and Standard Deviations on Composite PLAI Score by Group in Two Studies (Max Score =180)

			Current Study		Lehrer/deBernard Study			
Group	n		Pre	Post	Group	n	Pre	Post
Software W/Enhancement	27	M	88.22	101.66	LOGO	12	88.30	122.58
		SD	23.94	26.04			35.52	20.92
Software Alone	22	M	83.00	101.72	Instructional Software	13	86.00	113.77
		SD	21.63	23.88			32.84	28.84
Classroom Environment	29	M	85.93	96.75	Control		82.76	104.76
		SD	26.06	25.47		13	43.07	42.35

scores. Posttest scores were considerably higher for all groups in the Lehrer and deBernard study. As noted earlier, there were differences in the two studies. For example, in the Lehrer and deBernard (1987) study, the students (M = 3 yrs. 11 months) were special-needs children who attended a suburban special education preschool. Most of the students, 67% were described as speech or language impaired. The students, randomly assigned to treatments based on a composite score that included the PLAI, PPVT-R, and a general cognitive index (McCarthy Scales of Children's Abilities), were instructed in each condition for 12.5 weeks, three times each week for approximately 25 minutes each session. In contrast to this, students in this study (M = 4 yrs 7 months) were Head Start students. Fifteen out of the 78 students (19%) were receiving services for speech and/or language. The Head Start students, randomly assigned to treatments based on a summed score from the PLAI and the PPVT-R only, received instruction for 12 weeks, two times a week for 20 minutes each session. Additionally, Lehrer and deBernard (1987) used two different software conditions, a LOGO group and an instructional software group, compared to this study which used instructional software in both conditions. Neither instructional software condition in this study showed the discourse skill increases that the instructional software condition indicated in the Lehrer and deBernard (1987) study.

The following differences found in the Lehrer and deBernard study (1987) may account for the significant increase found for one of the two computer instruction conditions in their study: (a) greater intensity of instruction (3 x a week) and additional speech services given students, most of which were identified as speech or language impaired, (b) services delivered in a special education preschool setting with teachers specially qualified to provide instruction to special needs students. Although there was a noticeable difference in the mean age of the students in the two studies, there is no apparent reason why younger children found in the Lehrer and deBernard study would show more improvement. Additionally, the use of a cognitive index along with two language measures to form a composite score for students before randomly assigning them to treatment groups should not have influenced the results.

Secondary Analysis Related To Treatment

Students in/out of the program. Since there was a decrease of fifteen students from the program, the mean scores of those students who had dropped out of the program from all three groups was a concern. At issue is whether attrition was comparable across the three treatments. Mean pretest scores were computed for those students who dropped out of the program. However, results showed the scores overall of those students who dropped out were lower. This does not appear to account for the lack of significant results in this study. There was a significant effect on the PLAI IV score between the students, but the students who stayed in rather than those who dropped out had the higher mean scores.

At the beginning of the program, students within each Head Start class were assigned at random to one of the three treatment conditions. There were 42 boys and 51 girls. With a decrease of students from the program, the distribution of boys and girls within each of the treatment conditions was questioned. In fact, Table 14 shows there were more girls than boys in the software alone group even before instruction which was exacerbated with the attrition of students. This could potentially be a concern, since young boys generally lag behind girls in language development. However, a computation of mean scores of boys and girl post-instructionally by treatment group did not indicate substantive differences which might have favored one treatment group over the others.

Students receiving speech. Another area of interest was the students in this study who were also receiving speech services (n=15). The relationship between students receiving speech and treatment effects was addressed. Mean scores computed for those students receiving speech services on all

Table 14

Number of Boys and Girls by Treatment Group

	Pretest		Posttest	
Group	Boys	Girls	Boys	Girls
Software with Enhancement	16	16	15	12
Software Alone	10	18	7	15
Classroom Environment	16	17	15	14
	42	51 (N=93)	37	41 (N=78)

pretests were found to be lower compared with the pretest mean scores of the students not receiving speech services. No differences were noticeable by treatment group. Computer training, however, improved the PLAI I score of the students who were receiving speech services and computer training compared to the students who were only receiving speech services. This may have been due to the demands of the PLAI I subtest. On this level, the level of matching perception, students are asked to identify and to find items. With combined instruction from computer training and speech services, students may have been receiving more practice on this level. Conversely, the students receiving speech services showed less improvement on PLAI II, III, and IV, even with additional instruction from the computer and speech services. It is speculated that the students receiving speech services may not have been ready to take advantage of the other levels of discourse skill instruction. Results showed that improvement was the same for students in all three groups on the PPVT-R. It is possible that the PPVT-R was not an adequate indicator of improvement in vocabulary for students in either computer-aided instruction conditions.

To determine if the students receiving speech services affected treatment results, these students were removed from the analysis and a 3 X 2 factorial analysis (ANOVA) was computed on the four PLAI and PPVT-R scores. No significant main effect for group, nor an interaction effect was found. A significant main effect was found for time. The presence or absences of the speech students in the analysis did not appear to change the results.

Student absences relative to computer training. When intercorrelations were computed between number of absences and gain scores on the pre-posttest scores, no significant correlation was noted. Number of absences did not significantly correlate with gain scores on language assessment measures. One possible explanation is that the clinicians were able to make up, even with brief instruction, activities that were missed due to absences. Since each activity took approximately 10 minutes to complete, clinicians could address other activities that were missed during the rest of the 10 minute period. As a result, the high absentee rate did not significantly correlate with lack of improvement. Though most students were exposed to the software activities specified for this research, making up missed lessons precluded depth of instruction.

Computer training relative to high/low functioning students. A comparison of high functioning and low functioning students found a significant effect of computer training on the PLAI I score for low functioning students in both computer conditions. This indicates that computer training may be particularly effective for low functioning students on the discourse level of matching perception (e.g., "What is this?; "Find me a _____."). Though no significant effects were found, mean gain score increases were noticeably higher for both computer training groups for the high functioning students on the discourse level reasoning about perception (e.g., " What will happen if......?"). This indicates that computer training may be particularly effective for higher functioning students on this higher discourse level. This analysis was based simply on a comparison of high and low functioning student scores with student scores in the middle ranges arbitrarily split in two. For this reason, some caution should be exercised in interpreting the results.

Analysis of Language Sample Dimensions. Increases in mean gain scores for MLU, TTR, UBL, and TI in the software with enhancement condition may be an indicator of the greater instructional expectations for this condition (e.g., verbalization of responses along with a pointing response). A decrease in TR score found in the software with enhancement condition was also a positive sign. This indicated that students were initiating conversation and not simply responding to comments by the clinicians during the taping of the language samples. These findings, however, are based on very small sample sizes and must be interpreted accordingly.

It was of interest to compare the spontaneous language post-instructionally from the language sample analyses with language norms for language of students of a similar age. For example, a student 3 years 8 months to 4 years 9 months should have a MLU of 4.50- 6.00 (Bennett, 1986). Four years nine months is two months higher than the mean age for students in this study. The highest mean MLU post-instructionally (e.g., MLU of students in the software with enhancement condition) for students in this study was 4.46, closer to the MLU norm for students age 3 years 8 months. MLU's showed a slight decrease for students in the software alone and classroom environment condition, while an increase was noted for the students in the software with enhancement condition. This again lends encouragement to CAI+ used in the software with enhancement condition.

The TTR for 4.5 years should be 0.47, and 0.46 for 5.0 years (Templin, 1957). Type token ratio appeared appropriate for all groups. The greatest increase for TTR from pretest to posttest TTR score was in the software alone condition. Some increase was noted in the software with enhancement condition. A decrease in score for the classroom environment condition was found.

The upper bound length for an MLU of 4.00 should be 13

(Brown, 1973). The software alone and classroom environment condition did not meet this length. The software with enhancement condition surpassed this length (N=20).

Turntaking-initiating and turntaking-responding appeared to be within the norm for the two computer training conditions compared to a child 4 years 3 months (e.g., initiating moves approx. 25% of the utterances; responding moves approximately 68% of the utterances) (Stickler, 1987). In the control group, the students were below the norm for turntaking-initiating and turntaking-responding.

Qualitative Analysis of Anecdotal Records

Software/hardware. During the computer training, clinicians recorded comments about the software, Words & Concept Series. Many difficulties that were encountered with the software (e.g., student confusion with picture; delayed pointing response) could be dealt with immediately because the clinicians were present and working with the students. However, problems such as not being able to suspend the program to provide more time for instruction are problems that need the manufacturer's attention. Positive comments about the software centered around the reinforcers. All clinicians reported student enjoyment of the reinforcers in all the software programs. Specifically, this referred to the different animated characters that provided reinforcement when student responses were correct. Both Harn's (1986) study and that of Calvert et al. (1989) indicate software with action was positively related to progress with young children. Student interest in the reinforcer characters, bear out the control advantages of using computer software to motivate students as indicated in the Shrieburg et al. (1986) study.

Comments from the anecdotal records suggest modifications to Words & Concepts Series to make it more useful for improving discourse skills. These suggestions are the following: (a) to provide better security for the software to prevent loss, (b) to field test some vocabulary items with young children for picture confusion, (c) to indicate to the user with older model computers the possibility of some word confusion, and (d) to allow a delayed response to be correct rather than judged as an error.

There are also recommendations for the design of software; software with similar objectives to Words & Concepts Series. For example, a software program with the capability of pausing and temporarily freezing the picture is important for CAI+. Clinicians often need to reinstruct students on directions, to repeat instruction given by the software, to elaborate on instruction, and to allow more time for student input. This is extremely difficult without this capability, but essential for improving instruction. Also the addition of action with the vocabulary words would clarify unfamiliar words (e.g. place cup on saucer, hit golf ball with golf club), spur language (Harn, 1986; Calvert,1989), and provide more to stimulate conversation. A newly designed, Words & Concepts Series, should include: category descriptions for categories; the names of the objects in word association activity (e.g., replace object names for "Which one goes with this one" and "These two go together); and the necessity of pointing to each picture in word association).

Although this was not a primary objective, anecdotal records also provided information about hardware components, the speech synthesizer and the Touch Window, used in this research. For example, unclear speech from the speech synthesizer was sometimes reported. The presence of the clinician, however, dissipated the impact of this problem, and, as noted, Words & Concepts Series used on newer Apple computers has improved word clarity. The Touch Window appeared to cause more difficulties, because students had to learn the correct procedure in using this alternative input device. Problems with the Touch Window's frequent detachment is another issue, but one the manufacturer will need to address. The need for an improved design, possibly a wrap around design, with buttons that can be hidden to remove student distraction is one suggestion.

Training procedures. Clinicians also recorded comments about the training procedures used with the students. They indicated problems that were instruction and software related. There may be some explanation for some of the problems observed. For example, problems related to the activity, word association. Students in the software with enhancement group wanted to say "These two go together" rather than naming the objects that go together. The computer's voice response to a correct answer, however, is to say, "These two go together" and this might have provided some confusion for the students. Additional problems with the activity, word association, occurred because students were required in both computer conditions to point to two pictures to encourage a visual/motor link. The software program, however, does not require this and this could easily be perceived by some students.

Some of the software related problems enumerated difficulties students had with specific language skills in some of the software activities (e.g. categorization-exclusion; word identification by function; word association). This was to be expected, however, since these activities were particularly challenging to students. Besides noting problems, clinicians also provided information that suggest ways of encouraging verbalization and participation, and stimulating correct sound production when students are verbalizing responses.

Observations about student improvements appeared in the anecdotal records approximately one month after the training began. This information suggests that individuals working with 4-5-year olds using CAI+ should reasonably expect students to improve in their ability to follow the training instructions and verbalize their responses after four weeks of training.

It is from comments in the anecdotal records on the topic of training that examples of scaffolding or guided participation (Wood et al, 1976; Greenfield, 1984; and Rogoff,1984) in the software with enhancement (CAI+) condition are found. An important concept in the scaffolding process is that the task remain constant and not merely be simplified (Greenfield, 1984). This principle is exemplified in the instructional guidelines for the software with enhancement condition. For example, students were expected to verbalize their responses in this condition. Though some students were reticent and some found the task difficult, all students were continually encouraged as specified in the instructions to verbalize their responses.

One aim of the scaffolding process is to enable the learner to achieve a goal beyond simply modeling and imitating. Eventually, students are to achieve task competence not just task completion (Wood et al.,1976). In this study, the task for the software with enhancement condition was a verbalized response. Students, in the software with enhancement condition, were provided verbal models. However, verbal expression, using the vocabulary words and concepts in the students own words and generalizing the words and concepts learned was the ultimate goal for the students.

Using the Wood et al. (1976) framework which describe the functions of the tutor, examples of scaffolding as used in this study follow:

1. Recruitment. The first task of the tutor is to get the students interest and adherence to the task requirements. This task was simplified by the novelty attraction of the computer, the positive aspects of the software (e.g. reinforcer characters that provided action, color graphics), and the ease in responding with the Touch Window. Even with this, student attention was variable. When student interest waned, clinicians were able to revive their interest by playing up the game aspects of the task (e.g., encouraging students to get points to win the game).

2. Reduction in degrees of freedom. The learner does what he can do and the tutor fills in so that the task can be completed. Examples of this occurred in the software with

enhancement condition when clinicians provided a starter phrase (e.g., " you [sit in a____]") giving students the first word of a sentence as a reminder of the task or as many words as necessary to help them accomplish the task.

3. Direction maintenance. The tutor keeps the learner in pursuit of the objective. When students did not want to say words when pointing, clinicians reported they said, "What did you say," or " Name the picture" to direct students toward the objective.

4. Marking critical features. The tutor provides discrepancy between what the student did and what is correct. One example of this is when a clinician verbalized the incorrect choice of the child to encourage the child to think about his choice and subsequently correct his error.

5. Frustration control. The tutor reduces task frustration. Clinicians gave lots of prompts to encourage the children to verbalize a complete phrase. Clinicians also helped students point to the pictures, and whispered words to them if they couldn't remember the picture names to dissipate frustration.

6. Demonstration. The tutor demonstrates or models solutions to a task. The clinician instructions for both computer groups included modeling of the pointing response. In addition, clinicians modeled examples of verbal responses in

the software with enhancement condition.

Recruitment and demonstration were present in both computer-aided treatment groups. However, reduction in degrees of freedom, direction maintenance, marking critical features, and frustration control were concepts that directly involve the software with enhancement condition.

The term CAI+ is a new term delineated in this research. To fully understand this term, it is necessary to see how it fits into current information about CAI use in language therapy. Cochran (1987) describes two separate ways of looking at computer-assisted instruction. In the first example, the computer is used as the instructor in a 2-way model of interaction: client and computer. In the role of instructor the computer can provide information, questions, and answers for the user. This generally involves the child working alone with the computer with computer applications of a tutorial or drill-and-practice nature (Cochran & Bull, 1985). In the second example, the computer is used as a context for therapy in a 3-way model of interaction: client, computer, and clinician (Cochran, 1987). In this 3-way communication model, the computer is used for the basis of an interactive speech or language activity (Cochran & Bull, 1985).

This research suggests another concept, CAI+. It is an approach which fits between computer as instructor and computer as a context for therapy. In CAI+, there is a 3-way model of interaction between child, computer, and clinician (adult) where the computer is used as a tool. This coincides with the computer as a context for therapy model. The clinician, however, in the CAI+ model provides a scaffold for instruction as defined by Wood et al.(1976). Coinciding with the computer as instructor model, the CAI+ task is more structured. It is contended that CAI+ shares some components from each of the other models described, yet retains its own identity and theoretical base as described in this research.

CAI+ was the condition, software with enhancement, described in this research. The software alone condition was more aligned with the traditional use of CAI with the computer as instructor. Each model (computer as instructor, CAI+, computer as context for therapy) may be a valid choice depending on particular communication objectives that may be required. When the emphasis is on interaction, generalization, and extension of learning beyond modeling and imitating with a structured task, CAI+ may be an appropriate choice. Software programs that are structured, but still allow flexibility for interaction need to be developed to fit this computer-assisted model.

Student speech/language. From samples of student language in the anecdotal records, differences in content of verbalization were observed between the students in the two computer-aided treatment groups. For example, the software with enhancement group talked more about the instructional vocabulary than the software alone group which talked more about aspects of the game. It is suggested that given more time in treatment, this distinction might have produced differences between the computer-aided groups with the software with enhancement group showing greater increases in discourse skills.

Selected samples of student sentences indicated the sentence types used (simple sentences, questions, negatives, imperatives, and more complex grammatical constructions) were typical of 5-year-old students. Complex grammatical constructions expected of this aged child generally include passive sentences (Tager-Flushberg, 1989), however, and passives were not present in these samples. This might have been due to the nature of the task and the subsequent interaction. Children during computer-assisted training were generally speaking in the first person or directing their comments to the clinicians. The types of sentences present, nevertheless, do suggest that tape recording sessions of computer treatment may provide adequate samples of speech for language sample analysis.

Miscellaneous. A category on the anecdotal records was reserved for miscellaneous clinician comments. These comments centered on problems with student behavior and how these problems were resolved. The type of problems noted are to be expected when working with young children and serve as examples of additional considerations that must be accounted for in instructing young children.

Qualitative Analysis of User Response Survey

Clinician comments in the anecdotal records were ongoing during the three months of computer training. In order to provide an overview of their observations, clinicians were asked to complete a survey concerning the software/hardware, the training procedures, and the computer training program. Overall, clinician comments about the software (Words & Concepts Series) and the hardware (Touch Window and speech synthesizer) used for computer training with the Head Start students were very positive. Their comments, however, provide information to base suggestions to those intending to use computer programs with 4 and 5-year-olds and to the manufacturers for improving their products.

Generally, the comments were also positive about training procedures. Suggestions for improving the instructional content (e.g. more emphasis on student listening) and reducing time limits on instruction (e.g. 15 rather than 20 minutes) were, nevertheless, were by-products of their observations.

Problems experienced by the clinicians also suggest some training procedures that need to be addressed if instructional methods, as suggested in this research study, are recommended for the non-communication specialist. For example, a tape of interaction procedures and instructions as suggested in the software with enhancement condition would provide a constant and repeatable model for interaction that the non-communication specialist could emulate.

Observational differences between the two computer-aided groups was also addressed under training procedures. The comments were variable from clinician to clinician. Some of the differences expressed (e.g., less attention/more attention; easily bored/more interested) may be a function of the particular student groups assigned to the clinicians, the difference in clinicians, or the difference in the rapport between the students and clinicians. Further study would be needed to verify this assumption. Some of the other differences, however, may be real. For example, it is possible that the students in the software with enhancement condition were not as attentive to the computer voice as the software alone group. Some students might have become too dependent on the clinician. Care would have to be taken by the clinicians that this did not happen. It is also possible that the software, Words & Concepts Series, would be more effective in the software with enhancement condition without the voice. However, use of the speech synthesizer is preferable if non-communication specialists are providing the training since instructional components (e.g., specific questions addressed in activities) are held constant. One clinician on the user response survey noted differences in the computer-aided groups relative to the topics students discussed (e.g., software with enhancement discussed more program related topics versus software alone which discussed more non-program related topics). This was corroborated in the coded samples of student's spontaneous language in the anecdotal records. The samples showed that language content of the software with enhancement group was more instruction related than the language content of the software alone group.

Though the primary purpose of this research was to improve discourse skills, clinicians indicated a variety of benefits along with language improvement that computer training in their opinion provided. Clinicians suggested that the computer-aided training provided task focusing. This was similarly suggested by Lasky (1984) when he spoke of CAI increasing engaged time-on-task, and Ziajka (1986) in his discussion of an increase in attention span as a value in using computers. Not addressed in the literature, but an advantage that bears scrutiny is an improvement in interaction skills mentioned by the clinicians. Turntaking and communication between students during training may provide greater increases in interaction skills.

Conclusions

This was a study whose primary purpose was to determine whether commercially available software, modified with enhanced dialogue from instructors, could improve discourse skills in Head Start students over improvements obtained without enhanced instructor dialogue, and over improvements of ordinary classroom instruction. Significant differences in discourse skill improvement were not found between any of the three treatment groups. Statistically significant findings were: (a) a significant effect of time from pretest to postest across all three treatment conditions, and (b) a significant effect for level of functioning on the PLAI I, the first subtest of the Preschool Language Assessment Instrument.

Although the primary purpose of this research was not demonstrated, this study provided information which was not previously available and from which recommendations for clinical practice with 4 to 5-year-olds can be made. Clinical implications are the following:

1. CAI, using the software Words & Concepts Series, can improve discourse skills in 4 to 5-year-old Head Start

students, particularly the discourse skills matching perception and reasoning about perception.

2. CAI, using the software Words & Concepts Series, can improve the discourse skill, matching perception, with students who are receiving speech and language therapy.

3. CAI, using the software Words & Concepts Series, can significantly improve matching perception in low functioning students, and can improve reasoning about perception in high functioning students.

4. CAI+ can improve expressive language (e.g., MLU, UBL) and some pragmatic skills (e.g., TI), and may be a more appropriate choice for encouraging student cooperation, fewer discipline problems, and instruction-oriented spontaneous language.

5. CAI can be effective with two students in a group when short but more frequent sessions (e.g., 3x a week for 15 minutes) are used, and when an adult is present for interaction and instruction.

6. CAI with two students in a group can potentially provide an appropriate setting for language sample analysis.

7. CAI+ can potentially be used in the consultative model of service delivery in Head Start settings.

8. Newly designed structured software, which allows for flexibility of instruction, is needed to improve discourse

skills.

9. A theoretical framework for CAI+ is viable.

In any future attempts which use similar computer conditions, a longitudinal study is recommended. This can provide a training period with longer and more consistent thorough instruction.

Findings from this research also provide suggestions for related studies. For example, the use of the CAI environment as a context for language sample analysis bears scrutiny. Another study that warrants investigation is one in which a speech-language pathologist implements Words & Concepts Series in the software with enhancement condition using the consultative model of service delivery. The use of computers in the consultative model of service delivery has already been addressed in the literature (Schetz, 1989; Fitch, 1991). This should include CAI+ instruction in classrooms with supplementary hands-on classroom activities and teacher/teacher assistants as instructors. Finally, it is suggested that future sessions which use software with instructor enhancement should be video taped. Evidence for scaffolding in CAI+ can be further investigated through coded video taped samples of instructor/student language during computer training.

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APPENDIX A

TAP

Total Action Against Poverty in Roanoke Valley, 702 Shenandoah Avenue, N. W., P. O. Box 2868, Roanoke, Virginia 24001-2868

March 13, 1990

Ms. Katherine F. Schetz
607 - Rainbox Ridge
Blacksburg, Virginia 24060

Dear Mrs. Schetz:

After reviewing your proposal, I feel sure that the proposed speech/language program designed for pre-school children will greatly enhance our children's language skills. Our coordinators were quite enthusiastic about your proposal.

We would like to seek funds to purchase computers to continue implementing this program in our centers. Your offer to give our program the software will be greatly appreciated. It would also be of interest to our program to have a copy of any findings conclusive to your research.

Thank you very much for your presentation on Thursday, February 22nd and I am granting approval for TAP Head Start to be used in your study.

Best wishes in all your endeavors toward your doctoral program. We look forward to hearing from you and we are very pleased that you selected our program.

Sincerely yours,

(Mrs.) Cleo C. Sims
Head Start Director

CCS:pms

APPENDIX B

TAP
Total Action Against Poverty in Roanoke Valley — P. O. Box 2868, Roanoke, Virginia 24001-2868

December 13, 1990

Dear Parents,

Head Start has agreed to work with Virginia Tech to determine if computer software can be used to improve language. Participation in this project will give your child hands-on experience working with the computer, plus vocabulary, speech and language enhancement.

In order for your child to benefit from what we believe will be a very beneficial program, we must have the permission form at the bottom of this letter signed and returned to the center **tomorrow.**

Thanks for your cooperation.

Sincerely,

Carolyn D. Hooper
Education Coordinator

CDH/nl

\- -

I understand that my child's center has been chosen for this project which will be conducted between January and May of 1991. I grant permission for my child, ______________________________, to participate and to be tested before and after the project.

____
Parent/Guardian Signature

____
Date

APPENDIX C

VIRGINIA TECH

Division of Administrative
and Educational Services

University City Office Building
Blacksburg, Virginia 24061-0302

November 29, 1989

Ms. Katherine F. Schetz
607 Rainbow Ridge
Blacksburg, VA 24060

Dear Ms. Schetz:

Your data collection instruments have been reviewed and found to be in compliance with human subjects requirements.

Sincerely,

Jim C. Fortune
Chair, Human Subjects Committee
for AES Division

Appendix D

Timetable

Month	Objective	Implementers
Pre-Program Phase		
10/90	Define procedures and check with cooperating agencies	Researcher
10/90	Train Clinicians in test and implementation procedures	Researcher
11/90	Test Head Start students and score tests	Clinicians
	Supervise Clinicians	Researcher
	Analyze scores and identify treatment and control groups	Researcher
Program Phase		
02/91	Computer-aided language enrichment	Clinicians
	Supervise Clinicians	Researcher
03/91	Computer-aided language enrichment	Clinicians
	Supervise Clinicians	Researcher
04/91	Computer-aided language enrichment	Clinicians
	Supervise Clinicians	Researcher
05/91	Retest Head Start students and score tests	Researcher
	Supervise Clinicians	Researcher
Evaluation Phase		
05/91-06/91	Analysis	Researcher
07/91	Report of results	Researcher

Appendix E

RESEARCH PROJECT CONTRACT

I______________________________agree to participate in a research project supervised by Katherine Schetz. My responsibilities will be the following:

- to test students (approximately 20) before and after training and score the tests

- to complete three language samples for three Head Start students before and after training

- to use computer software with the Head Start students, two mornings a week for 12 weeks (approximately between 9:00-11:00), to record each session, to keep attendance and anecdotal records

- to attend brief weekly follow-up meetings at the end of each week of training

At the completion of the research project, I will receive a $450.00 stipend for my participation as agreed in the above listed responsibilities. Full attendance, unless otherwise excused, will be expected to receive full payment.

I understand that I will receive clinic clock hours for all work with the Head Start students. In addition, my campus clinic load will be reduced for COSD 445 or COSD 541.

______________________________ ________
Student Researcher Date

____
Research Supervisor

____
Department Head
Communication Sciences and Disorders

Appendix F

Training Instructions: Computer Software Words & Concepts Series

Software With Enhancement (CAI+) / Software Alone (CAI)

VOCABULARY [Set 1, Set 2]

Software With Enhancement (CAI+)	Software Alone (CAI)
We're going to play games with the computer. The computer will show you some pictures and tell you to find one of the pictures. Use one of your fingers (Hold up one finger)to find the picture. **Say the name of the picture when you point to it.*** Watch how I do it. (Press spacebar and demonstrate for one turn.) Now it's your turn. (Designate which student will have the first and second turn continuing to have them take turns throughout all software activities. In the event that one student is absent, the clinician will take turns with the student.)	We're going to play games with the computer. The computer will show you some pictures and tell you to find one of the pictures. Watch how I do it. (Press spacebar and demonstrate for one turn.) Now it's your turn. (Designate which student will have the first and second turn continuing to have them take turns throughout all software activities. In the event that one student is absent, the clinician will take turns with the student.

CATEGORIZATION [Inclusion With Review, Exclusion]

Inclusion With Review

Software With Enhancement (CAI+)	Software Alone (CAI)
The computer's going to show more pictures and wants you to point to one of the pictures **and say the name of the picture.*** Listen first and then you can take a turn. (Press spacebar). [computer gives list of items in a category. Following this, the computer will say, Which one is (clothing), (food), (a utensil), (furniture) etc., depending on the category.] **[Before the student makes a choice say,**	The computer's going to show more pictures and wants you to point to one of the pictures. Listen first and then you can take a turn. (Press spacebar).[computer gives lists of items in a category] (Designate turns)

*Clinicians were instructed to encourage students to use more than one word on these activities once they became familiar with the activities (e.g. More than one word required for Words & Concepts II and III).

Appendix F (con't)

[Categories for W & C I]

" Clothing is something you wear to cover your body.",

" Food is something that you eat",

" Furniture is something moveable that you use in your house like a table, or a bed",

" A utensil is an object that is useful or necessary in doing or making something."

[Additional Categories for W & C II]

" A body part is a part of a persons body like an ear or a foot."

" An animal is a living thing that is not a plant."

[Additional Categories for W & C III]

" A vehicle is something that carries people or things from one place to another like a car or a bus."

" Sports equipment is something you use when you play a game like a bat that you need to play baseball."

" Cleaning items are things you use when you get rid of dirt like a mop or a broom."

(Designate turns.)

Appendix F (con't)

Exclusion

This time the computer is going to ask,"Which one is <u>not</u> food?", "Which one is <u>not</u> clothing?," "Which one is <u>not</u> furniture?", "Which one is <u>not</u> a utensil?". Use your finger to find the picture. **Say the name of the picture when you point to it.** (Designate turns and press the spacebar.)

Use your finger to find the picture. (Designate turns and press the spacebar).

WORD IDENTIFICATION BY FUNCTION (No Options)

The computer is going to tell you what the objects do so you can find the right picture. Use your finger to find the picture **and name**

the pictures when you point to them. Listen to how I do it. (Press the spacebar and demonstrate for one turn giving a complete sentence, e.g. "you ___with a ___.") Now it's your turn. (Designate turns).**(If student gets wrong answer, ask, " Do you ______ from a (with a) _____ ?" going through other choices so they can reason out the answer.)**

Use your finger to find the picture. (Press the spacebar and demonstrate for one turn). Now it's your turn. (Designate turns).

WORD ASSOCIATION (No Options)

This time the computer is going to talk about objects that go together. Point with your finger and tell me what objects go together.

Listen to how I do it. (Press the spacebar and demonstrate for one turn, "A____goes with a _____.") Now its your turn. (Designate turns.)

Use your finger to find the picture. (Press the spacebar and demonstrate for one turn). Now it's your turn. (Designate turns).

Appendix F (con't)

CONCEPT-SAME/ALIKE (Three Picture Word Matching)

This time the computer wants you to find which two objects are the same. Tell me the pictures that are the same before you point to them. Watch and listen to the way I do it. (Press the spacebar and demonstrate for one turn, "The ______ are the same." Now it's your turn. (Designate turns.) (If necessary prompt students when they don't know the name of the objects. Once students learn the task, ask them, " Why are the ____ the same." Model correct responses if necessary using complete sentences; e.g. The ____ are both for ____.(functions of objects); The ___ are _____.(category), in order to encourage them to do the same in their responses. Help them to guess the answer.)	Use your finger to find the pictures. (Press the spacebar and demonstrate for one turn). Now it's your turn. (Designate turns).

CONCEPT-DIFFERENT (Three Picture Word Differences)

This time the computer wants you to find which object is different. Tell me the picture that is different before you point to it. Watch and listen to the way I do it. (Press the spacebar and demonstrate for one turn, "The ____ is different." Now it's your turn. (Designate turns). (If necessary prompt students when they don't know the name of the object. Once students learn the task, ask them,"How are the ____ different." Model correct responses if necessary using complete sentences; e.g. The ______ is not _________),in order to encourage them to do the same in their responses. Help them to guess the answer.)	Use your finger to find the picture. (Press the spacebar and demonstrate for one turn). Now it's your turn. (Designate turns).

Appendix F (con't)

<u>General Instructions</u>

Before students arrive: Boot the disk, choose # 2 to train, choose activity (Activities Menu), choose option for activity (Option Menu), choose how you want the lesson presented (Parameters Menu- chose 2,Interface and press till Touch Window (TW) appears, choose # 1 to Run. Stop when the computer prompt "Press spacebar or controller button" appears.	Same as CAI+
Take a turn whenever necessary to demonstrate correct pointing response.	Same as CAI+
Assist any student who is having difficulty getting correct answers by helping the student point to the correct answer if necessary.	Same as CAI+
One activity will be scheduled each session. If a scheduled activity is completed before the allotted time is up, this activity can be repeated or a previous activity which a child may have missed can be used.	Same as CAI+
If appropriate, repeat questions asked by the computer before guiding students to respond.	Do not ask any additional questions or provide any additional information unless a student specifically requests information. It is permissible, however, to repeat the word/ questions asked by the computer, and to provide whatever encouragement or instructions are needed for student attention and response.

Appendix F (con't)

Take a turn whenever necessary to remind students to name the picture and/or model the correct verbal response to encourage them to respond verbally as well as point.	Guide the students in making correct finger responses if necessary to teach them how to respond and to encourage their participation. If one or both students has particular difficulty, give extra assistance (guiding their finger to the correct response) so the program will continue advancing. MAKE THIS FUN AND SUCCESSFUL FOR THE CHILDREN.
If student gets wrong answer and it is appropriate, ask "What happened?" and "Why" or "What happened?," "Is that a _____" giving them their answer so they can check their response.	

<u>General Operating Instructions</u>

Boot the diskette, The Title Page will appear. Seclect 1 for Training.	Same as CAI+
To return to the Parameters Menu from within the program, press <CTRL>O while the program is waiting for you to respond.	Same as CAI+
To stop the program, type <CTRL>C. The Lesson Summary will appear. It will also appear when the program ends. Type "N" and it will return to the Title Page.	Same as CAI+
If the program "hangs", reboot the system. Press control, open apple, reset all at the same time.	Same as CAI+

APPENDIX G

ATTENDANCE RECORD/RECORD OF TRAINING

WORDS & CONCEPTS SERIES

Name: ____________________

Date	Vocabulary Set1	Set2	Categorization 1	3	Word Id By Fun	Word Ass	Concepts S	D

Name: ____________________

Date	Vocabulary Set1	Set 2	Categorization 1	3	Word Id By Fun	Word Ass	Concepts S	D

Appendix H

Anecdotal Records

Instructions: Record any appropriate information pertaining to the software/hardware, training procedures, student speech/language (e.g. Additional speech/language used other than responses to the computer), miscellaneous below. Note. Use one record sheet each week of training.

Software/Hardware		Training Procedures
	*	
	*	
	*	
	*	
	*	
	*	
	*	
	*	

Student Speech/Language		Miscellaneous
	*	
	*	
	*	
	*	
	*	
	*	
	*	
	*	

Note. Use this form for recording information from training sessions (2 children in each session) over a two session

Appendix I

Language Dimensions in the 4 to 5 year-old

Syntax/Morphology

- Mean length of response (MLR) calculated by dividing total number of words by total number of utterances in a child's speech sample (Lucas, 1980) should be 5.4 to 5.7 (Templin, 1957)
- Mean length of utterance (MLU) calculated by dividing the total number of morphemes by the total number of utterances (n=100) in a child's speech sample (Brown, 1973) should be 4.50+ for 47+ months (Miller & Chapman, 1981) or 4.50-6.00 for 46.6-58.8 months (Bennett, 1986). Upper bound Length for an MLU of 4.00 should be 13 (Brown, 1973).
- Children beginning school (5 year-olds) use simple sentences, questions, negatives, and imperatives similar to adults and are beginning to use more complex grammatical constructions such as passives, coordinations, relative clauses (Tager-Flusberg, 1989)

Semantics

- By 3 years, the average child has acquired nearly 1,000 words which are used with consistent meanings that bear a relationship to adult meanings (Dale, 1976)
- Vocabulary growth, which occurs prior to the school years, involves learning what individual words mean and learning how they are interrelated (Pease, Gleason, Pan, 1989)
- Many concepts of position, quality (e.g. same, 3-0 to 3-6 yrs and different, 3-6 to 4-0) and quantity are learned by 5.0 years (cited in Nelson, 1979)
- A type-token ratio, computed by dividing the total number of different words by the total number of words in a language sample, is a means of analyzing vocabulary diversity. The ratio should be 0.45 for 4.0 yrs, 0.47 for 4.5 yrs., and 0.46 for 5.0 yrs. (Templin, 1957)

Pragmatics

- Refinements in pragmatic abilities from 3 to 5 years include the ability to establish a topic and adjust to different audiences, to initiate conversation, respond and maintain 4-6 turns in conversation (4 yrs.), to use social openings/closings, signal interruptions, comprehend and use nonliteral forms (e.g. metaphors, similes) (DLI,1989)
- In Language Samples of 4.3 year olds, conversational move types would include initiating moves (approximately 25%) and responding moves (approximately 68%). False starts make up the difference (Stickler, 1987).

Appendix J

USER RESPONSE SURVEY

1. With your experiences over the last few months, you are in a position to provide important information about the software, touch window, training procedures, and speech and language of the students you instructed. Please give your general comments, positive and negative, about the following:

	Positive	Negative
software		
touch window		
training procedures		
student speech/language		

2. Did the program provide any additional benefits to the students other than speech and/or language?

3. Did you observe any differences between the students in the two different training programs?

4. In your opinion what is an optimal time period for instruction?

5. Do you recommend working with two in a group? Why or why not?

6. Would you change instructions to the students in the group who received additional instructions? If yes, how?

7. Which activities were the most difficult for the students?

8. What changes would you make if you could in the following:

a. software

b. hardware

c. training procedures

9. Overall, do you think the software is a benefit for language enrichment with preschool children?

Table K-1

Summary of Clinician Comments on Software

Software
Positive Comments
Reinforcer
-Children enjoyed reinforcers which prompted conversation (e.g. children talked about what reinforcer was doing; it brought out a lot of questions; children liked to guess which color reinforcer comes up in W & C III)
-Children enjoyed two reinforcers in WA and WIbF
-Children like reinforcer when it jumped up and down, movement spurred on language
Cues
-Children paid attention to cues
Graphics
-Good variation of color on space aliens (e.g. reinforcers in W & C III)

Negative Comments	Comments/Solutions
Problems Internally with Software	
-Text error, e.g. word baseball missing an "l" in W & C	
-Delayed student pointing response marked as wrong response	-If there was a long delay in responding due to Clinician instruction the student was penalized
-Program could not be suspended momentarily	-All C's wanted a pause button to allow more time for instruction

Table K-1 (con't)

-Program graphics not clear (e.g. cheese looks like watermelon: (W & C); leash like snake/ribbon, belt like ring, glove like baseball glove: (W & C II); footstool like colored sheep: (W & C III)	
Problems with Functioning of Software	
-wouldn't designate answer was wrong	
-some pictures didn't appear in blocks and thermometer kept erasing	-Replaced immediately by manufacturer
-at end of game program went into loop	-Reset activity
-software hangs up	-Turn off,wait,reboot
Problems within Software Activities	
-The need to point to two pictures in CS activities sometimes confusing to children	
-Some children tried to point to top picture in word association rather than point to one of the 3 choices at the bottom	
Miscellaneous Problems with Software	
-Computer disks easily slip out of jacket pockets	-C's turned disks sideways which was some help; need pocket with flap to hold software in package

Table K-2

Summary of Clinician Comments on Hardware

Hardware	
Negative Comments	**Comments/Solutions**
Touch Window	
Pressure/Position on Touch Window (TW)	
-Need to press, not lightly touch, for response to record	
-Pointing at side of picture causes selection of wrong picture	
TW not functioning properly	
-Selected answer on opposite side of monitor which was touched	
-Selected answer different from child's choice	
-Picture disappears when touched by child	-C turned off, waited 5 min. and rebooted
Calibration	
-TW didn't calibrate first time or had to be recalibrated several times	-need to sit directly in front of monitor and carefully touch X's to calibrate
TW attachment	
-Children recognize they can pull TW off; TW doesn't stay on; TW is a distraction; children frequently pull at TW and it needs reattaching monitor and TW	-helpful to use masking tape at top and bottom of TW to connect monitor and and TW

Table K-2 (con't)

	Speech Synthesizer
Voice Output Problems	
-Speaker went into loop of sounds, no words	-turn off, reboot
-Words unclear (examples: table like cable, hair like pear (W & C); mouse like blouse (W & C II); pilot like pirate (W & C III)	-Correct word can be provided;improved sound capabilities in newer computers

Table K-3

Summary of Clinician Comments on Training

Problems: Instruction Related

anguage Improvement Instructions

Problem	Solution
Naming*	
Does not want to say word when pointing; needs to be reminded almost every time to say words; would not talk at all; talks about everything but pictures or too much about other things; prefers to show action than to use a word; can only name items when cue is presented or item is known	"What did you say," or "Name the Picture"
Categorization	
Child says category instead of naming picture	
Child makes an incorrect choice	C said, " A ____ is a(an) ____?," inserting their incorrect response to encourage thinking about their choice and verbalizing the correct answer
Children need to explore reasoning behind choice making	Encourage naming of other categories and telling why some category names are not the correct choices before they name the correct choice, e.g. " A ____isn't a(an) _____, a(an) ___ is a _____."

* Refers to any activity where at least a word was required, e.g. Vocabulary or Categorization

Table K-3 (con't)

<u>Word Identification by Function/Word Association</u>	
Can not, does not want, will not, reluctant to say phrases, or sentences (e.g. will only name words);	Example, give starter phrase, "You sit in a ____" in Word Identification by Function activity using only as much of the phrase as necessary to assist student in responding in more than one word In Word Identification by Function, say," isten to the computer, he tells you what to say." After students make their choice and computer voice responds, then say to students, "That's what you say."
Difficulties getting children to say names of both objects in Word Association, e.g., they say "These two go together."	
Difficulties using correct plurals (e.g. says knife and knife); needs encouragement to use plurals and is/are correctly	Say the ____ go together" to model plurals
<u>Concept-Same/Alike</u>	
Difficulty saying" The _____are the same (e.g. might say the polish goes with the polish instead of the polishes are the same) in Concept Same/Alike which also involves difficulties with the correct use of plurals and is/are	C asked, "They are the same because (pause)," or "The_____are the____," to encourage the word same

Table K-3 (con't)

Concept-Different	
Difficulty saying" The _____ are different which also involves difficulties with the correct use of plurals and is/are, or simply did not want to say it; difficulty with concept different (e.g., kept pointing to same pictures)	Say, "Two are the same and one is different; it's by itself, it's different" Put up one finger to emphasize one in "Which one is different" and had students tell which ones were different before pointing Ask "Different from _____," to encourage a different type of response
Child prefers to say not the same rather than different	
Pointing Instructions	
Forgets to remove finger from TW; taping instead of pointing to pictures; need reminding to use one finger; would not touch screen correctly	
Confused about saying picture and pointing at the same time; difficulty doing both tasks	
Started pushing pictures they liked rather than ones that are the same	

Table K-3 (con't)

Used two fingers to point at the same time in Concept-Same/Alike and Concept-Different; need to be reminded to point to two pictures in Word Association and Concept- Same/Alike; need to encourage pointing to one picture at a time or wrong picture choice is recorded in Concept- Same/Alike	
Following Instructions	
Difficulties following directions in Word Identification by Function and Word Association	Say, "Say what I say"
Difficulty with directions in Word Association	"ook for the one down here that goes with this one up here"
Instructions For Turn Taking	
Problems getting children to take turns; child takes partners turn (e.g. takes partners turn when partner not answering fast enough); wants all turns/ wants to dominate; refuse/don't want to take turns; won't take turns even with clinician	
Maintaining Attention	
Twenty minutes may be too long (tired after 12 minutes), 15 minutes may be enough; 20 minutes too long to hold some childrens' attention	
Problems: Software Related	
Difficulties using correct vocabulary word; words difficult in W & C III (e.g. called pail/bucket; polish/fingernail polish; hoop/goal) and saying some categories (e.g.cleaning item; sports equipment; vehicle) and/or used different names for objects (e.g. hands for fingers;legs for foot; collar for belt)	Ask students to think of another words if name was different than computer wanted, e.g. lid vs. top

Table K-3 (con't)

Clothing as a category difficult for child; does not understand body part; problems with categories; difficulties identifying items within cleaning item category; difficulties understanding "not" and selecting correct answer in categoization (option-exclusion)	
Word Identification by Function difficult; concepts in Word Association and Word Identification by Function difficult for child; more difficulties with Word Association than Concept-Same/Alike	
Understood Concept Different better than Concept Same; difficulties with different after same	
Pointed too early before computer gave instruction (e.g." Find the ___"); doesn't listen to request of computer	Need to encourage listening before making choice
Imitates computer and talks to it	
Software great for a child alone, but would not recommend allowing a group to do it unsupervised	

Table K-4

Clinician Comments Reflecting Individual Student and Group Improvement

General Comments

-students said sentences well

-low functioning child spontaneously naming pictures

-with lots of prompting, child said whole phrases the first time

-students did better pointing to pictures

-child took turns; turn taking better; good turn taking, knows how to take turns

Comments Specific to Activities

Vocabulary 1, Vocabulary 2

-child did well on activity
-behavior problem child made it through game with 4 restarts
-group saying complete sentences

Categorization

-words in categories difficult at first, but some at end of activity getting all categories right
-child asks what a picture is if she can't remember in categories activity

Word Association

-child touches both pictures in Word Ass

Word Identification

-child uses complete sentence; another says function

Concept-Same/Alike and Concept-Different

-students doing well choosing correct picture
-students did well on Concept Same and Different
-group uses proper sentence form after examples
-many groups no problem with same
-some children can tell the reason they are the same
-some children no problem with different

Table K-5

<u>Selected Examples of Students Spontaneous Speech</u>

Simple Sentences

One time I seen a firetruck.
It's his turn.
I made him dance.
I love bacon.
We can win.

I have two dogs.
I love rakes.
They break.
It's empty.

It's going up.
I tie my shoe.
Bees live in a hive.
My mommy cooks eggs.
We're going to the circus
My mommy is in the hospital
It stings.
The vase is too little.
They're twins.

Questions

What's your name?
What is his name?
What's behind here?
What did he say?
What was he trying to so to the trap?
Where is the man?
Where's the red guy?
Where's that old cool guy?
Who's turn is it?
Who is talking?
Who gets to play with those toys?
Why doesn't that light up?
Why do we play different games?
How many you got?
Which color will it be?
How come he knows how to play?
How come a ball comes off the top os his head and bounces?
When am I going to get the socks?
When is the purple one coming back up?
Is this all?
Isn't that dangerous?
Is it a great big man in there?
Are we taking turns?
Can you do this?
Can we switch sides?
Can we push these buttons?
Can you turn your head around like him?
Do you like my shirt?
Do you know what birds eat?
Did you see the witch?

Table K-5 (Cont'd.)

Negatives

You not getting your points.

We don't know.
I don't know what it is.
I don't know which one it is.
I don't want to say anything.
We don't say it that way at my house.
I don't like salt because it burns my lips.
I don't eat bacon, but sometimes I eat eggs with cheese.
He doesn't get any turns.
He didn't blow me a big bubble like he did you.

I haven't done that one.
You can't eat a sock.

Imperatives

Push it again.
You need to clean it.
Turn that off so he can stop saying that.
Wait till we get up here.
Point, I already had a turn.
It's your turn now go.
Hey, wake up red guy.

Complex Constructions

He flied but he didn't have his wings out.
I don't like that purple one 'cause he gives me a big bubble.
I got a football that's like that.
He turned into a bubble like the Wizard of Oz.
I don't want to take a turn and you know why because I'm sleepy and I need to take a nap.
You put on a shirt and then you put on a tie.
You weren't paying attention so I took your turn.
I threw the ball ral high when I played on the football field.
I don't like bacon but I do eat eggs.
He did flips and jumped up and down.
When the red light is on we don't touch anything.
My sisters going to be coming to this school and she's going to be doing this.
I'll be glad when we get to the top.
I got lipstick and eyeshadow at home.
Miss Poff bought her hamsters and they're in the office.
If you see two that look the same don't push them.
We're not really touching two pictures we're touching the glass.
I have some gum and you can't have any.

Table K-5 (Cont'd.)

I look like I'm watching TV.
I wish that man would come up here and fall down.
Last time I watched TV there was a girl and when she looked in the mirror it was the wrong face.
My mom has lock but it broke.
My dog ran away and I got a new one.
I'm gonna get the best one and I'm gonna beat you.
I'd like him to be a doll and he could be at my house.
I should have stayed home and went to sleep.

Table K-6

Summary of Miscellaneous Clinician Comments

Problems	Comments/Solutions
Attention/Interest Problems	
Difficulty paying attention; short attention span; gets bored easily	-C holds child on lap to get attention/ cooperation -better attention working alone with clinician
Restless/moving a lot/out of seat	
Distracted/uninterested/not wanting to participate/not cooperative	-liked activity more when C stressed child was winning game; also encouraged excitement about activity
Child rowdy when paired with other child	-liked attention working alone; helped performance
Difficulties staying on task	
Unable to make it through even one activity alone	-able to do fairly well with another child by end of training
Child not as interested when taken out of play time	
Difficulties getting child to attend to voice	
Behavior/Emotional Problems	
Child cries and doesn't want to come; cries throughout session due to home problems	
Child does not want to participate; does not want to come; refuses to participate; non responsive; doesn't want to leave classroom	

Table K-6 (Cont'd.

Child bites window and partner; child bites another	
Child hits; child hits another in face	
Child grabs hand of other child to put on correct answer	
<u>Miscellaneous Comments</u>	
Imitates voice of computer; imitates computer' speech	
Children speak in unison	
Covers ears when it is not child turn so she wouldn't hear voice of computer	
Want to turn up knob on voice synthesizer	
Turns monitor off during instruction	
Child points with elbows;uses hand instead of finger to point; hits screen; won't leave fingers off even with reminding	
Child speaks so softly he can't be heard	- with encouragement child easier to hear at end of training
Child keeps looking behind window	
Child shoots at reinforcement characters	
Child talks to characters; imitates facial expression of character	
Some children want hugs for reinforcement	
Child brought baby doll and wanted doll to make choices	
Child asks every session to use bathroom	

VITA

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Educational Background

Graduation Anticipated December 1991, Ed.D., Administration & Supervision of Special Education, Virginia Polytechnic Institute and State University, Blacksburg, VA

MS, Communication Disorders, 1981, Radford University, Radford, Virginia

MS, Child Development, 1977, Virginia Polytechnic Institute and State University, Blacksburg, VA

BA, Speech and Hearing, 1969, University of Maryland, College Park, MD

Certification

Speech Pathologist License, Commonwealth of Virginia

Collegiate Professional Certificate, Special Education-Speech Disorders, State Department of Education, Richmond, VA

Certificate of Clinical Competence, ASHA, June 1982

Professional Experiences

Adjunct Professor, Department of Communication Sciences and Disorders, Radford University, 1990-91

Reviewer for American Speech-Language-Hearing Association, Fall, 1990

Internship, Administration & Supervision of Special Education, Department of Education, Richmond, VA, Fall, 1990

Speech-Language Pathologist, Montgomery County Schools, Christiansburg, VA, August 1981-1990 (Teacher Incentive Fund grant proposal, "Trial Application of Computer-Aided Speech and Language Therapy," awarded by Montgomery County Schools, January, 1985)

Member of the Advisory Board for Speech and Language, Department of Education, Richmond, VA, two-year term, 1988-89,1989-90

Member of the Advisory Board for Communication Sciences and Disorders, Radford University, 1987-1990

Student Teacher Supervisor, Spring 1983 and 1986

Internship in Speech-Language Pathology, Veterans Administration Medical Center, Salem, VA, Fall 1980

Membership in Professional Organizations

American Speech-Language-Hearing Association (ASHA)

Speech-Language Hearing Association of Virginia (SHAV)

Computer Users in Speech and Hearing (CUSH)

Council of Exceptional Children (CEC)

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