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Effect of Visual Reminder on the TTR and MLU-W of Oral Hearing-Impaired Students During High/Scope Recall Sessions

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THE EFFECT OF VISUAL REMINDER ON THE TTR AND MLU-W OF ORAL HEARING-IMPAIRED STUDENTS DURING HIGH/SCOPE RECALL SESSIONS

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THESIS

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ABSTRACT

Language samples of sixteen oral hearing-impaired students, aged 3.8 to 10.6 years with a mean SRT average of 27dB, were taken during High/Scope recall sessions under two conditions: with visual reminder (a videotape replay of their session work-time) or without visual reminder (no videotape relay of their work-time). These language samples, taken over a three month period, were analyzed with SALT (Systematic Analysis of Language Transcripts) for flexibility (using TTR) and structure (using MLU-W), and for five other SALT analyses. In each of the seven SALT analyses, improvement was shown for both groups with a trend for greater improvement shown in favor of the group with visual reminder.

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Joan Kissel

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER 1

INTRODUCTION

Research in the language development of the hearing-impaired shows a considerable variety in the types of intervention studied. Current approaches have less emphasis on teacher-directed therapy and more emphasis on pragmatic approaches, especially through the use of conversational dialogue (Clark and Clark, 1977; Skarakis and Prutting, 1977; Wood and Howarth, 1979; Kretschmer and Kretschmer, 1979; Clarke, 1983; Prinz, 1985; and Clarke and Stewart, 1986).

In placing emphasis on pragmatic approaches and conversational dialogue, Clark and Stewart (1986) emphasize conversational speech opportunities in real-life experiences. Clarke (1983) takes the position that the hearing-impaired child must see "language within the context of dialogue or communication" (p. 157). Clark and Clark (1977) believe that their research shows that conversations will lead into other types of discourse such as descriptions, explanations, questions, and narratives. They stress the need for the meaningful use of real language by the child. There is, however, an implication that conversational interaction should be kept at a slower rate, that sentences should be kept simple but well formed, that topics should be limited to the here and now, and that

the appropriate use of gestures should be encouraged (Snow and Ferguson, 1977).

Kretschmer and Kretschmer (1979) also stress the importance of dialogue, but add the use of modeling and expansion techniques. Wood and Howarth (1979) discuss child to child communication and the importance of the analysis of conversations. Solomon (1980) discusses the advantages of using videotapes to allow experiences to be relived with language attached to them. A review of the literature, however, indicates that hearing-impaired children continue to display difficulties in academic and life skills with all areas of communication including those of phonology, semantics, syntax, and pragmatics and that these difficulties show up in a paucity of the flexibility of language use no matter the type of remediation used. The following review of the literature, therefore, will focus on research in the areas of speech and language, teaching settings which might facilitate language growth, and diagnostic tools which might be used to measure that language.

Review of the Literature

The Speech and Language of the Hearing-Impaired

The work of the following researchers testifies to the problems of the hearing-impaired in the areas of speech and language. Northern and Downs (1978) describe general problems with spoken as well as written language. Pinter (1918), Reamer (1921),

Mindel and Vernon (1972) describe depressed reading skills averaging at the 5.3 grade level or below for young adults. Mashie (1980), Metz and Whitehead (1980), and McReynolds and Jetzke (1986) discuss problems with phonology in the area of voiced and voiceless consonants. Davis, Schum, Lansing, and Elfenbein (1982) describe problems with vocabulary and the use of grammatical structures. Davis and Blasdell (1975) report problems with the use of relative clauses. Quigley and Kretschmer (1982) indicate that the average young adult hearing-impaired uses syntactic structures below that of the level of the normal ten year-old child. Walter (1978) describes difficulties with function words such as articles and prepositions. Wilbur, Montanelli, and Quigley (1976) indicate morphological and syntactic rule problems and conjoined clause problems. Charrow (1974) describes difficulties with function words and morphological endings, especially verb endings. Power and Quigley (1973) report passive and active voice confusions. Yoshinage (1983) reveals quantity and quality defects in written English composition. Prinz (1985) reveals that hearing-impaired students use fewer words, shorter sentences, and have more grammatical errors than same age or younger normal-hearing subjects. Curtiss, Prutting, and Lowell (1979) report problems with the pragmatics of language, and Skarakis and Prutting (1977) indicate difficulties with semantic functions and pragmatic intent.

While the research on the language competencies of the hearing-impaired indicates many major problems, some solutions to these problems have been found. The use of discourse in developing

various aspects of communication, for instance, has been selectively researched by Marschark and West (l985), who studied the creative language abilities of deaf children in their ability to generate stories to experimenter-supplied themes. They found that four twelve to fourteen year old hearing-impaired children, using sign language, had creative constructions in nonliteral communications skills (novel trope, frozen trope, gesture, and pantomine) equal to or better than their hearing age mates (p. 73). The use of grammatical structures has been studied by Clarke and Rogers (l981) who measured the syntactic abilities of eight- to nineteen-year old hearing-impaired school-aged students on the Test of Syntactic Abilities. Clarke and Rogers found that the syntactic abilities of hearing-impaired students were significantly related to hearing threshold level, number of multiple handicaps, age, educational setting, method of communication, and hearing aid usage. No significant increases in scores were found after the children reached eleven years of age.

The generative potential of the hearing-impaired has been studied by Watson, Sullivan, Moeller, and Jensen (l982), who investigated the relationship between the nonverbal intelligence and language of twenty-five deaf children between the ages of six and ten. Subtests which required visual memory were found to be the best predictors of language performance. English language performance was found not to increase as a function of age and chronological age and language age were not related.

The application of most appropriate academic mode and setting has been researched by Geers and Moog (1987), who developed the Spoken Language Predictor (SLP) (p. 84). King (1984), in a national survey of language methods used with hearing-impaired students in the United States, reports that the most popular system used in the training programs of the hearing-impaired was the sentence pattern to teach language. Of the training programs King (1984) researched, 86% of the programs used sentence patterns to help students produce grammatical sentences, 71% used sentence patterns to help students analyze grammatical sentences, and 79% used sentence patterns to correct ungrammatical sentences. Gaines, Mandler, and Bryant (1981) looked at the comprehension and retention of stories which students had read, the comprehension and recall of sequences of activities, facts, amount of information recalled, etc. which had been experienced through the written mode. Ausberger and Mullica (1983) describe strategies for language teaching including drills, interactive methods, and barrier games designed for language teaching. The Alberta, Canada Department of Education documents such components as auditory training, speechreading, sign language, and speech as components for its preschool program. All of these researchers have contributed aspects which help in understanding the speech and language competencies of the hearing-impaired student.

These communication competencies, however, cannot be looked at from single points of view. They must include those aspects of motivation, interest, creativity, grammatical proficiency,

generative potential, appropriate academic setting, and opportunity that the speech and language of any child would necessitate. Wilbur (1977), for instance, makes a strong statement for the training of the sentence, not for the sake of putting the sentence together correctly, but for its use within its larger pragmatic environment (p. 91). He indicates that the majority of the training for the hearing-impaired up to the present time has been on parts of language rather than on the whole of language. Recent findings from the literature support Wilbur by indicating that emphasis should be on the larger pragmatic communicative contexts through discourse rather than on single grammatical structures (Prinz, 1985, p. 809). DeVilliers (1983) talks about the communication context being important to the understanding and use of syntactic forms and implies that the failure to provide appropriatic pragmatic contexts when testing distorts that assessment of the child's knowledge.

The context of the stimuli, thus, and the effect of these stimuli on the quantity and quality of the communication skills of hearing-impaired students are of social, academic, and language competence interest. Kretschmer and Kretschmer (1978) indicate that while the importance of developing spoken language competence has been a concern of the educators of the hearing-impaired, information concerning the success of various stimuli has not been documented in a systematic manner (p. 114).

The manner of gathering data from a pragmatic context is, therefore, an area of current interest in the speech and language of the hearing-impaired. Up to the present time, the mode of the

majority of the studies on the verbal output or flexibility of the hearing-impaired has been taken from students talking during activities or responding to interview-type questions. Previous studies of this type which have investigated the communication interactions of children have included those such as done by Miller (1978), and McKirdy and Blank (1982). In the Miller (1978) study, which looked at the pragmatic interactions of children based on a theory of pragmatics delineated by Bates (1976), pragmatic communicative interactions were analyzed according to the relative dominance of the speaker, turn-taking, topic maintenance or switching, and communication breakdowns. The language of the students in the study was assessed for number of utterances, mean number of morphemes per utterance, total speaking times, number of turns, number of verbal turns, number of non-verbal turns, number of topic switches, total number of breakdowns, saves, verbal saves, and nonverbal saves. In the McKirdy and Blank (1982) research, the dialogue of pairs of preschool-aged deaf and hearing-impaired students was studied for communication interaction. Communication was viewed in light of speaker-responder and indicated that the deaf children had "difficulties in responding to initiations produced at Level II (Level I: Matching Experience; Level II: Selective Analysis of Experience; Level III: Reordering Experience; and Level IV: Reasoning about Experiences)" (p. 489). Of the 24 hearing-impaired students in this study, only two were from an oral program (p. 489).

In neither of these two studies (Miller, 1978, and McKirdy and Blank, 1982) was there a comparison, however, of a beginning

baseline measurement to a final descriptive study count over a number of sessions. The McKirdy and Blank (1982) study took a language sample from a single fifteen-minute session, and the Miller (1978) study considered the student's communication over a single one-half hour session. Neither study noted changes over several sessions. An opportunity for children to talk about their previous experiences was not an integral part of either the McKirdy and Blank (1982) or the Miller (1978) studies. The language samples were taken during play time but did not include language taken from a recall time of the play period.

An examination of language sampling under different experimental conditions has been done by numerous researchers and can be typified by the research of Stalnaker and Creaghead (1982), who gathered language samples from twelve preschool Head Start children. Among the experimental conditions which Stalnaker and Creaghead used in gathering the language samples were the use of story retelling, the use of toys in conjunction with experimenter asked questions, and conversation elicited from playing with toys. A fourth way to elicit a language sample from dialogue would be through the retelling by the student of experienced activities with and without the use of visual reinforcement such as a videotape of the child in the activity under discussion.

Some research studies concerning the hearing-impaired have looked at children talking about their experiences. Crain (1980) used the student's own pictures of their experiences as a form of stimuli to develop discourse. Solomon (1980) used videotapes of field trips

to allow experiences to be relived. Liss (1981) observed from her research that hearing-impaired students in grades three, six, and nine watch more TV at home than hearing children of all ages. Read (1980) reported research which indicated that the use of media in the classroom is as good as another "aide." Mitchell (1982) suggested that it is a child's interaction with his environment which contributes to linguistic development. The role of the teacher in developing these opportunities has also come under scrutiny. McGehee and Pendergrass (1979) suggested that teachers must be able to function as facilitators, thus allowing the students to interact in the group, be exposed to group processes, and develop their communication skills, thus improving the quantity and quality of their verbal output. To facilitate the pragmatic environment, a classroom setting which is designed to extend and expand the spoken communication skills of hearing-impaired children with a teacher-facilitating model and opportunities for conversational dialogue between the students would be necessary.

The High/Scope Curriculum Classroom

Research suggests a pragmatic setting in which the students talk about their experiences in as real-to-life situations as possible with a teacher-facilitator as being necessary for optimum language growth. The High/Scope Curriculum, based on the developmental view of what children's learning should be as set forth by Jean Piaget, would seem to meet the majority of the requirements for a

teacher-facilitated classroom that has experiential-dialogue opportunities. According to Weikert (1986), "The fundamental premise of the High/Scope Curriculum is that children are active learners who learn best from activities they plan and carry out themselves" (p. 4) (Appendix A). The High/Scope Curriculum follows Piagetian precepts that a series of accumulating experiences over time changes children's thinking about their world and allows them to move from one Piagetian stage to the next. The curriculum is arranged in such a way that the child initiates his own learning acitvities (Weikart, p. 15). The High/Scope Curriculum classroom is also based on the following precepts as set forth by Weikert (1986), its founder:

(1) Teachers must understand how children mentally construct the world and how these mental constructs change in the course of children's development.

(2) Teaching must build upon, not direct or control, the thoughts and actions of children.

(3) Children must have daily opportunities to decide what they want to do.

(4) The child's daily plan must provide the starting point for teaching.

(5) Certain key experiences are essential to children's early intellectual growth (Weikart, 1986, p. 4-5).

These precepts embody certain guidelines which include a consistent daily routine and, among other things, a plan-do-review sequence. The teacher and the child plan the work-time 'do' activities. Then the

child carries out the activities with the child being responsible for executing his plan.

The child is engaged in activities of his own choosing and interest. The teacher's role is to observe, encourage, extend, and set up problem-solving situations. The recall time gives children the opportunity to review their work-time activities in a number of ways. These ways might include talking about the children they worked with, telling of problems they had, how they completed their projects, the sequence of their activities, and what they liked or did not like about what they did. The children express their ideas using the language of the activities with the emotional excitement that involvement brings. It is hoped that the recall time will help "develop each child's ability to express thoughts, ideas, and feelings, to speak about, dramatize, and graphically represent experiences in order to communicate with others" (High/Scope Resource, Spring, 1986).

The High/Scope Curriculum classroom was originally begun in 1962 in Ypsilanti, Michigan, by Dr. David P. Weikart. It was known as the Perry Preschool Project (Hohmann, Banet & Weikart, 1979, Foreword). While it was originally set up for children whose families were drawn from below the poverty line (Schweinhart and Koshel, 1986), the program is considered feasible and sound for children whose language lag is developmental due to sensory or motor limitations (Hohmann, Banet, and Weikart, 1979, p. 16). Hohmann, Banet, and Weikart justify using the High/Scope Curriculum classroom for hearing impaired students on the basis

that "the experiential base that provides interesting things to talk about, a reason and an invitation to communicate, must be present and this set of active experiences should be basically the same for the hearing-impaired child and hearing child or for the language-impaired child and the child with 'normal' language ability" (p. 16). In this type of classroom setting, optimum opportunities for language development and expression would be present and should be measurable and statistically feasible.

Type-Token Ratio as a Diagnostic Tool

In considering the language that would be measurable and statistically feasible for its quantity and quality, a flexibility ratio has been devised by Miller (1981). This ratio, called the Type-Token Ratio (TTR) (Miller, 1981), measures the syntactic and semantic flexibility of language by comparing the total number of words in a speech sample to the total number of different words. This information is of interest because of the historical documentation previously cited which shows deficiencies of quantity and quality in the speech and language of hearing impaired students in both their oral and written language. In considering the TTR for each student, however, Hess, Sefton, and Landry (1986, p. 129) cite a number of potential problems, among which are the type of TTR to use and the sample size. If the resultant TTRs are to be used to compare them against any referenced norms such as Templin (1957), or with programs such as the Systematic Analysis of Language Transcripts

(SALT, 1985) by Miller and Chapman, or the Mordecai, Palin, and Palmer program (LINQUIST 1: Computer-assisted Language Sample Analysis, 1982) (computer software developed to analyze child language samples using the basic TTR), then an acceptable sample size would have to be used. Hess, Sefton, and Landry (1986) indicate in their research that if samples of 350 words cannot "be obtained from a child, then TTR measures based on smaller samples should be applied and interpreted with caution" (p. 133) and that:

1. TTRs should not be compared for language samples that differ in number of words,
2. TTRs for sample sizes of 50 to 100 words have reliabilities that are judged to be inadequate for research or clinical purposes,
3. The size of the language sample needed for a minimum reliability of .70 is 350 words, and
4. It is feasible to obtain 350-word samples for which TTRs are acceptably reliable (p. 133).

These findings, however, apply to children ages 3:0 years to 5:11 years who were capable of conversational interaction with adults during play activity (Hess, Sefton, and Landry, 1986, p. 131). Do these standards also apply to hearing-impaired students?

Hess, Sefton, and Landry (1986) do recommend, however, that the basic TTR is recommended for research and clinical use with language samples of young children (p. 133). The basic TTR (as opposed to the mean segmental TTR, the cumulative TTR curve, and the decremental TTR curve) is figured by counting the number of

words in accordance to rules specified by Templin (1957, p. 160) for identifying tokens. Then, after taking the number of different words in each segment to obtain the types, the number of types is divided by the number of tokens to obtain the basic TTR (Johnson, 1944). TTR is reported as the ratio between total number of words used. Templin (1957) reports that she found a ratio of .50 (1:2) consistently occurring across all age groups, sex groups, and socioeconomic status in the normal population (Templin in Miller, 1981, p. 42). Templin's computed TTRs were done on normal-hearing children from the ages of 3.0 years to 8.0 years. In computing the TTRs for these children, the means of the different words used ranged from 92.50 to 166.50 words while the means of the total words used ranged from 204.90 to 378.80 words. In computing TTR, Hess, Sefton, and Landry (1986) state, "The basic TTR is easily computed, {and} it is conceptually fundamental" (p. 133). Miller and Chapman (1981, p. 159) also report that it is feasible to obtain local norms and use these in analyzing language samples. While TTR is a general index used in quantifying aspects of the language sample, the mean length of utterance (MLU) can be used as a general indicator of structural development (Miller, 1981).

Mean Length of Utterance-Words as a Diagnostic Tool

Mean length of utterance in words (MLU-W), a general indicator of structural development, "is associated with distinct developmental achievements and to this extent the stages can be

said to be qualitatively different from one another" (Miller, 1981, p. 25). Miller reported in a study done in Madison, Wisconsin, that there was a strong correlation between age and MLU-W and that the relationship was "essentially linear" (p. 25). This indicates that given a certain MLU, age can be predicted, or given a certain age, MLU can be predicted within one standard deviation. Miller (1981) recommends using mental age to predict MLU in special populations (p. 27).

Statement of the Problem

A review of the literature shows language performance of hearing-impaired students which evidences deficiencies in both oral and written language. These performances are described in the literature as deficiencies in flexibility and structural development indicated by depressed vocabulary use, syntax irregularities, morphological omissions, reduced sentence length, omission of clauses, and other language irregularities which set the communication skills of hearing-impaired students apart from those of their normal hearing peers.

Rationale

The possibility that the quality and quantity of hearing-impaired students' language could be improved through the context of active participation using visual reminder as a stimulus, and that that improvement could be measured through flexibility and

structural studies is of research interest. In a pragmatic, teacher-facilitated setting, the focus would be on the students and their interactions with each other, the teacher, objects, and events. The resultant language, sampled over a stated period of time, should reflect that interest and any language gain could then be analyzed through flexibility and structural analyses. Moreover, a study of this kind, which allows for the students' reconstructive memory of activities through visual reinforcement and is fostered in a pragmatic setting such as a High/Scope classroom, might add to our knowledge of that growth.

It will be of research value, therefore, to set up a study using matched pairs randomly assigned to a control group and an experimental group to study the differences which visual reinforcement might make on language. For the purpose of the study, the type-token ratio will be used to measure the syntactic and semantic flexibility of the hearing-impaired students' speech. The mean length of utterance for words will be used to measure structural form and will be a second language criteria in matching the pairs. To increase opportunities for language expression, a pragmatic setting which affords optimum opportunities for language use will be required. As Miller and Chapman (l981) suggest the setting of local norms for the population and ages of interest, a baseline measurement of type-token ratio and mean length of utterance for words will be set for each of two randomly matched groups and then followed under differing circumstances in a pragmatic setting. This information is relevant because of the

historical documentation which shows deficiencies of quantity, quality, and structure in the speech and language of hearing-impaired students. A study of this nature will be of value as few assessment or teaching methods address language production (1) gathered from pragmatic, teacher-facilitated activities, (2) over a period of time, and (3) in which visual reinforcement of those activities was available during the verbalization.

The question of the benefit of video presentation for hearing-impaired students needs to be asked. Research indicates that hearing-impaired children watch more TV, at least in their homes, than do normal-hearing students (Liss, l981). Liss observed from her research that hearing-impaired students in grades three, six, and nine watch more TV at home than hearing children of all ages. Read (l980) reported research which indicated that the use of media in the classroom is as good as another "aide." Crain (l980) reported that hearing-impaired preschoolers reacted to pictures of their own experiences. Solomon (l980) used video- tapes to relive experiences from field trips. None of these researchers, however, took language samples from these experiences under the conditions of watching a videotape or not watching a videotape, or analyzed language samples over an extended period of time to measure language changes which resulted from the reconstructive memory afforded by the video presentation.

A study which looks at the reconstructive memory of hearing-impaired students under two circumstances, with visual reinforcement and without visual reinforcement, and over a

specified time period, will give pertinent semantic and syntactic language data. This data will be of clinical interest in developing knowledge about the flexibility and structure of the language of hearing-impaired students.

Therefore, using a High/Scope classroom setting, the present study will investigate the effectiveness of visual replay compared to no visual replay on the speech and language of hearing-impaired students over a specified time period of fifteen sessions. Analyses of semantic content and flexibility using Type-Token Ratio, analyses of structure using Mean-Length of Utterance, analyses of the effect of time and the interaction of treatment and time will be done using SALT. Ancillary language information gained from the study will be reported.

Research Questions

Will viewing a videotape of their activities have an effect on the language flexibility (as measured by TTR) of hearing-impaired students recalling the session's activities more so than those who do not receive visual viewing? Will viewing a videotape of their activities have an effect on the language structure (as measured by MLU-W) of hearing-impaired students recalling the session's activities more so than those who do not receive visual viewing? Will both groups of students show changes in TTR and MLU-W over a time period of fifteen sessions?

CHAPTER II

METHODS

In attempting to enhance functional communication, to measure the language that resulted from that enhancement, and to further determine the optimum conditions for that communication expansion, an experimental study was set up. The purpose of this study was to ascertain whether or not the use of visual reminder significantly affected the verbal expression of hearing-impaired children in a pragmatic context. This study included a control group and an experimental group made up of randomly assigned matched pairs of hearing-impaired students. The study was implemented in such a manner that the students planned, worked, and recalled their work experiences in a pragmatic, teacher-facilitated High/Scope curriculum classroom setting (Appendix A).

Measurements of changes in verbal expression in both the control and the experimental groups were taken during High/Scope activities. The experimental group experienced the independent variable of viewing a video- tape of the work session during recall portions of the sessions. Language samples for both groups were analyzed for flexibility in general semantic aspects of language by changes in the Type-Token Ratios (Miller, l981) and structural

changes in their Mean-Length of Utterances (Miller and Chapman, 1981). These language samples were taken over a period of fifteen sessions to allow for the environment to facilitate language growth.

The purpose of this experiment was to ascertain whether or not a visual reminder of activities would influence language flexibility (Type-Token Ratio) and increase language structure (Mean-Length of Utterance) and whether or not these changes would continue to show improved flexibility and structural changes over a period of time. The purpose of this comprehensive study was to determine factors which might influence the language quantity and quality of hearing-impaired students. Language samples were taken from videotaped High/Scope recall sessions over a three-month period. The data were collected over a series of eighteen sessions: three to set the baseline data points and fifteen to set the next three data points. A mean computed from samples from three sessions was used to get a baseline data point for each of the students. The pairs were then matched and randomly assigned to either an experimental or a control group, after which fifteen sessions were run. Data points were made using the baseline, the fifth, the tenth, and the fifteenth sessions. SALT (Systematic Analysis of Language Transcripts, Miller and Chapman, 1985) was used to analyze the language samples. Analyses were made for Main Effect of Treatment, Main Effect of Time, and for the Main Effect of the Interaction of Treatment and Time.

Subject Selection

Sixteen hearing-impaired students were selected to participate in the study. Each student was matched with another student in the group for sex, aided Speech Reception Threshold, (SRT), Mean Length of Utterance in Words (MLU-W), and Type-Token Ratio (TTR). Baseline data on each of these variables was taken at the beginning of the study. All students were considered to have non-verbal performance within normal ranges as determined by psychological testing information contained in their school files. The students were chosen from a pool of self-contained or mainstreamed students presently staffed as meeting the criteria for hearing-impaired placement in the Orange County, Florida Public School System. Each student had parent permission to participate in the study and to wear FM equipment designed to maximize the auditory stimuli of the classroom. A copy of each parent permission form used is in Appendix B.

Variables Used in Subject Selection

The measures of linguistic criteria chosen were the students' Type-Token Ratios (TTR, Miller, l981) and Mean Length of Utterance-Words (MLU-W, Miller & Chapman, l981) as determined from baseline measurements taken at the beginning of the experiment. Non-linguistic criteria included aided SRT (Speech Reception Thresholds) or SAT (Speech Awareness Threshold) hearing levels, and non-verbal performance levels.

Type-Token Ratio

For the purpose of this study, Type-Token Ratios (TTR) of conversational speech samples were used to measure the flexibility of hearing-impaired students' speech. Research in Type-Token Ratios (Miller, 1981) has indicated that the flexibility of a student's speech could be adequately measured by comparing the total number of words in a speech sample to the total number of different words. This information was of interest because of the historical documentation which shows performance deficiencies of quantity and quality in the speech and language of hearing-impaired students in both oral and written language.

As Type-Token Ratios have been normed on hearing populations (Miller, 1981), and as Miller and Chapman (1981) recommend the setting of local norms for specialized populations, the use of the Type-Token Ratios of the matched pairs of this study was feasible, but only if the groups or the pairs were not compared to any so-called norms, but only to their own pre-test baselines. Therefore, for the statistical purposes of this study, comparisons of pre- and post-test baselines were made for each of the groups and students rather than comparisons to any previously determined norms.

Students chosen for this study had baseline TTRs ranging from .40 to .84 with a mean of .63. The control group (the group without visual reminder) had a baseline TTR mean of .60 and the experimental group (the group with visual reminder) had a baseline TTR mean of .65.

Mean Length of Utterance-Words

For the purpose of this study, Mean Length of Utterance-Words (MLU-W) of conversational speech samples was used to measure the language structures of hearing-impaired students' speech. In considering the Mean Length of Utterance (MLU) for each student, Scarborough, Wyckoff, and Davidson (1986) advise that "the MLU values obtained by Miller and Chapman {1981} and in the present study (Scarborough. Wyckoff, and Davidson [1986]) might be used with confidence as a standard of comparison or as 'norms,' below age 42 months; and that validation of MLU means for older preschoolers will be problematic until it is known why their 48- and 60-month olds' MLUs were so much lower than those for the children from Madison {Miller and Chapman's 1981study}" (p. 396). Samples for the Miller and Chapman (1981) and for the Scarborough, Wyckoff, and Davidson (1986) studies were obtained for middle-class children "engaged in one activity (play) with only one conversational partner (their mothers)" (p. 396).

Only for language samples of a similar nature can MLU be compared to these findings. Thus, the use of what the child is doing with regard to his or her MLU for the matched pair purposes of this study was feasible, but only if the child or the pairs were not compared to any so-called norms. Brown (1973) reports that "mean length of utterance in morphemes is a general index of grammatical development and has been shown to increase with age up to MLUs of 4.00 to 4.50" (Miller, 1981, p. 75). According to Miller (1981), the child's MLU defines his or her stage assignment in Brown's scheme.

Miller presents a chart delineating a child's age, MLU, and a standard deviation (p. 26). It must be noted that these norms were set on a small sample of middle-class students, not on a hearing-impaired population.

Students chosen for this study had baseline MLU-Words ranging from 1.50 to 5.39 words per utterance with an overall mean of 3.13 MLU-Ws. The control group (the group without visual reminder) had a baseline mean of 3.25 MLU-Ws and the experimental group (the group with visual reminder) had a baseline mean of 3.00 MLU-Ws.

Age and Sex

The ages of the students chosen for this study ranged from 3.8 to 10.6 years with an average age of 7.6 years for the control group and an average age of 7.4 years for the experimental group. Three of the eight pairs were female and five of the eight pairs were male. The females ranged from 4.2 years to 10.7 years. The males ranged from 3.8 years to 8.1 years.

Speech Reception Threshold (SRT)

The reception of speech relates to the activities of life and thus is more meaningful than puretone audiometric stimulus (Schill, l985). While puretone testing is simpler and speech reception testing is more difficult and complicated, Schill (l985) says that the information gained justifies the extra work and effort. The term speech reception threshold (SRT) could represent either spondaic

(disyllable) stimuli or other stimuli. Speech awareness threshold (SAT) or speech detection threshold (SDT) is that point at which the listener just barely detects the signal. SRT is that point at which the listener can repeat 50% of the speech material presented by the audiologist. The listener does not have to understand the material, only repeat it. All students in this experiment had aided speech reception thresholds within the ranges of 10dB to 50dB or a speech awareness threshold of 30dB (two students were matched by SAT). The students within the pairs were matched so that their SRTs were within ten points (five points is considered as test-retest reliability). The mean hearing threshold of SRT or SAT for the two groups was 27dB.

The control group had a mean SRT-SAT of 28 dB and the experimental group had a mean SRT-SAT of 23dB. All SRT or SAT levels for children are listed in Appendix C.

Nonverbal Intelligence Indicators

Performance scores falling within normal limits on one of the following constituted evidence of normal non-verbal intelligence: the Weschsler Intelligence Scale for Children-Revised (WISC-R) (Weschler, 1974), the Language Age of the Hiskey-Nebraska Test of Learning Aptitude (H-NTLA) (Hiskey, 1966), the Ravens Progressive Matrices (Ravens, 1977), the Vulpe Assessment Battery (Vulpe, 1979, gross and fine motor sections), the Leiter International Performance Scale and the Arthur Adaptation (Leiter, 1969), or the

Goodenough Draw A Man (Goodenough, 1926). One of these was selected as records on them were available from the students' academic or speech and language records.

Research by Hirshoren, Hurley, and Kavale indicates that the performance of hearing impaired students on the WISC-R and the H-NTLA shows a high degree of agreement between the two measures with a mean performance IQ of 88.07 on the WISC-R and a mean performance IQ of 89.86 on the H-NTLA for hearing impaired children between the ages of eight and thirteen years in a total communication setting. While the students in this present study were from an oral program rather than a total program, so that the statistics might change with regard to reliability and validity between the two measures, Hirshoren et al. (1979) have stated that "[t]he concurrent validity of the Performance Scale IQ of the WISC-R with deaf children is adequate for purposes similar to those for which the H-NTLA LQ is used with deaf children" (p. 78) (also see Watson and Goldgar [1985] for cautions in using extreme scores of the H-NTLA Language Quotient, p. 57).

Two nonverbal intellectual assessment tests were also available from the records of the students. One of these was the Goodenough-Harris Drawing Test, also known as the Draw A Man (DAM) (Goodenough, 1926), and the Raven's Progressive Matrices (RPM) (Raven, 1977). The Goodenough assesses conceptual and intellectual maturity and personality characteristics (Harris, 1980, p. 253) and the Raven's Progressive Matrices Scales (1977) "[c]an be described as 'tests of observation and clear thinking . . . '" (p. G3).

All students selected for this study fell within ranges considered normal on one or more of the above measures.

Random Assignment of Matched Pairs to Experimental or Control Groups

One student from each of the matched pairs with each of the participating criteria (sex, aided SRT, MLU, and TTR) was randomly assigned to either a control group or an experimental group. Thus, there were eight students in the control group and eight students in the experimental group.

The groups in this random assignment were shown to be from the same population for TTR and MLU-W at the baseline data point by a Wilcoxon Signed Rank Test for Paired Difference Experiment (McClave and Dietrich, 1985, p. 496). For the statistical analysis, the *t* was the test statistic. A .05 alpha level was used. The *t* for TTR was non-significant at the $t = 1.05$ (7df) and the *t* for MLU-W was also non-significant at $t = .41$ (7df).

Physical Facility

The classroom was set up in an existing elementary school which housed students in kindergarten through fifth grade. The school also housed both mainstreamed and self-contained hearing-impaired students in nursery through fifth grade. These hearing-impaired students were enrolled in an oral hearing-impaired

program. The classroom was structured after the High/Scope model (Appendix A).

Daily Routine

The High/Scope (Appendix A) curriculum classroom was set up at Kaley Elementary School in the Orange County Florida School District. The students served in this classroom were staffed into an oral hearing-impaired program and were seen on an itinerant basis by the speech and language clinician assigned to the hearing-impaired program.

The therapy sessions for this study were of a one-hour duration twice a week and included planning, work-time, and recall segments. During the recall sessions of the control group, the students orally reviewed activities which had gone on. During the recall sessions of the experimental group, the students were shown a videotaping of their activities while they orally reviewed the activities which had occurred. The duration of recall sessions for the control and the experimental groups were the same. Twenty minutes were allotted for the recall sessions

Each group was seen separately. Because of the number of students in each group and to facilitate dialogue and response time, the groups were broken down into two smaller groups of four students each. The experimental groups were seen for one hour on Mondays and Thursdays and the control groups were seen for one hour on Tuesdays and Fridays. The scheduling of each group depended in

part on prior committments for each of the students. As a result, the experimental groups were seen back to back in the mornings while the control groups were seen with one group early in the morning and one group after lunch. When a session was missed due to the absence of a student, the session was made up on Wednesdays if at all possible.

The control groups and the experimental groups entered the classroom at separate times. Each group participated in activities as prescribed by the format of the High/Scope curriculum. Each group was videotaped during the planning, work-time, and recall activities. The TV monitor was turned off during the planning and work time activities.

During the recall sessions, each child took his turn in telling what had happened during the planning and work-time. He had opportunities for adding information or engaging in conversation with the teacher or with peers. The control groups experienced the High/Scope recall portion of the activities by talking about what they had done. The experimental groups also experienced the High/Scope recall portion of the activities by talking about what they had done. While the experimental groups were telling, however, the TV monitor was showing a recording of their activities. The sound was turned off of the TV monitor.

Both the recall sessions of the control group and the recall sessions of the experimental group were videotaped. The control group could be taped directly onto a storage tape, while the experimental tape had to be dubbed later by the researcher. These

tapes were not shown to the students at any time, but were used for data collection.

To enhance the communication system in the classroom, the students in the experiment were each outfitted with a Telex TDR-7 Master Binaural FM Receiver with TCN. The teacher was outfitted with a Telex TW-7 Transmitter. Each student wearing this equipment had parental permission in writing to do so (Appendix B). Ear molds and settings were made by a certified audiologist employed by the Orange County Public School System. All fittings for the FM equipment were double validated by an audiologist. Fittings for the FM equipment are listed in Appendix D.

All sessions, including part of the planning time, part of the work- time, and all of the recall time, were videotaped with a Zenith VM6200 camcorder.

The classroom was equipped with a Sharp black and white 24" TV monitor, a Zenith VCR VHS, a Zenith VM6200 camcorder, twenty VCR 120 tapes, and four tapes to fit the Zenith camcorder. Tapes from the camcorder were dubbed onto the VCR 120 tapes. The VCR 120 tapes were used for data collection storage. Each group had a tape for planning and work-time and a separate tape for recall. These tapes were dated by session. In order to keep track of the day each session took place, and so that the date of the session would show on each taped session in case the jacket was lost, a visible piece of paper with the month, day, and year was placed within viewing distance of the camera.

Collection of the Data

The students were videotaped during the sessions and were aware that the taping was going on. The experimental groups viewed the video- tape of the work sessions during the recall portions of the sessions. The control groups participated in recall sessions, but without the videotape being shown. After the three baseline sessions, each group participated in the study for a total of fifteen more sessions over a period of three months from September 14, 1987 to December 14 , 1987.

It was not possible at the beginning of the study to estimate the possible number of utterances or number of words forthcoming from the students during the recall time. That information, therefore, contributed to the statistical information derived from this study. The TTRs and MLU-Ws for each of the students for each of the sessions were based on the utterances they made during the recall time.

To set the baseline data points, three sessions were run and language sample transcriptions were taken. The composite means for TTR and for MLU-W for the control group and for the experimental group were used as the baseline data points for each of these analyses and for matching the pairs of students. Fifteen sessions were then run. Language sample transcriptions were taken from the recall portions of the fifth, tenth, and fifteenth of these sessions. SALT (Systematic Analysis of Language Transcripts, Miller and Chapman, 1985), an IBM Computer program for the analysis of various aspects of language was used to analyze the language samples.

Among the analyses available were Type Token Ratio (TTR), Mean Length of Utterance in Words (MLU-W), Mean Length of Utterance in Morphemes (MLU-M), Complete and Intelligible Number of Different Word Roots (C&I#DWR), Complete and Intelligible Total Number of Words (C&IT#W), Total Utterances Number of Different Word Roots (TU#DWR), and Total Utterances Total Number of Words (TUT#W). Approximately twenty minutes of videotaping was available for these analyses from each of the recall sessions.

Statistical Analyses

In addition to determining that the two groups came from the same population, statistical analyses consisted of a 2x4 ANOVA on each of the seven areas of language interest (TTR, MLU-W, MLU-M, C&I#DWR, C&IT#W, TU#DWR, and TUT#W) to determine if significance differences occurred among the groups for the Main Effect of Treatment, for the Main Effect of Time, or for the Main Effect of the Interaction of Treatment and Time.

If a significant difference was found for any of these analyses, the Newman-Keuls multiple-comparison using the studentized range was run to find out where the differences occurred between the data points (Ferguson, p. 269).

CHAPTER THREE

RESULTS

Three research questions were asked: Will viewing a videotape of their activities have an effect on the language flexibility (as measured by TTR) of hearing-impaired students recalling the session's activities more so than those who do not receive visual viewing? Will viewing a videotape of their activities have an effect on the language structure (as measured by MLU-W) of hearing-impaired students recalling the session's activities more so than those who do not receive visual viewing? Will both groups of students show changes in TTR and MLU-W over a time period of fifteen sessions?

In order to answer these questions, language data on TTR and MLU-W were collected and analyzed during four selected High-Scope recall sessions. These data were analyzed using the SALT program and are listed by means for each of the selected sessions' data points in Appendix C. Ancillary language information reflecting on changes made by the two groups was also available from SALT data and is also reported in this chapter. These data are also listed in Appendix C.

The experimental group language samples were taken with visual reminder and the control group language samples were taken without visual reminder. The baseline data for each group consisted of the mean of a composite of three sessions and is listed in Appendix C as the first data point for each of the groups. The second data point for each of the groups was taken during the fifth session following the taking of the baseline and is listed in Appendix C as the second data point. The third data point for each of the groups was taken during the tenth session following the baseline and is listed in Appendix C as the third data point. The fourth data point for each of the groups was taken during the fifteenth session and is listed in Appendix C as the fourth data point.

Three statistical analyses were run. These analyses consisted of a comparison of the means of the data points for each of the groups for each of the SALT analysis (Appendix C), a 2x4 ANOVA (Appendix E) on the Main Effect of Treatment, the Main Effect of Time, and the Main Effect of the Interaction of Treatment and Time, and a Newman-Keuls multiple-comparison analysis of means (Appendix F) on any significant differences between the groups found by the ANOVAs.

Appendix C gives the means for the various data points. Appendix E gives the over-all F and degrees of freedom (df) for each of the main effect analyses of the ANOVAs. Appendix F gives the data on the Newman-Keuls Main Effect of Time analyses using the studentized range for the seven SALT analyses. The Newman-Keuls analyses of data for the Main Effect of the Interaction of Time and

Treatment are included in Tables of Means where significance was found.

Analyses of Type-Token Ratio

Table 1 gives the means for each of the data points for the experimental and control groups for TTR. As can be seen at data point #1, both of the groups started out with comparable TTRs of .65 and .61, fifteen and eleven points above the .50 norm, with the group with visual reminder slightly further away from the norm. By the fourth data point, the group with visual reminder is at .49, just .01 off the national norm of .50 while the group without visual reminder dropped down to .45 or slightly below the national norm. The group receiving visual reminder received the score most closely related to the national norm of .50, although both groups showed a trend toward the norm from the baseline to the fourth data point.

TABLE 1

TTR MEANS OF FOUR DATA POINTS FOR EXPERIMENTAL GROUP (WITH VISUAL REMINDER) AND CONTROL GROUP (WITHOUT VISUAL REMINDER) USING SALT

DATA POINTS	DP#1	DP#2	DP#3	DP#4
Experimental Means: With Visual Reminder	.65	.45	.42	.49
Control Means: Without Visual Reminder	.61	.45	.52	.45
Overall Means:	.63	.45	.47	.47

The ANOVA (Appendix E - TTR) showed no Main Effect of Treatment [$F(1) = .01$, $p > .05$], no Main Effect of Interaction between Treatment and Time [$F(3) = 1.30$, $p > .05$], but a significant difference in the Main Effect of Time at the .01 level with [$F(3,42) = 8.20$, $p < .01$].

The Newman-Keuls (Appendix F - TTR) for the Main Effect of Time showed that there were significant increases between the baseline and data points two, three, and four, but no significant differences among data points two, three, and four.

Analyses of Mean Length of Utterance-Words

Table 2 gives the means for each of the data points for the experimental and control groups for MLU-W. As can be seen at data point #1, both groups started out with comparable MLU-Ws of 3.00 and 3.25 words respectively, with the group with visual reminder slightly below that of the group without visual reminder. By the fourth data point, the experimental group showed steady gain and had surpassed the control group with 3.97 to 3.71 MLU in words.

TABLE 2

MLU-W MEANS OF FOUR DATA POINTS FOR EXPERIMENTAL GROUP (WITH VISUAL REMINDER) AND CONTROL GROUP (WITHOUT VISUAL REMINDER) USING SALT

DATA POINTS	DP#1	DP#2	DP#3	DP#4
Experimental Means: With Visual Reminder	3.00	3.47	3.79	3.97
Control Means: Without Visual Reminder	3.25	4.10	4.05	3.71
Overall Means	3.13	3.79	3.92	3.84

The ANOVA (Appendix E- MLU-W) showed no significant difference between the groups for the Main Effect of Treatment [$F(1) = .11$, $p > .05$] or the Main Effect of the Interaction of Treatment and Time [$F(3) = 1.20$, $p > .05$]. A significant difference, however, was found between the groups for the Main Effect of Time at the .01 level [$F(3,42) = 5.00$, $p < .01$].

The Newman-Keuls comparison of means (Appendix F -MLU-W) for the Main Effect of Time showed that there were significant increases between the baseline and data points two, three, and four, but no significant differences among data points two, three, and four. This was consistent with the findings for TTR.

While the groups were established by the *t* test to be from the same population for TTR and MLU-W, there was a non-significant trend at the beginning of the study in both TTR and MLU-W in favor of the control group (without visual reminder). By the fourth data point, this had been reversed and the trend lay with the experimental group (with visual reminder) for both TTR and MLU-W.

Analyses of Mean Length of Utterance-Morphemes

Five ancillary language areas were also analyzed by SALT. Table 3 gives the means for the first of these, MLU-Morphemes (MLU-M). As can be seen at data point #1, the group without visual reminder was slightly ahead of the group with visual reminder (3.46 to 3.20 MLU-Ms) (Appendix C - MLU-M). By the fourth data point, the group with visual reminder had surpassed the group without visual reminder by .37 MLU-M (4.23 to 3.86). The trend set in favor of the group with visual reminder by TTR and MLU-W was continued by MLU-M.

TABLE 3

MLU-M MEANS OF FOUR DATA POINTS FOR EXPERIMENTAL GROUP (WITH VISUAL REMINDER) AND CONTROL GROUP (WITHOUT VISUAL REMINDER) USING SALT

DATA POINTS	DP#1	DP#2	DP#3	DP#4
Experimental Means: With Visual Reminder	3.20	3.60	4.06	4.23
Control Means: Without Visual Reminder	3.46	4.30	4.19	3.87
Overall Means	3.33	3.95	4.13	4.05

The ANOVA (Appendix E - MLU-M) showed no significant differences between the groups for the Main Effect of Treatment [$F(1) = .06$, $p > .05$] or the Main Effect of the Interaction between Treatment and Time [$F(3) = .17$, $p > .05$]. A significant difference

between the groups, however, was found for the Main Effect of Time at the alpha .01 level [$F(3,42) = 4.80$, $p < .01$].

The Newman-Keuls analysis (Appendix F - MLU-M) for the Main Effect of Time showed that there were significant increases between the baseline and data points two, three, and four, but no significant differences among data points two, three, and four. This followed the trend for the Main Effect of Time set between the data points in the analyses of TTR and MLU-W.

Analyses of Complete and Intelligible Number of Different Word Roots

Table 4 gives the means for each of the data points for the experimental and control groups for Complete and Intelligible Number of Different Word Roots (C&I #DWR), a second ancillary analysis of SALT. As can be seen at data point #1, both groups started out with comparable means for C&I#DRW, with the visual reminder group having a mean of 20.46 complete and intelligible different word roots and the group without visual reminder having a mean of 22.42 complete and intelligible different word roots, slightly better than the group with visual reminder (Appendix C-C&I#DWR). By the fourth data point, both groups showed gain, with the group with visual reminder having the larger amount of gain. This trend was consistent with the data for TTR, MLU-W, and MLU-M.

TABLE 4

C&I#DWR MEANS OF FOUR DATA POINTS FOR EXPERIMENTAL GROUP (WITH VISUAL REMINDER) AND CONTROL GROUP (WITHOUT VISUAL REMINDER) USING SALT

DATA POINTS	DP#1	DP#2	DP#3	DP#4
Experimental Means: With Visual Reminder	20.46	49.50	37.00	62.00
Control Means: Without Visual Reminder	22.42	40.00	35.13	53.50
Overall Means	21.44	44.75	36.07	57.75

The ANOVA (Appendix E - C&I#DWR) showed no significant differences between the groups for the Main Effect of Treatment [$F(1) = .09$, $p > .05$] or for the Main Effect of the Interaction of Treatment and Time [$F(3) = 2.70$, $p > .05$]. A significant difference was found for the Main Effect of Time at the .01 level [$F(3,42) = 46.10$, $p < .01$].

The Newman-Keuls analysis for the Main Effect of Time (Appendix F - C&I#DWR) showed significant differences between all possible contrasts. This did not follow the trend set for MLU-W, MLU-M, or TTR. The information on the data point at baseline and data point four, however, was consistent with the data for TTR, MLU-W, and MLU-M and showed a trend in favor of the experimental group with visual reminder.

Analyses of Complete and Intelligible Total Number of Words

Table 5 gives the means for each of the data points for the experimental and control groups for Complete and Intelligible Total Number of Words (C&IT#W), a third ancillary analysis of SALT. As can be seen from data point #1, the group without visual reminder

had an advantage over the group with visual reminder at the baseline data point with a mean of 47.04 words to 25.08 words. By the fourth data point, both groups showed gain overall from the other data points with the group with visual reminder reaching a group mean of 138.13 words and the group without visual reminder reaching a mean of 118.25 words. The advantage showed a trend in favor of the group with visual reminder in keeping with TTR, MLU-W, MLU-M, and C&I#DWR.

TABLE 5

C&IT#W MEANS OF FOUR DATA POINTS FOR EXPERIMENTAL GROUP (WITH VISUAL REMINDER) AND CONTROL GROUP (WITHOUT VISUAL REMINDER) USING SALT

DATA POINTS	DP#1	DP#2	DP#3	DP#4
Experimental Means: With Visual Reminder	25.08	130.88	92.13	138.13
Control Means: Without Visual Reminder	47.04	93.63	75.13	118.25
Overall Means	36.06	112.26	83.63	128.19

The ANOVA (Appendix E - C&IT#W) showed no significant differences between the groups for the Main Effect of Treatment [$F(1) = .24$, $p > .05$] or for the Main Effect of the Interaction of Treatment and Time [$F(3) = 2.60$, $p > .05$]. Significance was found for the Main Effect of Time at the .01 level [$F(3,42) = 26.80$, $p < .01$].

The Newman-Keuls analysis of means for the Main Effect of Time (Appendix F- C&IT#W) showed a significant difference between the baseline data point and the second data point. A significant

increase was found from data point one to data point two, a significant decrease from data point two to data point three, and then a significant increase from data point three to data point four. This analysis was in keeping with the analysis for C&I#DWR.

The comparison of the baseline data point and the fourth data point was consistent with the data for TTR, MLU-W, MLU-M , and C&I#DWR and continued to show a trend in favor of the group with visual reminder.

Analyses of Total Utterances Number of Different Word Roots

Table 6 gives the means for each of the data points for the experimental and control groups for Total Utterances Number of Different Word Roots (TU#DWR), a fourth ancillary analysis of SALT. As can be seen from data point #1, the mean of the group with visual reminder started out slightly behind the mean of the group without visual reminder (Appendix C - TU#DWR), a trend noted in all the previous analyses. By the fourth data point, both groups showed gain over each of the first three data points with the group with visual reminder having the larger amount of growth, a mean of 67 different word roots to a mean of 57.63 different word roots for the group without visual reminder. This trend was consistent with the data for TTR, MLU-W, MLU-M, C&I#DWR, and C&IT#W. The advantage at the fourth data point showed a trend in favor of the group with visual reminder.

TABLE 6

TU#DWR MEANS OF FOUR DATA POINTS FOR EXPERIMENTAL GROUP (WITH VISUAL REMINDER) AND CONTROL GROUP (WITHOUT VISUAL REMINDER) USING SALT

DATA POINTS	DP#1	DP# 2	DP#3	DP#4
Experimental Means: With Visual Reminder	16.17_b	56.00_d	41.63_c	67.00_e
Control Means: Without Visual Reminder	23.54_b	42.00_c	37.75_c	57.63_d
Overall Means	19.86	49.00	39.69	62.32

*Group means with common subscripts do not differ from each other.

The ANOVA (Appendix E- TU#DWR) showed no significant differences between the groups for the Main Effect of Treatment [$F(1) = .24$, $p > .05$]. Significance, however, was found at the .05 level for the Main Effect of Time [$F(3) = 47.10$, $p > .01$] and, for the first time, for the Main Effect of the Interaction of Treatment and Time [$F(3,42) = 3.10$, $p < .05$].

The Newman-Keuls (Appendix F - TU#DWR) for the Main Effect of Time showed a significant difference between all the data points at the .05 alpha level. However, the data are better explained by the analysis of the Main Effect of the Interaction of Treatment and Time which yielded significant differences between the groups at the first data point in favor of the group without visual reminder and at the fourth data point in favor of the group with visual reminder. No significant differences were found between the groups at data point three. Both differences demonstrate greater gains in TU#DWR for the experimental group.

TABLE 7

TUT#W MEANS OF FOUR DATA POINTS FOR EXPERIMENTAL GROUP (WITH VISUAL REMINDER) AND CONTROL GROUP (WITHOUT VISUAL REMINDER) USING SALT

DATA POINTS	DP#1	DP#2	DP#3	DP#4
Experimental Means: With Visual Reminder	28.12_{a*}	167.63_{d}	117.75_{bc}	178.75_{d}
Control Means: Without Visual Reminder	47.46_{a}	104.83_{bc}	92.63_{b}	134.50_{c}
Overall Means	37.62	136.23	105.19	156.63

*Group means with common subscripts do not differ from each other.

The ANOVA (Appendix E - TUT#W), showed no significant differences between the groups for the Main Effect of Treatment [$F(1) = 1.20$, $p > .05$]. Significance, however, was found at the .05 level for the Main Effect of Time [$F(3,42) = 28.60$, $p < .01$] and for the Main Effect of the Interaction of Treatment and Time [$F(3) = 3.30$, $p < .05$]. These data are consistent with those found for the previous analyses with the trend in favor of the group with visual reminder.

The Newman-Keuls for the Main Effect of the Interaction of Treatment and Time (Table 7 - TUT#W subscripts) showed significant differences between the groups at data points two and four. Both differences demonstrate greater gains in TUT#W for the experimental group. Both groups showed the same trend, with gains at DP#2, decreases in TUT#W at DP#3, then gains again at DP#4. However, the experimental group experienced a statistically significant decrease at DP#3, which the control group did not experience. The data at the fourth data point are in keeping with the

data found for TU#DWR, with the trend in favor of the group with visual reminder with significance at the .05 alpha level.

CHAPTER FOUR

DISCUSSION

Three questions were asked in this study: Will viewing a videotape of their activities have an effect on the language flexibility (as measured by TTR) of hearing-impaired students recalling the session's activities more so than those who do not receive visual viewing? Will viewing a videotape of their activities have an effect on the language structure (as measured by MLU-W) of hearing-impaired students recalling the session's activities more so than those who do not receive visual viewing? Will both groups of students show changes in TTR and MLU-W over a time period of fifteen sessions? These questions were asked within the context of a teacher-facilitated, pragmatic classroom.

In order to answer these questions, language data on TTR and MLU-W were analyzed using SALT (Systematic Analysis of Language). Ancillary information available from SALT was also analyzed for contributary language information on changes made on the students' language during the fifteen selected High-Scope recall sessions.

The main finding from this study was that the use of TV as a visual reminder of activities made a difference over a period of time. While both groups made significant progress, the control group as well as the experimental group, there was a trend by the

fourth data point in favor of the group with visual reminder in all seven of the SALT analyses run.

The TTR flexibility analyses showed that at the fourth data point, the group with visual reminder was just .01 off the national norm of .50 while the group without visual reminder dropped down to .45 or slightly below the national norm. The group receiving visual reminder received the score most closely related to the national norm of .50, although both groups showed a trend toward the norm from the baseline to the fourth data point. It must be noted that TTR norms have been set across age, sex, and socio-economic lines for normal-hearing students. That the language flexibility of hearing-impaired students showed a trend toward the norm in fifteen teacher-facilitated, pragmatically orientated treatment sessions is important research knowledge. The flexibility of the students' language was undoubtedly changed by a large gain in total number of words used. Students' word usage gained from a mean low of 28.12 words to a mean high at the fourth data point of 178.75 words. Sample language from baseline sentences show such utterances for a child with a beginning TTR of .72 and a MLU-W of 2.28 as "That one," "Game," or "On the shelf". The total number of words used by this child at the baseline data showed a mean of 8.30 words. By the fourth data point, this child had a TTR of .42, a MLU-W of 3.07 and was using l66 words in his language sample. Such utterances as "I gonna make paint," "It not hot," and "The stove is off" were used during the fifteenth recall session.

Structural changes in the students' language were reflected by changes in MLU-W. The analysis of means for MLU-W showed that both groups started out with comparable MLU-Ws of 3.00 and 3.25 years and months respectively, with the group with visual reminder slightly below that of the group without visual reminder (Appendix XII, Chart #1 - MLU-W). By the fourth data point, the experimental group showed steady gain and had surpassed the control group with 3.97 to 3.71 MLU in words. The result for the group with visual reminder is comparable to a three month growth in three months time for children normed on MLU in the Miller study (Miller, 1981, p. 25). It should be remembered that hearing-impaired students have not been shown to make growth comparable to normals on any of the studies reported in Chapter I of this paper. Sample sentence structure from baseline sentences show such utterances for a child with a beginning TTR of .59 and a MLU-W of 2.62 as "Play fish," "That it," and "Play (um) stuff." The total number of words used by this child at the baseline data showed a mean of 15 words. By the fourth data point, this child had a TTR of .56, a MLU-W of 5.40 and was using 81 words in his language sample. Such utterances as "I wanna make gingerbread man," "I wrote my plan," and "I get food color and yarn out" were used during the fifteenth recall session.

The study also showed patterns of how the students were learning and using language. For instance, for both the groups, a large increase in vocabulary was noted from the first to the second data points, a decrease from the second to the third data points, and then an increase at the fourth data point. The group with visual

reminder showed steady increases in MLU-W and MLU-M while the group without visual reminder surged at the second data point and then fell back at the third and fourth data points, but still showed considerable gain at the fourth data point over the first data point. From the data and from previous research noted in Chapter I, it is difficult to tell if these changes would be maintained or would continue at projected fifth, sixth or seventh data points. As there are no previous studies using the SALT program on the particular type of language sample used in this study, further research is indicated. In order to facilitate any follow-up studies, information on FM settings, SRT-SAT, and baseline, second, third, and fourth data point measurements on all the analyses have been included in the Appendices.

It is the impression of the researcher that the teacher-facilitated classroom, the use of the TV in recording all the sessions, and the allotment of twenty minutes for recalling the activities for both the groups wherein the students were expected to talk about their activities, all contributed greatly to the results. The students enjoyed the classroom, did not balk at making plans before they could start on their chosen activity, and willingly cleaned up for the recall sessions. They waited expectantly for their turn to talk and carried on spirited conversations with one another both during the work sessions and the recall sessions. They responded positively to being videotaped during the recall sessions, almost as if they were "movie stars."

As the fifteen sessions progressed, an increase in dialogue between the students and between the students and the teacher could be noted from watching the tapes. Language became a viable tool for these students and the results show in the final language analyses. The students were asking each other for help rather than going to the teacher without interaction with the other students, as can be noted both from the baseline tapes and from ensuing tapes. The interaction of conversation became a tool of the classroom.

Vocabulary growth was as remarkable as was the trend toward the norm for TTR and the three months growth in three months time for MLU. While the growth shown in Total Number of Words and Total Number of Root Words is statistically important, a search of the literature showed no research which delineates growth in these two areas, at least for hearing-impaired students. Most of the research was concerned with general differences between types of programs, oral-aural, aural-oral with finger spelling, or total communication. It might be interesting to make SALT language analyses over a period of time on the above types of programs and compare them with the results of the High-Scope recall sessions using TV as a reminder or even not using TV as a reminder as both groups made statistically important growth gains.

When comparing these results to any future results, several interesting factors need to be noted. Results from comparison of the means of the two groups from the baseline data point to the fourth data point showed that while there was no statistical difference in either TTR or MLU-W in the randomly matched groups

at the beginning of the study, there was a numerical advantage in favor of the group without visual reminder for each of the two main statistical analysis (TTR and MLU-W) and for each of the five ancillary analyses run [Complete and Intelligible Number of Different Word Roots (C&I#DWR), Complete and Intelligible Total Number of Words (C&IT#W), Total Utterances Number of Different Word Roots (TU#DWR) and Total Utterances Total Number of Words (TUT#W)]. Data analyzed at the completion of the fifteen sessions showed that there was also a statistical difference at the baseline in favor of the group without visual reminder for Total Utterances Number of Different Word Roots (TU#DWR) and for Total Utterances Total Number of Words (TUT#W).

The analyses showed that each group had either a move toward the norm for the TTR or a increase in language use for MLU-W, MLU-M, C&I#DWR, C&IT#W, TU#DWR, and TUT#W. Means of the four data points for the seven SALT analyses are listed in Appendix G. While the group without visual reminder started out in a more favorable position in each of the analyses run, a trend in favor of the group with visual reminder was found by the fourth data point for all seven of the analyses. For TTR, results showed that the group with visual reminder at .49 was .01 away from the national norm of .50 (a TTR of 2:1) and the group without visual reminder was .05 away from the national norm. The mean of the group with visual reminder showed almost a one full point gain in MLU-W going from 3.00 MLU to 3.97 MLU, indicative of chronological age growth from 34.8 months to 42.6 months. The group without visual reminder

went from 3.25 MLU at the baseline data point to 3.71 MLU, a gain from 36.3 to 40.3 months. The group with visual reminder gained 7.8 months and the group without visual reminder gained 4 months in the three months the sessions were run.

Analyses of the means of the two groups for the Main Effect of Treatment, the Main Effect of Time, and the Main Effect of the Interaction of Treatment and Time were done using an ANOVA. The Newman-Keuls was run where statistically significant differences were found. While the ANOVA showed no Main Effect of Treatment between the groups for any of the seven analyses, both groups showed gain from the baseline to the fourth data points for each of the measures analyzed. In each case, the analyses showed a Main Effect of Time at the .01 alpha level. The Main Effect of the Interaction between Treatment and Time showed no statistical differences for any of the seven analyses except for TU#DWR and TUT#W, where differences were significant at the .05 alpha level in favor of the group with visual reminder. These two analyses indicate a gain in vocabulary diversity from the baseline to the fourth data point for each of the groups.

While TTR and MLU-W and MLU-M can be compared to norms, there are no studies which relate the vocabulary growth of hearing-impaired students to norms. Of future interest, therefore, would be follow-up studies using High-Scope recall sessions with the visual reminder of TV to see if comparable gains would be indicated for hearing-impaired children as well as for children from other populations.

APPENDICES

APPENDIX A

DESCRIPTION OF THE HIGH/SCOPE CLASSROOM

APPENDIX A

Description of the High/Scope Classroom

In order to give the students an opportunity to participate in activities of their own choosing, the classroom was divided into distinct areas which included housekeeping, art, block, quiet, music, science, and animal-plant centers. All areas were visible from any other area in the room and from a central planning area which included a low table and five chairs.

The housekeeping area included a hot plate, electric mixer, toaster oven, refrigerator and various utensils , pots and pans, and utensils, including paper plates, napkins, glasses and assorted containers. The art area included paints, brushes, crayons, assorted sized and textured papers, cutting instruments, glues and pastes, containers for mixing paints, easels, smocks, and assorted collage and manipulables of a handicraft nature. The quiet area included materials to sort and build with, arrange, fit together and take apart, use for decoding and pretending. This included books and puzzles. The construction area included basic construction tools, a variety of supplies such as nuts, bolts, nails, sandpaper, glues, wire, rubber bands, styrofoam pieces, bottlecaps, jar lids, etc. The music area included musical instruments such as found in a rhythm band, records, record player, etc. The block area included building materials, materials for filling and emptying, and materials for pretending. The animal and plant area included a gerbil set-up, aquarium, terrarium, cages and food, pots and potting soil, seeds, bulbs, etc.

The planning segment allowed each student to indicate what he or she was going to do during the work time and included:

pointing to an area
naming an area, object, or child he/she was going to work with
describing what he/she was going to do

describing how he/she was going to do something
drawing or tracing what he/she was going to do
dictating or writing what he/she was going to do.
going to the area he/she intended to work in as soon as he/she had talked with an adult about his/her plan
hanging his or her sign on the planning board in the area he/she has planned to begin working in

(Weikart, 1986, p. 33)

The teacher sat with the child/children, talked individually with each child and:

asked the child what he/she would like to do
gave the child time to respond
acknowledged the choice or plan the child made
helped the child expand his/her plan
gave suggestions if the child couldn't think of anything
reminded the child of something he/she began yesterday, if such was the state,
watched to see which children needed assistance getting started on their plans
went to children who needed assistance as soon as every child in the group had planned

(Weikart, 1986, p. 33)

The recall segment of the sessions allowed each student to indicate what he or she did during the work time and might have included:

naming the area, object, or child he/she worked with
describing what he/she did and how he/she did it
pantomiming work time activity
singing about work time activity
showing a product made at work time
tracing an object used at work time
drawing or painting a picture of work time activity or object used

(Weikart, 1986, p. 34)

The teacher sat with a small group of children at their level and talked with the children:

asked what they did
gave suggestions
gave each child time to respond
acknowledged each's child's activity
provided language to help each child describe his activity
helped children think through problems that came up

(Weikart, 1986, p. 3)

APPENDIX B

COPIES OF PERMISSION LETTERS

PERMISSION TO WEAR AUDITORY AMPLIFICATION

PERMISSION TO PARTICIPATE IN THE STUDY

ORANGE COUNTY SCHOOLS
Hearing Impaired Program

Use of Auditory Amplification

Auditory amplification equipment is provided in the school for hearing impaired students in accordance with State Board of Education Rules S.B.
6-A.3013 (9) (c)9)d).

The student's name is on his assigned unit and it is set to compensate for his hearing loss according to his latest audiogram. Earmolds are provided. When a students uses the classroom amplification, his personal hearing aid is removed.

If you have any questions regarding this procedure or any objections to your child's use of this amplification system, please contact your child's teacher immediately.

- -

Please detach and return to the teacher.

I give my permission for _____ to use the
Student's Name

classroom auditory amplification system provided by Orange County Schools, and to have earmolds made for use with the amplification system.

_____ _____
Date Parent or Guardian

AUD
Form #32
6/81

Kaley Elementary
August 24, 1987

Dear Parents:

The Speech and Language classroom will participate in a language study this Fall. Mrs. Kissel will be selecting students for this study.

Students selected will go to the Speech class for two one-hour periods each week. During these sessions, students will be videotaped and their language will be analyzed for number of words and number of different words. They will also participate in a special program designed to increase the quality and quantity of their language.

Mrs. Kissel would sincerely appreciate your child's participation in the study. As of this time, she doesn't know which students will meet pre-set criteria for participation, but will let you know as soon as possible after the permission slips are back. She will also consult with you at the end of the study about language changes found from the study for your child.

_____ Yes, I give my permission.

_____ No, I don't give my permission

for _____ to participate in the

Language study.

_____
Parent Signature

_____
Date

APPENDIX C

MEAN DATA FOR FOUR DATA POINTS FOR EXPERIMENTAL AND CONTROL GROUPS FOR SRT-SAT, TTR, MLU-W, MLU-M

MEAN DATA POINTS FOR FOUR DATA POINTS FOR EXPERIMENTAL AND CONTROL GROUPS FOR C&I #DWR, C&IT#W, TU#DWR, TUT#W

APPENDIX C

BASELINE DATA FOR DATA POINT #1
SRT TTR MLU-W MLU-M

EXPERIMENTAL					CONTROL				
SUBJECT	SRT	TTR	MLU-W	MLU-M	SUBJECT	SRT	TTR	MLU-W	MLU-M
1	30	.59	2.62	3.24	9	20	.65	2.10	2.20
2	30	.84	4.02	4.08	10	40	.61	3.52	3.82
3	20	.55	4.48	5.22	11	25	.70	2.50	2.93
4	30	.56	5.39	5.61	12	25	.50	4.07	4.25
5	20	.73	1.69	1.71	13	10	.63	2.57	2.57
6	50	.72	2.28	2.28	14	20	.56	4.61	4.71
7	15	.42	1.99	1.99	15	15	.40	4.92	5.17
8	30	.80	1.50	1.50	16	30	.80	1.67	2.00

TOTALS IN MEANS:	EXPERIMENTAL	CONTROL
SAT-SRT	28.13	23.13
TTR	**.65**	**.61**
MLU-W	**3.00**	**3.25**
MLU-M	3.20	3.46

APPENDIX C

FIFTH SESSION DATA FOR DATA POINT #2
SRT TTR MLU-W MLU-M

EXPERIMENTAL					CONTROL				
SUBJECT	SRT	TTR	MLU-W	MLU-M	SUBJECT	SRT	TTR	MLU-W	MLU-M
1	30	.45	3.53	3.60	9	20	.32	4.65	4.82
2	30	.34	3.77	3.86	10	40	.54	3.17	3.17
3	20	.29	6.47	6.68	11	25	.59	5.44	5.56
4	30	.46	3.95	4.41	12	25	.49	5.45	5.55
5	20	.43	2.80	2.96	13	10	.43	3.33	3.47
6	50	.53	3.00	3.00	14	20	.54	3.91	3.96
7	15	.58	2.87	2.93	15	15	.44	4.73	4.87
8	30	.50	1.38	1.38	16	30	.24	2.08	3.00

TOTALS IN MEANS:	EXPERIMENTAL	CONTROL
SAT-SRT	28.125	23.125
TTR	**.45**	**.45**
MLU-W	**3.47**	**4.10**
MLU-M	3.60	4.30

APPENDIX C

TENTH SESSION DATA FOR DATA POINT #3
SRT TTR MLU-W MLU-M

EXPERIMENTAL					CONTROL				
SUBJECT	SRT	TTR	MLU-W	MLU-M	SUBJECT	SRT	TTR	MLU-W	MLU-M
1	30	.34	3.54	3.64	9	20	.36	4.50	4.59
2	30	.47	4.22	4.83	10	40	.47	3.19	3.54
3	20	.29	7.11	7.73	11	25	.52	3.52	3.52
4	30	.38	5.24	5.45	12	25	.48	5.05	5.43
5	20	.39	3.00	3.15	13	10	1.00	4.00	4.00
6	50	.43	3.11	3.26	14	20	.40	4.80	4.97
7	15	.50	2.67	2.93	15	15	.36	5.44	5.63
8	30	.52	1.41	1.45	16	30	.54	1.86	1.86

TOTALS IN MEANS:	EXPERIMENTAL	CONTROL
SAT-SRT	28.13	23.13
TTR	**.42**	**.52**
MLU-W	**3.79**	**4.05**
MLU-M	4.06	4.19

APPENDIX C

FIFTEENTH SESSION DATA FOR DATA POINT #3
SRT TTR MLU-W MLU-M

EXPERIMENTAL					CONTROL				
SUBJECT	SRT	TTR	MLU-W	MLU-M	SUBJECT	SRT	TTR	MLU-W	MLU-M
1	30	.56	5.40	5.67	9	20	.42	3.91	4.06
2	30	.52	3.16	3.19	10	40	.44	3.11	3.42
3	20	.42	6.76	7.38	11	25	.53	3.31	3.36
4	30	.44	6.38	6.78	12	25	.44	5.18	5.27
5	20	.49	3.19	3.46	13	10	.36	2.96	3.07
6	50	.42	3.07	3.15	14	20	.53	4.41	4.59
7	15	.58	2.48	2.91	15	15	.44	5.21	5.43
8	30	.48	1.32	1.32	16	30	.40	1.66	1.69

TOTALS IN MEANS:	EXPERIMENTAL	CONTROL
SAT-SRT	28.13	23.13
TTR	**.49**	**.45**
MLU-W	**3.97**	**3.71**
MLU-M	4.23	3.86

APPENDIX C

BASELINE DATA FOR DATA POINT #1

EXPERIMENTAL GROUP

Complete and Intelligible		**Total Utterances**	
Number of Different Word Roots		Number of Different Word Roots	
Total Number of Words		Total Number of Words	
SUBJECT:	#DWR	T#W	#DWR	T#W
1	8.31	15.00	9.33	16.33
2	14.67	19.00	17.67	25.33
3	24.00	45.67	24.00	45.67
4	48.00	88.67	48.67	92.00
5	9.33	15.67	12.00	19.67
6	6.67	8.33	9.00	13.33
7	4.67	7.00	7.33	11.00
8	1.00	1.33	1.33	1.67
TOTALS:	Σ=163.67	200.67	129.33	225.00
Mean:	20.46	25.08	16.17	28.12

APPENDIX C

FIFTH SESSION DATA FOR DATA POINT #2

EXPERIMENTAL GROUP

Complete and Intelligible	**Total Utterances**
Number of Different Word Roots	Number of Different Word Roots
Total Number of Words	Total Number of Words

SUBJECT:	#DWR	T#W	#DWR	T#W
1	34	99	39	124
2	36	76	52	144
3	92	320	104	376
4	66	173	66	173
5	65	159	71	201
6	47	109	55	149
7	40	80	44	132
8	16	31	17	42
TOTALS:	Σ= 396	1047	448	1341
	Mean: 49.50	130.88	56	167.63

APPENDIX C

TENTH SESSION DATA FOR DATA POINT #3

EXPERIMENTAL GROUP

Complete and Intelligible		**Total Utterances**	
Number of Different Word Roots		Number of Different Word Roots	
Total Number of Words		Total Number of Words	
SUBJECT:	#DWR	T#W	#DWR	T#W
1	24	53	27	59
2	28	83	31	124
3	63	220	70	237
4	67	146	70	154
5	56	159	71	201
6	47	129	59	147
7	25	43	30	71
8	9	18	11	40
TOTALS: Σ=	296	737	333	942
Mean:	37	92.13	41.63	117.75

APPENDIX C

FIFTEENTH SESSION DATA FOR DATA POINT #4

EXPERIMENTAL GROUP

	Complete and Intelligible		**Total Utterances**	
	Number of Different Word Roots	Total Number of Words	Number of Different Word Roots	Total Number of Words
SUBJECT:	#DWR	T#W	#DWR	T#W
1	45	81	47	86
2	51	98	73	243
3	104	250	107	260
4	90	204	90	204
5	92	220	98	315
6	67	166	70	193
7	33	57	37	78
8	14	29	14	51
TOTALS: Σ=	496	1105	536	1430
Mean:	62	138.13	67	178.75

APPENDIX C

BASELINE DATA FOR DATA POINT #1

CONTROL GROUP

	Complete and Intelligible		**Total Utterances**	
	Number of Different Word Roots		Number of Different Word Roots	
	Total Number of Words		Total Number of Words	
SUBJECT:	#DWR	T#W	#DWR	T#W
9	23.67	38.33	24.33	40.33
10	15.00	45.00	17.00	30.67
11	13.00	19.00	13.33	19.33
12	35.00	70.00	36.33	73.00
13	8.00	18.67	8.33	21.00
14	37.33	66.00	39.33	70.33
15	45.33	116.33	47.67	122.00
16	2.00	3.00	2.00	3.00
TOTALS:	Σ=179.33	376.33	188.33	379.67
	Mean: 22.42	47.04	23.54	47.46

APPENDIX C

FIFTH SESSION DATA FOR DATA POINT #2

CONTROL GROUP

	Complete and Intelligible		**Total Utterances**	
	Number of Different Word Roots	Total Number of Words	Number of Different Word Roots	Total Number of Words
SUBJECT:	#DWR	T#W	#DWR	T#W
9	36	99	37	104
10	39	83	46	108
11	53	102	53	107
12	51	106	51	106
13	4	4	9	41
14	68	168	68	178
15	62	174	64	179
16	7	13	8	16
TOTALS: Σ=	320	749	336	839
Mean:	40	93.63	42	104.83

APPENDIX C

TENTH SESSION DATA FOR DATA POINT #3

CONTROL GROUP

	Complete and Intelligible		**Total Utterances**	
	Number of Different Word Roots	Total Number of Words	Number of Different Word Roots	Total Number of Words
SUBJECT:	#DWR	T#W	#DWR	T#W
9	29	79	33	129
10	31	57	35	76
11	29	49	29	49
12	53	109	53	109
13	21	50	24	89
14	49	90	51	100
15	63	142	70	156
16	6	25	7	33
TOTALS: Σ=	281	601	302	741
Mean:	35.13	75.13	37.75	92.63

APPENDIX C

FIFTEENTH SESSION DATA FOR DATA POINT #4

CONTROL GROUP

Complete and Intelligible		**Total Utterances**	
Number of Different Word Roots		Number of Different Word Roots	
Total Number of Words		Total Number of Words	
SUBJECT:	#DWR	T#W	#DWR	T#W
9	56	133	56	140
10	52	118	64	146
11	56	106	64	127
12	76	171	79	186
13	30	83	35	109
14	75	141	77	144
15	64	146	64	156
16	19	48	22	68
TOTALS:	Σ= 428	946	461	1076
	Mean: 53.50	118.25	57.63	134.50

APPENDIX D

SETTINGS FOR THE FM EQUIPMENT

APPENDIX D

FITTINGS FOR THE FM EQUIPMENT

SUBJECT	GAIN LEFT EAR	GAIN RIGHT EAR	SPL	TONE	FM	TONE	SPL
1	L/4	R/4	1	5	8	5	1
2	L/-	R/8	-	-	8	6	4
3	L/7	R/7	2	5	8	5	2
4	L/8	R/8	1	5	8	5	1
5	L/7	R/7	4	6	8	6	4
6	L/8	R/6	1	4	8	6	1
7	L/8	R/8	1	5	8	5	1
8	L/	R/	SAT				
9	L/5	R/5	4	6	8	6	4
10	L/-	R/8	-	-	8	6	4
11	L/-	R/8	-	-	8	5	4
12	L/-	R/7	-	-	8	1	1
13	L/6	R/6	2	5	8	5	2
14	L/-	R/7	-	-	8	4	1
15	L/3	R/3	1	1	8	1	1
16	L/	R/	SAT				

APPENDIX E

ANOVA FOR THE SALT ANALYSES

APPENDIX E

ANOVA FOR THE SALT ANALYSES

	MAIN EFFECT OF TREATMENT		MAIN EFFECT OF TIME		MAIN EFFECT OF INTERACTION OF TREATMENT AND TIME	
	F	df	F	df	F	df
MLU-W	.11	1	5.04	3,42	1.20	3
MLU-M	.06	1	4.78	3,42	1.74	3
TTR	.01	1	8.15	3,42	1.34	3
C&I#DWR	.09	1	46.05	3,42	2.69	3
C&IT#W	.24	1	26.75	3,42	2.56	3
TU#DWR	.24	1	47.11	3,42	3.14	3
TUT#W	l.l6	1	28.59	3,42	3.28	3
Alpha level needed for significance						
.10	2.84		2.23		2.23	
.05	4.08		2.84		2.23	
.01	7.31		4.31		4.31	

APPENDIX F

CRITICAL VALUES FOR NEUMAN-KEULS MAIN EFFECT OF TIME FOR THE SALT ANALYSES

CRITICAL VALUES FOR NEWMAN-KEULS MAIN EFFECT OF THE INTERACTION OF TREATMENT AND TIME FOR THE SALT ANALYSES

APPENDIX F

CRITICAL VALUES FOR NEWMAN-KEULS MAIN EFFECT OF TIME FOR THE SALT ANALYSES

VARIABLE	DP#1	DP#2	DP#3	DP#4
MLU-W	3.12_{b}*	3.78_{a}	3.92_{a}	3.84_{a}
MLU-M	3.33_{b}	3.95_{a}	4.12_{a}	4.04_{a}
TTR	$.63_{b}$	$.45_{a}$	$.47_{a}$	$.47_{a}$
C&I#DWR	18.48_{a}	44.75_{b}	35.06_{c}	57.75_{d}
C&IT#W	36.06_{b}	112.25_{a}	83.63_{c}	128.19_{a}
TU#DWR	19.85_{d}	49.00_{c}	39.69_{b}	62.31_{a}
TUT#W	37.79_{b}	136.25_{a}	105.19_{c}	156.63_{a}

*Means with common subscripts do not differ.

APPENDIX F

CRITICAL VALUES FOR NEWMAN-KEULS MAIN EFFECT OF THE INTERACTION OF TREATMENT AND TIME FOR THE SALT ANALYSES

VARIABLE	DP#1	DP#2	DP#3	DP#4
TU#DWR				
EXPERIMENTAL	16.17_{a}*	56.00_{d}	41.63_{e}	67.00_{c}
CONTROL	23.54_{b}	42.00_{e}	37.75_{e}	57.63_{d}
TUT#W				
EXPERIMENTAL	28.12_{a}	167.63_{d}	117.75_{c}	178.75_{d}
CONTROL	47.46_{a}	104.83_{c}	92.63_{c}	134.50_{c}

*Means with common subscripts within each analysis do not differ.

APPENDIX G

MEANS OF FOUR DATA POINTS FOR THE SEVEN SALT ANALYSES

APPENDIX G

MEANS OF FOUR DATA POINTS FOR THE SEVEN SALT ANALYSES

SALT LANGUAGE ANALYSES	ANALYSES DATA POINTS			
MLU-W	**DP#1**	**DP#2**	**DP#3**	**DP#4**
Experimental: With visual reminder	3.00	3.47	3.79	3.97
Control: Without visual reminder	3.25	4.10	4.05	3.17
MLU-M				
Experimental: With visual reminder	3.20	3.60	4.06	4.23
Control: Without for visual rem	3.46	4.30	4.19	3.86
TTR				
Experimental: With visual reminder	.65	.45	.42	.49
Control: Without visual reminder	.61	.45	.52	.45
C&I#DWR				
Experimental: With visual reminder	20.46	49.50	37.00	62.00
Control: Without visual reminder	22.42	40.00	35.13	53.50
C&IT#W				
Experimental: With visual reminder	25.08	130.88	92.13	138.13
Control: Without visual reminder	47.04	93.63	75.13	118.25
TU#DWR				
Experimental: With visual reminder	16.17	56.00	41.63	67.00
Control: Without visual reminder	23.54	42.00	37.75	57.63
TUT#W				
Experimental: With visual reminder	28.12	167.63	117.75	178.75
Control: Without visual reminder	47.46	104.83	92.63	134.50

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