A Comparative Evaluation of Listening Skills of Hearing Impaired Preschool Children Treated by the Home Auditory Program, Utah Project SKI*HI, 1972-75

Susan Gail Crant Carne

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A COMPARATIVE EVALUATION OF LISTENING SKILLS OF
HEARING IMPAIRED PRESCHOOL CHILDREN TREATED
BY THE HOME AUDITORY PROGRAM,
UTAH PROJECT SKI*HI, 1972-75

by

Susan Gail Crant Carne

A thesis submitted in partial fulfillment
of the requirements for the degree
of
MASTER OF SCIENCE
in
Communicative Disorders

Approved:

Committee Chairman

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UTAH STATE UNIVERSITY
Logan, Utah

1977
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For his assistance and patience during the years of work, I wish to express a special feeling of appreciation to my husband, Cy. His loving support, and that of my parents, Mr. and Mrs. C. C. Crant, has been essential to the achievement of my goals.

Susan Gail Crant Carne
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ABSTRACT

A Comparative Evaluation of Listening Skills of Hearing Impaired Preschool Children Treated By the Home Auditory Program, Utah Project SKI*HI, 1972-75

by

Susan Gail Crant Carne, Master of Science Utah State University, 1977

Committee Chairman: Thomas S. Johnson, Ph.D.
Department: Communicative Disorders

The purpose of this paper was to evaluate the effectiveness of the Home Auditory Program of Project SKI*HI on the listening skills of its students during the years 1972-1975.

The scores of two groups of children, as measured on the SKI*HI Listening Skills Scale were compared. The statistical evaluation indicated that:

1. Significant improvements in listening skills were demonstrated by one group of children during three to eleven months of treatment, and

2. The scores of this treated group were significantly superior to the non-treated group, despite a similarity in age and degree of hearing loss between the two groups.

(68 pages)
CHAPTER I

INTRODUCTION

Given normal hearing, a child enters school at age five with a highly sophisticated language system. The acquisition of this language system has occurred largely in his home. The model for his language development has been, for the most part, his parents and family. His language has developed naturally and easily--because this child hears.

Given impaired hearing, a child enters school at age five without an adequate language system. He must then begin the acquisition of a language system in an artificial, structured environment, his classroom. The primary model for this language development will be his teacher. An inferior language system will develop artificially and with extreme difficulty--because this child does not hear.

Background

The Utah Project SKI*HI program was created in 1972 by its director, Thomas C. Clark, to aid the preschool hearing-impaired child in establishing his language system as naturally and easily as possible. "The Project attempts to identify the (hearing-impaired) child in the first few months of life, make appropriate environmental and prosthetic treatment and provide a parent home program that will make possible a maximum linguistic environment for the child."

(Project SKI*HI Manual, 1975). Funded by the United States Office
of Education, Bureau of Education for the Handicapped, the goal of the program was (and continues to be) to create home environments which are optimally conducive to language development in early life.

Project SKI*HI was developed with the hope that future hearing-impaired children would begin school with a basic language system. They would have learned, as preschoolers at home, to consistently wear proper amplification and to maximally utilize their residual hearing. They would have learned, before beginning school, that words have meaning and that the need to communicate is a strong one.

Children enrolled in Project SKI*HI progressed through three subprograms, all integral to the development of language:

1. The Home Hearing Aid Program taught the parents the fundamentals of hearing and hearing loss, and trained them in management of the hearing aid(s). The goals of this initial program were that, in eight to ten weeks, the parents would become competent in managing the aid, and that the child would fully accept the aid and wear it during all his waking hours.

2. The Home Auditory Program taught the parents the fundamentals of listening skills development, and guided them in teaching their children to optimally use his residual hearing. The goal of this program was that a child would demonstrate increased awareness

---

1At the end of the three year period of funding by the Federal Government, the State of Utah took over funding the project. While Thomas C. Clark has remained as director, the project name has been changed to the Utah Parent Infant Program. It continues to provide home services similar to those provided by Project SKI*HI.
of sound and its meaning, and progress through a hierarchy of listen­
ing abilities. (See Appendix A.)

3. The Home Language Program taught the parents the funda­
mentals of language development. The goal of this program was to
make home activities linguistically meaningful to the hearing-impaired
child. (See Appendix B.)

Each family was assigned a "Parent-advisor" whose job it was to
guide them in creating the optimal home environment for the child.
Hour-long weekly visits by the parent-advisor were held in the child's
home, during which time progress was monitored and reported. (See
Appendix C.) The progress of the child and his parents was closely
supervised by the professional project staff, and graduation from
the program was held at the appropriate time.

Purpose

The purpose of this study was to evaluate the effectiveness of
the Home Auditory Program of Project SKI*HI on the listening skills
of its students, during the years 1972-1975.

The SKI*HI Home Auditory Program

To understand the importance of hearing to the development of
language is to understand the importance of Project SKI*HI's Home
Auditory Program.

The child who suffers a hearing loss is deprived of
the source of this language development--hearing. Without

treatment of the hearing disorder and modification of the
home language environment, this child will either have
severe language disorders or no language at all. This
language disorder begins at birth and is compounded with age. (Project SKI*HI Manual, p. 38, 1975)

Hearing-impaired children can learn to use their residual hearing to aid them in acquisition of language. Numerous researchers (Wedenberg, 1954; Pollack, 1970; Downs, 1974) report tremendous success in aural rehabilitation even among the profoundly deaf. Because it has been shown (Downs and Northern, 1974; Watson, 1964; and Pollack, 1970) that the critical time for language acquisition is the first years of life, and because it had been shown (Ling, 1975; Grammatico, 1975) that all hearing-impaired children can benefit from auditory training, the project decided to develop a strong auditory training program for its preschool students. Whether a child eventually developed his language aurally or manually (total communication), the Project placed great emphasis on teaching each child to optimally use his residual hearing.

According to the Project SKI*HI Manual, a complete auditory program for hearing-impaired children had to have the following components:

1. Early identification
2. Early fitting of amplification
3. A means of evaluating the infant for the correct aid
4. Operable aids being worn full time by the child
5. A means of teaching the child to use his residual hearing.

The Home Hearing Aid Program provided the first four components; the Home Auditory Program the fifth.
Communication skills

As the Home Auditory Program was initiated and the child began to learn to listen, the parents began to learn how to effectively communicate with their child. Several "Communication skills" were incorporated into the Auditory Program to aid the parents:

It is essential that parents learn to communicate with their child while the child is learning to listen. During the first seven auditory levels, the child is learning to respond to sounds at varying levels and distances and making environmental discriminations. At this time, the child will most likely be at a pre-language level. If parents learn how to develop basic communication skill with their child while the child is learning how to listen, they will be encouraging the child's language development. So while the parents are teaching their children the first six auditory levels, they are also establishing communication by doing such things as providing ad concham stimulation, babbling stimulation, using communicative clues, parallel talk, etc. When the child reaches the seventh auditory level, gross vocal discrimination, parents are stimulating the child with onomatopoeia sounds and functional words. It is at this time that some language principles such as frequency are introduced. When the child reaches the fine speech discrimination level, parents are providing consonant and vowel stimulation. They are also incorporating additional language principles such as expansion. (Project SKI*HI Manual, p. 87, 1975)

(See Appendix A for further explanation of the nine auditory levels.)

Some communication skills taught to the parents along with beginning auditory skills were:

1. Correct conversational distance with minimal background noise
2. Ad concham stimulation
3. Babbling stimulation
4. Communicative clues
5. Parallel talk
Auditory clues

An important lesson taught the parents and practiced in the Auditory Program was the use of "auditory clues." As described in the manual:

Auditory clues are used to encourage the child to listen carefully for sounds. They are devices to "tune-in" a child to sound.

Clues constitute such things as bareing the ear and cocking the head, pointing to the ear and saying listen, holding up dog's ear or a toy's ear indicating "listen", covering both ears with both hands, etc. Auditory levels two through five are always first taught with clues. Then the child listens to sounds without clues and then with distraction.* Auditory clues are used with gross environmental discrimination, gross vocal discrimination, and fine speech discrimination if the child is not listening and needs clues as a reminder to listen.

*For example, if the child is being taught to localize to the telephone, the skill is first taught with clues - "Listen, Johnny, listen carefully." Second, the sound would be presented without clues. Lastly, Johnny would be distracted (food, toys, etc.) while the sound was presented. (Project SKI*HI Manual, p. 92-93, 1975)

Steps in teaching auditory skills

The teaching of each auditory level was based on the concept that the parent-advisor model the skill to the parent and then the parent perform the skill for the parent-advisor. As described in the manual, the following six steps were used in teaching the parents the auditory skills:

1. Parent advisor describes the skill. Usually this description involves what sound the mother will use, how to use clues, how to present the sound, what responses to look
for in the child, what to do if the child responds, and what to do if the child doesn't respond.

2. Parent advisor models the skill using the hearing impaired child.

3. The mother performs the skill with the child.

4. Parent advisor reinforces specific things mother does well.

5. Parent advisor and mother discuss mother's performance, i.e., "How did mother feel about her performance?" "How would she have done it differently?", "Where and when can you use the skill during the week?" (Specific time and places) etc.


Criteria for moving to a higher auditory level

The following guidelines were used in determining the correct time for a child to move to a higher auditory level:

If a child is on one auditory level (i.e., localization) he should respond (localize) without clues to three or more different sound stimuli at a 50% higher consistency level before the next auditory level is initiated. For example, the child would localize to knocking, his name when called, and an electrical appliance (without clues) half or more of the times during presentation of these sounds before moving on to "distances." It is not necessary for the child to respond (localize) to three or more stimuli with distraction since distraction is not a constant element during the child's day. However, since distraction often occurs, activities should be presented on each level that incorporates mild to strong distraction and the child should respond at least once under distraction to two to three different sound stimuli. (Project SKI*HI Manual, p. 92, 1975)

Statement of the problem

It was clear to the author that the rationale behind the establishment of the Auditory Program was well thought out. However,
the question remained: How effective was the Program in improving children's listening skills? Did children who had been through the Program have better use of their residual hearing than similar children who had not been through it?

Objectives

This statistical evaluation of listening skills made three comparisons. Using two groups of subjects, this study

1. Showed differences in pre-treatment listening skills scores and post-treatment listening skills scores of Group A;
2. Showed differences in pre-treatment listening skills scores of Group A and pre-treatment listening skills scores of Group B;
3. Showed differences in post-treatment listening skills scores of Group A and pre-treatment listening skills scores of Group B.

The author wished to show whether or not a significant change in listening skills occurred in Group A after they had been treated by Project SKI*HI. Did Group A improve their listening skills? Also, she wished to show the differences in listening skills of the two groups before either had treatment. Did these two groups begin treatment with similar skills, despite their age differences? Finally she wished to show that significant differences in listening skills were demonstrated by two similar groups of children. How did the group who received treatment compare with the group who didn't?
This study answered three questions:

1. Did the listening skills of the children in Group A change during their treatment period? A Post-

2. Did these two groups of children begin treatment with similar listening skills?

3. Were the listening skills of Group A (after treatment) different than those of Group B (before treatment)?

![Figure 1. Questions answered by study](image)

**Definition of terms**

Listening skills were measured on the SKI*HI Hierarchy of Listening Skills Checklist (see Appendix A) as observed by each child's Parent-advisor.

The Parent-advisor was asked to check (√) the stage at which the child had responded to for three consecutive weeks. If the child moved through a new stage each week, then they checked (√) the highest level achieved.
Stages of auditory development. Check the highest level achieved.

1. alerting--evidenced by cessation of activity, widening of eyes, pointing to ear or the like immediately after a sound is produced.

2. searching--evidenced by looking around for sound source immediately after presentation of sound.

3. localization--evidenced by finding the sound source without having looked at the object or event that produced it.

4. distance hearing--evidenced by localizing to a sound produced from a source at least 20 feet away.

5. elevation hearing--evidenced by localizing to a sound produced at an altitude requiring the child to look up and down--if up including a sound made at least 20 feet away

6. gross sound discrimination--evidenced by the child identifying one noisemaker from another without looking--close distance--e.g., a horn and a rattle.

7. voice discrimination--evidenced by the child identifying the father's voice from the mother's voice without looking--close distance.

8. tonal discrimination--evidenced by the child identifying one tonal pattern from another, e.g., an angry voice from a soothing voice--close distance.

9. articulation discrimination--evidenced by the child identifying one word from another word when both are spoken with the same tonal pattern, e.g. "Show me the ball. Show me the fish." . . . close distance. Note any new auditory responses during the month.

Figure 2. Listening Skills Checklist
2. Treatment, as used in this study, referred only to home intervention services provided the children by Project SKI*HI Home Auditory Program. Properly fitted with hearing aids, the child would learn to make maximum use of his residual hearing.

Hypotheses

The specific hypotheses tested in this study were:

1. Group A's pre-treatment listening skills do not differ significantly from Group A's post-treatment listening skills (see Appendix E).

2. Group A's pre-treatment listening skills do not differ significantly from Group B's pre-treatment listening skills (see Appendix F).

3. Group A's post-treatment listening skills do not differ significantly from Group B's pre-treatment listening skills (see Appendix G).
CHAPTER II
REVIEW OF LITERATURE

Project SKI*HI developed its Auditory Program with the beliefs that listening skills are developmental and that early auditory training for hearing impaired children is imperative for development of a language system. The author attempted in this Chapter to uncover evidence in the literature which supported the ideas that:

1. Auditory training is important and necessary for speech and language development.
2. Critical periods exist for language and speech development. Thus early intervention is necessary for effective listening training.
3. Amplification, alone, will not teach a child to develop his residual hearing.
4. Auditory training is useful and appropriate for even the profoundly deaf.

This being one of the first published reports on the accomplishments of Project SKI*HI, the literature reviewed for this study could not be restricted to documentations of the Project. The author felt, however, that the literature which was reviewed strengthened the significance of her findings.

The importance of auditory training

Evidence pervades the literature that auditory training during early life in imperative for the development of language in hearing-impaired children.
Berg (1976, p. 161) concluded after his extensive research review that

The utilization of residual hearing offers great possibilities for eliminating or alleviating the underdeveloped listening, speech, language, and academic skills of hearing-impaired children in the special classes of the nation's schools.

He endorses the Utah Project SKI*HI as an effective model for delivery of preschool services throughout the country.

Oyer and Frankman (1975, p. 216) after studying research reports on programs for young deaf children, concluded:

... there seems no doubt that substantial improvement can occur with auditory training; what appears to be still needed is a coordinated program based on research findings that would allow a determination of the content and progression of skills that should be introduced to the child.

Withrow (1975, p. 415) agrees: "The development of the child's residual hearing should be a foremost component of any educational program for the hearing-impaired."

Grammatico, (1975, p. 303, 304) concurs that the development of listening skills is an ongoing process which should begin when the hearing-impaired child is still an infant. It should be a continuous process to be emphasized during the child's entire waking day. "Spoken language is the focal point of all auditory training sessions."

In 1967, Wedenberg again published his belief that early auditory training is vital even to the children with no measurable hearing. His original report (1954) on the same subject, included the results of his study of thirty-six severely hard-of-hearing children, which was carried out from 1939 to 1953. The period of auditory training that these children received varied from 3/4 to 8-1/2 years. Although he
did not statistically compute the children's improvement in listening skills, he did conclude that, on the whole, all pupils profited by the training. In addition to improved speech results, the children improved their social behavior and adaptation, speech-reading abilities, thinking abilities, learning abilities, and intelligence quotients.

DiCarlo (1958) proposed a quantitative, objective, method to measure the effects of auditory training based on delayed auditory feedback. He reasoned that if severely hearing-impaired children were using auditory clues as a result of training, delayed auditory feedback would have an effect on their speech as it does on the speech of normal hearing people. The test on the speech of twenty-three hearing-impaired children showed that the children who had had auditory training were more affected in their speech by delayed auditory feedback than those without training. As well as proposing a method of monitoring the effectiveness of auditory training, DiCarlo contributed support to the argument that auditory training is necessary for speech development.

Lach et al. (1970) reported the results of their study designed to show what effect auditory training had on speech development. They periodically evaluated the development of speech in seven young deaf children throughout a parent guidance rehabilitation program. Data was collected on voice quality, vowel and consonant usage, and number of words produced.

Before auditory training, two of the children had very deviant and five had slightly deviant voice qualities. After twelve months of auditory training, no child had markedly deviant voice quality and five of the seven were judged to have normal voices.
Whether or not the auditory training was the determining factor involved in this successful program would be difficult to conclude. However, Lach et al. did seem to feel the auditory training was the main cause of the changes.

Several other authors maintain that listening training is vital for speech and language development (Griffiths, 1974; Sanders, 1972; and Dale, 1967). Griffith (1969) stated that children who receive auditory training after age six never really learn to use their hearing for speech and language.

The importance of early intervention

Many of the current designs for administering treatment to the hearing-impaired, including that of Project SKI*HI, presuppose an urgency for early intervention.

Wedenberg (1954, p. 65) not only favored intensive auditory training for children, he strongly recommended early intervention:

It is easiest for a child to learn to speak during the first five years of life. After that time it becomes considerably more difficult; the "teachable moment" has passed to a great extent. Methodic auditory training should be initiated as soon as hearing loss is diagnosed, and, the greater the hearing loss, the more important this becomes . . . A child is never too young to listen.

Wedenberg felt confident that a profoundly hard of hearing child never learns to speak spontaneously without daily methodic training.

Young (1976, p. 71) expressed this viewpoint based on his experiences:

Readiness periods for development of listening skills and oral language are largely confined to the first
two years of life. Later identification—beyond one year—results in stimulus deprivation that leads to central nervous system processing problems that cannot often be significantly improved by intensive teaching or use of hearing aids. The poor language outcome of so many educationally deaf children resides in late identification rather than lack of, or poor teaching methods.

Bricker and Bricker (1974, p. 432) concur:

The infant and prelinguistic child are not simply sitting around listening to well formed sentences. They are exploring their environment and synthesizing a sensorimotor account of it all. Consequently, an early intervention program in language should begin during early infancy rather than in the middle of the second year of life.

Watson's study in 1964 reported that there are optimum maturational stages for development of speech and language through which hearing children pass in the course of their development. The closer in time to normal that the hearing-impaired child can reach these stages, the more likely is his linguistic ability to make good progress.

Pollack (1970, p. 68) agrees: "It is (also) true that the closer we follow the normal patterns of development, the better the results will be. Nature proceeds in an orderly sequence."

Berg (1976, p. 90) refers to the 1971 Simmons study which suggested why special assistance should be provided to hearing-impaired children from infancy. She noted that it is during the first years of life that language learning ordinarily advances rapidly. She also indicated that language is inextricably linked with auditory experiences. Simmons concluded that delayed identification of hearing loss and delayed utilization of residual hearing prolong the time it takes a child to progress through the various stages of language development.
These studies and others support the theory of "critical periods." As defined by Rohwer, 1976, a critical period is a span of time during which an organism must have experiences of a particular kind if he ever is to acquire certain skills. Such periods are usually located very early in the organism's life span. Horton (1974, p. 470), referring to general human development, stated,

The experiences and stimulation, or lack of it, during the early (and apparently critical) periods of development can result in profound and enduring effects upon the neurological, physiological, and behavioral capabilities of the human.

Northern and Downs (1974) interpret the critical period theory as implying and effect which becomes more and more devastating with the duration of deprivation following the onset of the period. They agree that, regarding hearing loss, the effects of delayed intervention are obvious enough to justify early treatment. Moores (1967, p. 3) lends this support to the existence of a critical period:

The specific ability to develop language appears to hit a peak around the ages of 3 to 4 and tends to decline steadily thereafter. Perhaps any language development program that is initiated after the age of 5, no matter what methods are used, is doomed to failure for the majority of deaf children.

Need for treatment in addition to amplification

One of Grammatico's (1975, p. 304) strong assertions is that "Listening will not develop without educational intervention. Simply wearing amplification will not result in development of residual hearing." She names the key factors in the acquisition of sophisticated listening skills as sound awareness, discrimination, intonation patterns (voice melody), auditory memory, and localization of sound.
Parents of hearing-impaired children are often disappointed when an obvious immediate effect does not materialize after hearing aids are fitted. The misconception that hearing aids are a "cure-all" for hearing loss is exposed in the literature by several authors (Hirsh, 1970; Streng, et al., 1958; Whitnall and Fry, 1970). It is not enough to "bathe the child in sound."

Hard of hearing children who wear hearing aids for the first time emerge from a relatively quiet world into one of noisy confusion. All around them are sounds which they do not recognize. Often these children express amazement when they first hear water flushing in the bathroom, the refrigerator's motor humming, and many other household sounds that most people take for granted (Streng et al., 1958).

The child must be taught which sounds can be relegated to background, which sounds are immediately pertinent, and what meaning those sounds have. The infant with impaired hearing must be exposed to sound--patterned or changing sound. It should be made absolutely clear to parents that simply installing a hearing aid and thus "bathing the child in sound" is not a sufficient start in an auditory training program. The sound environment must be carefully planned.

Usefulness of auditory training even for the profoundly hearing-impaired

Carhart (1947) professed before the advent of modern hearing aids that even when the remnant of hearing is small, auditory training can be used at least as an aid in developing command of language, in instructing the child to speak, and in encouraging better adjustment to the world of hearing people. Rollins (1972, p. 426-427) believes
auditory training is the key to helping the hearing-impaired child make maximum use of his limited hearing and gain full benefit from amplification:

Children must be taught to listen, to be aware of various sounds, and to learn to distinguish between them . . . . Residual hearing, even if there is only very little, is extremely precious. It can provide the child with a vital link to the world around him—because he can be taught to hear and to understand some of the sounds in that world. It is especially helpful in his language development—both in his understanding of the language of others and in his ability to express himself.

Several researchers support the idea that auditory training is appropriate for even the most profoundly hearing-impaired children.

The knowledge that deaf children, though they are unable to interpret speech by hearing, can profitably use even a tiny bit of hearing to advantage should make a significant contribution to educational practice. (Streng et al., 1958)

Hopkins and Hudgins (1953) suggest that even though it is not possible to predict from the audiogram how much a child will profit from auditory training, all acoustically-handicapped children seem to derive some benefit from it and should have every opportunity to continue training throughout their school lives.

Whetnall and Fry (1970, p. 116) too felt that even the severely involved child could benefit from listening training: "Few, if any, deaf children have absolutely no hearing at all: all or very nearly all, have at least some residual hearing. The object of auditory training is to enable the child to make the fullest possible use of this residual hearing, which is perhaps better described as 'usable' hearing. Without adequate auditory training this usable hearing becomes useless.
Ling (1975, p. 64) supports the theory that early auditory training is necessary and important for all hearing-impaired children. Some hearing impaired children can acquire normal speech communication skills through the use of hearing aids. But the greater the loss, the less chance there is of completely natural speech acquisition; and the later the beginning of instruction, the greater becomes the need for skilled speech teaching. Total deafness is rare, and hearing—however limited—is the most effective modality for teaching most aspects of speech.

Summary

Evidence exists in the literature that:

1. Auditory training is important and necessary for speech and language development;

2. Critical periods exist for language and speech development. Thus early intervention is necessary for effective listening training;

3. Amplification is not enough, children must be taught to use their residual hearing;

4. Auditory training is useful and appropriate for even the profoundly deaf.
The data for this study was extracted from the case histories, audiological reports, and parent-advisor monthly reports collected by the Utah Project SKI*HI office from 1972 to 1975. These files are located at the Office of the Utah Parent-Infant Program, Utah School for the Deaf, 846 Twentieth St., Ogden, Utah 84401.

From the files of the children served by Project SKI*HI during its first three years, fourteen children were randomly selected without regard to their listening skills. The attempt was made to locate data on as many pairs of children who "matched" in type of hearing loss, amount of hearing loss, and chronological age.

All fourteen children suffered sensori-neural hearing losses. The sample population is described in Table 1. The three parameters taken into consideration when the author paired the children for statistical purposes were (1) that the type of hearing losses were the same, (2) that the severity of their hearing losses were similar, and (3) that the children in Group A, after treatment, were within six months of age to the children in Group B, before treatment. The fact that the mean hearing loss was slightly higher for Group A strengthened the significance of the findings. The amount of time between pre- and post-data collection on the children in Group A varied from three to eleven months.

Each child's listening skills were taken from the monthly reports submitted by his parent-advisor. The parent-advisor, during her
weekly visits to the home, would observe and record the auditory behavior of the child. The highest level the child achieved in each months would be recorded on section 6 of the Monthly Parent-Advisor Evaluation Form. The parent-advisor simply recorded the highest level of listening skills, on a scale of one to nine, that the child had demonstrated during the month (see Appendix C).

Group A's scores were extracted twice: (1) from the initial monthly report, and (2) from the final monthly report. Group B's scores were extracted once: from the initial monthly report. The author tested her hypotheses by comparing these three sets of data in the following way:

2. Group A's initial report with Group B's initial report.

The statistical comparison of the scores was accomplished using the Mann-Whitney U test for the difference between two populations. This test assumes random and independent sampling with independent groups, and an underlying continuous scale of measurement. The measurement scale (in this case the Listening Skills Scale) must be at least ordinal in character.

Because of the intermittent report-writing common in the beginning months of the Project, often a period of treatment would pass before the initial monthly report. To rule out the possibility that this variable could significantly affect the outcome, the author ran a Mann-Whitney U test on the time lapse between initial treatment and initial report for each group of children (see Table 5).
Also, to rule out the possibility that the amount of hearing aid usage was the critical factor in any difference in the two groups, the author ran a Mann-Whitney U test on the amount of time per month amplification was being worn by the subjects (see Table 6).

Limitations

1. The author had no control over original data collection. The included data were extracted from the records kept by the Project SKI*HI office. To date, no reliability tests have been run on the data collection tools used.

2. Though a larger population was desirable, one could not be obtained because (a) some early children's files were incomplete and (b) the number of children that could be matched for comparison was limited.

3. Because the Project SKI*HI Scale of Listening Skills was used as the barometer of change, only children who had been judged on that scale could be included in the study. Since the scale is not in general use, only children enrolled in the Project qualified for inclusion.

4. Many parameters that could affect the validity of this evaluation could not be studied within the context of this paper. Factors such as age of identification, hearing status of family, number of siblings, cause of hearing loss, presence of other handicaps, amount of parental cooperation, sex of child, enrollment in an Oral or Total Communication program, were recognized by the author as possible influencing forces. However, the small number of
subjects available only made possible the control by matching of three variables:

A. Type of hearing loss,
B. Degree of hearing loss, and
C. Age of child.

The author was also able to minimize another possible influence on the study by comparing the time lapse between initial treatment and initial data collection for each group. Although individual matching by amount of hearing aid usage could not be done, the author compared the two groups as a whole in an effort to minimize this variable's influence on the data.

5. Because of the numerous variables not controlled in this study, definite conclusions as to the cause of changes in listening skills could not be drawn. Nor was the amount of changes found in the treated group judged. Only the fact that the treated children did demonstrate significantly different listening skills than the untreated children, was verified.

6. All subjects used in the study were residents of the State of Utah.
TABLE 1

AGE AND HEARING LOSS OF FOURTEEN SUBJECTS

<table>
<thead>
<tr>
<th>Pair</th>
<th>I.D. #</th>
<th>Age at final data collection (months)</th>
<th>Type of hearing loss</th>
<th>Hearing loss (dB HTL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>018</td>
<td>45</td>
<td>S/N*</td>
<td>110 +</td>
</tr>
<tr>
<td>2</td>
<td>001</td>
<td>33</td>
<td>S/N</td>
<td>110 +</td>
</tr>
<tr>
<td>3</td>
<td>037</td>
<td>14</td>
<td>S/N</td>
<td>110 +</td>
</tr>
<tr>
<td>4</td>
<td>039</td>
<td>47</td>
<td>S/N</td>
<td>110 +</td>
</tr>
<tr>
<td>5</td>
<td>007</td>
<td>55</td>
<td>S/N</td>
<td>95</td>
</tr>
<tr>
<td>6</td>
<td>025</td>
<td>47</td>
<td>S/N</td>
<td>85</td>
</tr>
<tr>
<td>7</td>
<td>005</td>
<td>36</td>
<td>S/N</td>
<td>60</td>
</tr>
<tr>
<td>( \bar{X} ) &amp; &amp; 39.6 &amp; 97.1 + &amp;</td>
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<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>I.D. #</th>
<th>Age at initial data collection (months)</th>
<th>Type of hearing loss</th>
<th>Hearing loss (dB HTL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>023</td>
<td>42</td>
<td>S/N</td>
<td>85</td>
</tr>
<tr>
<td>020</td>
<td>33</td>
<td>S/N</td>
<td>85</td>
</tr>
<tr>
<td>013</td>
<td>20</td>
<td>S/N</td>
<td>83</td>
</tr>
<tr>
<td>012</td>
<td>45</td>
<td>S/N</td>
<td>95</td>
</tr>
<tr>
<td>019</td>
<td>56</td>
<td>S/N</td>
<td>95</td>
</tr>
<tr>
<td>021</td>
<td>44</td>
<td>S/N</td>
<td>85</td>
</tr>
<tr>
<td>004</td>
<td>35</td>
<td>S/N</td>
<td>80</td>
</tr>
<tr>
<td>( \bar{X} ) &amp; &amp; 39.3 &amp; 86.9 &amp;</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Sensori-neural
CHAPTER IV
RESULTS AND DISCUSSION

Three hypotheses were tested using the Mann-Whitney U test for the difference between two populations.

I. The hypothesis was rejected that Group A's pre-treatment listening skills did not differ significantly from Group A's post-treatment listening skills.

The fourteen listening skills scores ranged from 2 to 9. A two-tailed alternative and the .05 level were chosen. The computed R value for the pre-treatment scores, 70.5, yielded a U value of 6.5. The computed R value for the post-statement scores, 42.5 yielded a U value of 42.5. Since the critical U values for N = 7,7 were 8 and 41, the hypothesis was rejected. (See Appendix E.)

II. The hypothesis was accepted that Group A's pre-treatment listening skills did not differ significantly from Group B's pre-treatment listening skills.

The fourteen listening skills scores ranged from 2 to 7. A two-tailed alternative and the .1 level were chosen. The computed R value for Group A, 56, yielded a U value of 21. The computed R value for Group B, 49, yielded a U value of 28. Since the critical U values for N = 7,7 were 11 and 38, the hypothesis was accepted. (See Appendix F.)

III. The hypothesis was rejected that Group A's post-treatment listening skills did not differ significantly from Group B's pre-treatment listening skills.
The fourteen listening skills scores ranged from 2 to 9. A two-tailed alternative and the .02 level were chosen. The computed R value for Group A, 33.5, yielded a U value of 43.5. The computed R value for Group B, 71.5 yielded a U value of 5.5. Since the critical U values for N = 7.7 were 6 and 43, the hypothesis was rejected. (See Appendix G.)

Due to some irregular data collection in the beginning months of the Project, some children received treatment previous to their initial reports. Therefore, their initial reports might not have reflected true listening skills as they existed at the beginning of treatment. The author ran a Mann-Whitney test on the number of months that lapsed for each group between initial treatment and initial report. It was felt that if this time lapse occurred similarly in each group, it would minimize the possibility of its influence on the scores.

The hypothesis was accepted that there was no significant difference between Group A and Group B in the amount of time lapse between initial treatment and initial report.

The fourteen time lapses ranged from 0 to 17 months. A two-tailed alternative and the .05 level were chosen. The computed R value for Group A, 37, yielded a U value of 40. The computed R value for Group B, 68, yielded a U value of 9. Since the U values for N = 7.7 are 8 and 41, the hypothesis was accepted. (See Appendix H.)

To rule out the possibility that the amount of time each group wore amplification was the critical factor, the author ran a Mann-Whitney test on this variable. If each group were wearing its hearing
aids for similar amounts of time, then the influence of this variable would be minimized.

The hypothesis was accepted that there was no significant difference between Group A, post-treatment, and Group B, pre-treatment, in the amount of monthly time that amplification was worn.

The fourteen monthly amounts ranged from 0 to 360 hours. A two-tailed alternative and the .1 level were chosen. The computed R value for Group A, 57, yielded a U value of 20. The computed R value for Group B, 48, yielded a U value of 29. Since the critical U values for N = 7,7 are 11 and 38, the hypothesis was accepted. (See Appendix I.)

Summary of results

This study indicated that:

1. After three to eleven months of treatment, the children in Group A significantly improved their listening skills (see Appendix E).

2. Group A's pre-treatment skills did not differ significantly from Group B's pre-treatment listening skills (Appendix F).

3. Though essentially equal in age and hearing loss, Group A demonstrated significantly better listening skills than Group B (Appendix G).

The study also determined that:

1. Despite the somewhat irregular data collection on the beginning months of the Project, there was a significant difference between Group A and Group B in the amount of time lapse between initial treatment and initial report (Appendix H).
2. There was no statistical difference in the amount of time the two groups of children wore amplification (Appendix I).
CHAPTER V

CONCLUSIONS

I. The hypothesis was rejected that Project SKI*HI treatment did not significantly change the listening skills of Group A.

These children did improve. Within just three to eleven months of treatment, these children demonstrated increased utilization of residual hearing that, to the .05 confidence level, was not due to chance. Because the author could not control all variables that might have caused the improvement, the conclusion could not be drawn that the Project SKI*HI treatment was the determining cause of damage. However, neither can that possibility be ruled out.

II. The hypothesis was accepted that the two groups of children did not significantly differ at the time their initial scores were recorded.

Both groups of children demonstrated similar levels of listening skills at the times they began Project SKI*HI treatment. It was observed that, at that point of comparison, the children were not matched in age. Group A was three to eleven months younger. Yet they were making use of their residual hearing as effectively as the older Group B.

This observation presents a strong argument for auditory training for young hearing-impaired children. If it could be assumed that neither group had had structured auditory training before entering
Project SKI*HI, it could be speculated that hearing-impaired children do not effectively "train themselves" to use their residual hearing.

III. The hypothesis was rejected that there was no difference in the listening skills of the two groups after Group A had had treatment.

Group A's listening skills were significantly superior to Group B's. Despite their similar ages, similar hearing losses, and similar use of amplification, Group A was making better use of residual hearing than was Group B. A possible difference in the reliability of the data collection of the two groups must be considered. Group A's post-treatment data was collected after relatively long associations with the parent-advisor. Group B's pre-treatment data was collected with less familiarity between the child and the parent-advisor. Because of the difficult, sometimes long-term task of assessing a child's auditory skills, it is possible that Group A's post-treatment skills were more accurately recorded.

The use of amplification by the two groups warrants discussion. Although the appropriateness of the children's amplification could not be controlled for, it was shown that there was no significant difference in the amount of time per month each group wore their hearing aids. The mean number of monthly hours the children wore their aids (238.5 out of a possible 360) indicated both groups were wearing aids frequently. Yet Group B lagged behind in its listening skills. It is likely that these children, as has so often been the case, were identified and fitted with aids, but were neglected in their need for an auditory training program. Again, evidence that, even when given
amplification, hearing-impaired children do not "train themselves" to use residual hearing.

The careful matching of age in each group for the testing of the third hypothesis enabled the author to rule out simple maturation as the primary cause of improvement in Group A. Had Project SKI*HI intervention not been the primary cause of change, the two groups would have differed in listening skills at the time of initial treatment. They did not, despite the large age difference. Group B, allowed normal maturation, developed inferior listening skills compared to Group A, allowed maturation and intervention.

Project SKI*HI was justified in its quest for an effective Auditory Training Program. It is apparent to the author that this program delivered effective services to its children during the years 1972-1975. It is imperative that preschool hearing-impaired children be taught to use their residual hearing as an integral part of their language program.

**Summary**

The purpose of this paper was to evaluate the effectiveness of the Home Auditory Program of Project SKI*HI on the listening skills of its students during the years 1972-1975.

The scores of two groups of children, as measured on the SKI*HI Listening Skills Scale were compared. The statistical evaluation indicated that,
1. Significant improvements in listening skills were demonstrated by one group of children during three to eleven months of treatment, and,

2. The scores of this treated group were significantly superior to the non-treated group, despite a similarity in age and degree of hearing loss between the two groups.

Recommendations

A need exists to evaluate the tools being used by the Project to monitor the children's progress. Reliability studies need to be completed on all facets of Project data collection.
REFERENCES


Additional Sources


Appendix A

Hierarchy of Listening Skills

LEVEL 1: REFLEXIVE
Child responds reflexively to sounds
1. moro response
2. startle
3. cessation of activity
4. widening of the eyes
5. increase in activity
6. crying

LEVEL 2: ALERTING TO SOUNDS
Child knows a sound is present but does not know its source. Child may respond by pointing to the ear, facial expression, searching for the sound, etc.

LEVEL 3: LOCATING THE SOUND SOURCE
Child can locate the sound source. The child may turn to the sound source (localize), run to the sound source, etc.

LEVEL 4: DISTANCE HEARING
Child hears sound at varying distances. He may localize to the sound, find the sound, run to the sound, etc.

LEVEL 5: LEVELS OF HEARING
Child hears sound above and below him. He may turn to the sound, go to the sound source, etc.

LEVEL 6: GROSS ENVIRONMENTAL DISCRIMINATION
Child can associate the sound with its source. He may respond by pointing to the source of the sound (without seeing the sound source when the sound is presented) imitating the sound, using the sound source correctly.
LEVEL 7: GROSS VOCAL DISCRIMINATION
a) onomatopoeia sounds
b) functional words with strong prosody patterns
Child can make prosodic discriminations. He can associate the sound with its source (toot-toot with train). He knows the nature of the sound and will imitate it. He knows the function of the sound. (When he hears "no no" that means to stop.)

LEVEL 8: TONAL DISCRIMINATION
Child can discriminate an angry voice from a pleasant one. He can discern the different voice patterns used in a question versus a declaration.

LEVEL 9: FINE SPEECH DISCRIMINATION
a) vowels
b) consonants
Child can make phonemic discriminations. He indicates this discrimination by:
    a) imitation
    b) pointing to correct picture or item after hearing word
    c) responding correctly to the word
Appendix B

Description of Overall Program

The home intervention program consists of the following main components which are given in the same sequence which they are developed with the parent and child:

a. Home Hearing Aid Program
b. Home Auditory Program
c. Home Language Facilitation Program
d. Home Total Communication Program

A diagram showing the Home Intervention Program:

<table>
<thead>
<tr>
<th>Process</th>
<th>Treatment of the hearing disorder</th>
<th>→</th>
<th>Language and communication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Program</td>
<td>Hearing aid fitting</td>
<td>Home Hearing Program</td>
<td>Home Auditory Program</td>
</tr>
<tr>
<td></td>
<td>Child Development Assistance</td>
<td>←</td>
<td>Psychological and Emotional Support</td>
</tr>
</tbody>
</table>


Appendix C

Sample Monthly Report

6. Stages of Auditory Development

I. General Instructions for gathering data

A. The parent-advisor should record on weekly report
   the highest state of auditory development the child
   has achieved or definitely responding.

II. Specific instructions for recording data on monthly
    report forms.

A. Summarize your weekly reports

B. Check (✓) the stage at which the child has responded
   to for three consecutive weeks. If the child moves
   through a new stage each week, then check (✓) the
   highest level achieved.
MONTHLY PARENT ADVISOR EVALUATION FORM  
(Due 10th of following month)  

Name of child ____________________ Name of Parent Advisor ____________  
Month ______________ Year __________ Date forwarded ________________  

Data for this form is derived from observations and questions during the home visits of one month and from study and referral to materials between visits.  

Note: See Appendix A for specific instructions for gathering and reporting data.

1. Hearing Aid. Underline as appropriate.  
   a. Total number of waking hours hearing aid is worn _________.  
   b. Total number of waking hours hearing aid is not worn _________.  
   c. Total number of down time hours _________.  
   d. 1 yes no 2 yes no 3 yes no  

2. Vocal-Verbal Stages of Utterances. (spontaneous, not imitative)  
   Check highest level achieved.  
   1. vocal--one syllable--limited articulation--cry, coo, grunt, etc.  
   2. vocal--one syllable--some articulation emerging--pre-babbling.  
   3. vocal--vocal play or babbling, repetitive syllables, e.g. baba (same) or bado (different).  
   4. verbal--single word, often functions as sentence, single or double syllable, does not have to be articulated correctly.  
   5. vocal--jargon, sentence-like, non-linguistic, tonal patterns across many syllables simulative of adult speech--and/or echolalia of it occurs.  
   6. verbal--two-word sentence, miniaturized language system, pivot open class might be typical but not inclusive, e.g. a car, big car, car broken, not car.  
   7. verbal--3-4 words, noun phrase (e.g. my big car, no more car, the other big car) or designative, predicative, and verb phrase constructions (e.g. it a car, the car broken, take car again) also telegraphic (e.g. finished went home.)
8. Verbal--kernal sentences--designative construction, predicative construction, and actor-action sentence--with or without article e.g. there's the car, the car is broken, car is broken, I see a car, I see car.

9. Transform - emerging transformation--revealed by substitutions of pronouns for noun phrases, use of interrogatives, employment of and to join series of words--affirmative, negative, and imperative constructions--complex sentences generated by rules of addition, deletion, permutation, and substitution within or among kernal sentences.

3. Tonal patterns in utterances. (spontaneous or imitative) No limit to number you may check. These apply to single syllable or multiple syllables responses.

1. One loudness (monoloudness) or one pitch (monopitch) or abnormal loudness variation or pitch variation

2. Appropriate loudness change within syllable or from syllable to syllable.

3. Appropriate pitch change within syllable or from syllable to syllable.

4. Articulations within utterances. Circle symbols for articulations which have been used by the child from the time of the first home visit. Accumulate total.

5. Language development. Underline the highest level of prelinguistic development of the highest levels of both receptive and expressive language achieved in months. Refer to your copy of the descriptions at these different age norm levels.

1. Prelinguistic - 0-4, 4-6
2. Receptive - 6-8, 8-12, 12-18, 18-24, 24-36, 36-48, 48-60
3. Expressive - 6-8, 8-12, 12-18, 18-24, 24-36, 36-48, 48-60

6. Stages of auditory development. Check the highest level achieved.

1. Alerting--evidenced by cessation of activity, widening of eyes, pointing to ear or the like immediately after a sound is produced.

2. Searching--evidenced by looking around for sound source immediately after presentation of sound.
3. localization--evidenced by finding the sound source without having looked at the object or event that produced it.
4. distance hearing--evidenced by localizing to a sound produced from a source at least 20 feet away.
5. elevation hearing--evidenced by localizing to a sound produced at an altitude requiring the child to look up and down--if up including a sound made at least 20 feet away.
6. gross sound discrimination--evidenced by the child identifying one noisemaker from another without looking--close distance--e.g. a horn and a rattle.
7. voice discrimination--evidenced by the child identifying the father's voice from the mother's voice without looking--close distance.
8. tonal discrimination--evidenced by the child identifying one tonal pattern from another, e.g. an angry voice from a soothing voice--close distance.
9. articulation discrimination--evidenced by the child identifying one word from another word when both are spoken with the same tonal pattern, e.g. "Show me the ball. Show me the fish." . . . close distance. Note any new auditory responses during the month.

7. Program competencies of parents. Underline level of competence with:
   a. Management of hearing aid: maintaining, checking, trouble shooting,
      Number of weeks to reach 100% competency ________, or
      Competency level reached if longer than ten weeks ________.
   b. Structuring auditory development activities under direction:
      Auditory stage ________.
      No, Minimal, Considerably Substantial, Very Substantial, Complete
   c. Conducting auditory development activities independently (own initiative):
      Number of opportunities ________. Number of opportunities utilized ________.
   d. Facilitating language development under direction:
      No, Minimal, Considerable, Substantial, Very Substantial, Complete
   e. Facilitating language development independently (on own initiative)
      Number of opportunities ________. Number of opportunities utilized ________.
Evaluation for Total Communication

This form is to be completed on all total communication children and families in addition to the regular monthly report. There is one exception. For total communication children it will not be necessary to fill in the vocal-verbal section on the monthly report.

The Child

I. Gathering Data: Parent advisor will observe the consistent expressive and receptive language skills of the child during the sessions. Parents will observe and note language skills during the week and record in the parent notebook. If the parent advisor's observations are different from the parent's the parent advisor will record the highest of the two language levels on her weekly reporting form.

II. Recording Data: Parent advisor notes on the weekly reporting form under "language" the child's expressive and receptive levels. As the end of each month, the parent advisor notes the highest level attained during the month and indicates on the monthly total communication reporting form.

1. Spontaneous expressive language: (check highest level attained)
   - One word without voice
   - One word with voice
   - Jargon without voice
   - Jargon with voice
   - Two words without voice
   - Two words with voice
   - Three words with voice
2. Receptive language (child responds with appropriate behavior):

One word commands
Two word commands
Three-four word commands
Four-five word commands

The Parents

I. Gathering Data: Parent advisor determines what lessons mother
(or significant parent) completes at 80-100% competency by inquiring after
parent views the lesson for one week. If 80-100% competency is not achieved,
parent views lesson another week.

II. Recording Data: Lessons completed at 80-100% level are noted on
the weekly form under "report on previous assignment". All lessons completed
by end of the month are noted on monthly report.

Check lessons completed at 80-100% competency levels during the past
month:

A. Instructional
   Manual Alphabet
   To-be Verbs/ Pronouns
   Affixes/ Question Words

B. Activity Lessons
   Changing Diaper
   Going to Bed
   Going to the Bathroom
   Getting Dressed
   Getting a Drink
   Mealtime
Cooking
Washing Dishes
Washing Clothes
Sewing
Cleaning House
Going Shopping
Gardening
Child Hurts Himself
Girl Playing Outside
Boy Playing Outside
Girl Playing Inside
Boy Playing Inside
Puppets
Counting, coloring, cutting
Follow the leader
Story Telling (Opposites)

C. Subject Lessons:
Playings
Prepositions
Sports
Body Parts
Clothing
Holidays
Medical
Money
Work, Jobs, Professions
Animals Part I
Animals Part II
I. Gathering Data: Parent advisor observes parent at sessions and notes immediately after session on weekly form (narrative).

II. Recording Data: Parent advisor records highest level obtained by parent during the month as indicated on weekly reports.

Check Highest Level

Parents use consistently (75% or more of their utterances to the child):

One word (sign) in naming, simple commands, etc.
Two word sentences signed completely (undivided tense affixes) ___
Three-four word sentences signed completely (undivided tense affixes) ___
Four-five word sentences signed completely (undivided tense affixes) ___

I. Gathering Data: Parent advisor observes and makes comments in body of weekly report. Comments are subjective.

II. Recording Data: Parent advisor makes judgment based on best performance as indicated in weekly reports.

Check appropriate ability level on parent's fluency (speed, smoothness, of signs, continuity of signing).

excellent _____ very good _____ good _____ fair _____ poor _____ very poor _____
Appendix D
Communication Skills to be Incorporated into Auditory Program

These communication stimulation skills are to be taught to the parents along with the beginning auditory skills. Parents move on to the next language stimulation skill only after they have indicated spontaneous use of the skill in their home.

I. Correct Conversational Distance with Minimum Background Noises:
   1. Make it as easy as possible for your child to hear your communication.
      A. Get down on your child's level as close to his ears as possible.
      B. Keep background noises at a minimum when vocalizing to your child. Keep T.V.'s, radios, other electrical appliances off or very low so your child will have an easier time to hear you. The slide and audio tape presentation, "Sound Approach" discusses these two concepts. Since this tape presentation is usually made in the final home hearing aid lesson, you may want to leave these two concepts with the parents at that time.

II. Ad Concham Stimulation
    1. Provide ad concham stimulation for the child. Ad concham means to talk directly into the child's ear. Remember to produce varied intonational and rhythm patterns in your
stimulation. Sing, babble, coo into your child's ear while providing accompanying body motions such as dancing, marching, swinging, etc.

III. Babbling Stimulation
1. Imitate your child's babbling and vocal play. If your child says, ba, ba, ba, you say, ba, ba, ba.
2. Imitate your child's movements and add voiced sounds to go along with the movements. For example, if your child is bouncing his legs, you bounce your legs while you use sounds like la-la-la-la.
3. Initiate babbling for your child to hear. Introduce a sound to two each week. Reinforce your child when he imitates your babbling but never insist on him babbling. Your child may not imitate your babbling until he has had many weeks of "Listening." Remember to provide varying intonational and rhythm patterns with accompanying bodily motions.
4. Let your face and voice tell the child that what you are doing is interesting and fun. Let him know by the varied sounds you make and your interesting facial expressions that communication is fun.

IV. Communicative Clues
1. Take advantage of "communicative clues" your child may give you by responding with simple language. Children are constantly giving their parents clues as to what they want, what they see, how they feel. For example, a child cries and the mother knows he is hungry or uncomfortable. A child points
to his bottle and the mother knows he wants his bottle. Often parents react to a clue by simply giving the child what he wants without saying anything to the child. The child cries, mother changes him. The child throws his cracker away, mother picks it up; the child points to water, mother gives him a drink of water. It is important that the parents take advantage of these clues and respond with simple language. Here are some examples:

<table>
<thead>
<tr>
<th>Clue</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. <strong>Crying</strong> (why is the child crying - hungry? wet? sick?)</td>
<td>Oh, your diaper is wet. What a wet diaper. Let's give you a dry diaper. Where is a dry diaper? Cathy wants her bottle. Where is Cathy's bottle? I see the bottle. Here is your bottle.</td>
</tr>
<tr>
<td>B. <strong>Pointing</strong> (what is the child pointing at?)</td>
<td>Do you see a dog? I hear the dog go &quot;arf, arf, arf.&quot; That is a big dog. You want some water. Here is a glass. Turn on the water. Mum-m, that water is good.</td>
</tr>
<tr>
<td>C. <strong>Trying to open or close a door</strong> (Is he trying to open the refrigerator? Is he trying to open a closet door?)</td>
<td>Open. Open the door. Here is your coat. Let's put on your coat. Oh-h, what a warm coat.</td>
</tr>
<tr>
<td>D. <strong>Tugging</strong> (perhaps at mother's legs or dress)</td>
<td>You want me to come. Say, come, Mommy, come.</td>
</tr>
<tr>
<td>E. <strong>Stretching</strong> his arm up.</td>
<td>You want to come up. Up, up, up, you come.</td>
</tr>
<tr>
<td>F. <strong>Looking</strong> (Child is looking at mother.)</td>
<td>I see you. Hi, sweetheart. I love you.</td>
</tr>
</tbody>
</table>
G. **Standing by an object**
   (where he is standing—by the frig., the dinner table, the toilet, the window. Does he need to go to the bathroom, what does he see or want?)

   Do you see some children? Yes. I see some children. Say, "hi".

   Tommy is hungry. Mumm, smell the good food. Come sit on your chair, up, up, up. Now you can eat some food.

H. **Child is babbling or vocalizing to make a want known (what does the child want?)**

   You want a cracker. Here is a big cracker, a big, big cracker.

I. **Child is quietly playing and babbling.**

   Mother calls to child, "Stevie, Stevie, I see you. I love you."

V. **Parallel Talk** (talking with your child, not for your child which is modeling.)

   1. Tune into the child. Talk about what interests him. Things that interest children are the obvious things that are happening around him. Talk about the objects, people, and happenings around him. Talk about the here and now, not about what has happened or what will happen.

   2. Everything has a name, use it. Never point. Avoid pronouns (it, that, these, them, this). Instead, use the name of the object as much as possible.

   **Wrong:** Here is some milk. Drink it. It tastes good, but it is cold.

   **Right:** Here is some milk. Drink your milk. Your milk tastes good. Your milk is cold.

   3. Use short, simple sentences. For example, rather than saying, "Suzie, do you want me to get a cracker for you?", say, "Do you want a cracker?" or "Suzie wants a cracker?"
4. Use natural gestures when you talk. "I don't know," "bye, bye", "Come here", etc.

5. Give your child a chance to show that he understands. Give him time to respond to what you say. Reinforce him for responding correctly.

6. Give your child a chance to use his voice. Be a listener as well as a talker. Reinforce him for using his voice. Reward him when he attempts to say a word.
APPENDIX E

DIFFERENCES BETWEEN GROUP A'S PRE-TREATMENT LISTENING SKILLS SCORES AND THEIR POST-TREATMENT LISTENING SKILLS SCORES

Hypothesis

\( H_0 = \) Group A's pre-treatment listening skills do not differ significantly from Group A's post-treatment listening skills.

Decision Rules

Given: A two-tailed alternative, the .05 level, and \( N = 14 \).

Table

<table>
<thead>
<tr>
<th>Score</th>
<th>Group</th>
<th>Post</th>
<th>Pre</th>
<th>Post</th>
<th>Post</th>
<th>Post</th>
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Computation

\[
\begin{align*}
R_{\text{pre}} & = 70.5 \\
R_{\text{post}} & = 34.5 \\
U_1 & = n_1 n_2 + \frac{n_1(n_1 + 1)}{2} - R_1 \quad U_2 = n_1 n_2 + \frac{n_2(n_2 + 1)}{2} - R_2 \\
U_1 & = 49 + 28 - 70.5 \\
U_1 & = 6.5 \\
U_2 & = 42.5
\end{align*}
\]

Interpretation

Critical \( U \) values (for \( N = 7,7 \)) are 8 and 41. Since the observed \( U \) values are 6.5 and 42.5, the \( H_0 \) is rejected.
APPENDIX F

DIFFERENCES BETWEEN GROUP A'S PRE-TREATMENT LISTENING SKILLS SCORES AND GROUP B'S PRE-TREATMENT LISTENING SKILLS SCORES

Hypothesis

\[ H_0 = \text{Group A's pre-treatment listening skills do not differ significantly from Group B's pre-treatment listening skills.} \]

Decision Rules

Given: A two-tailed alternative, the .1 level, and \( N = 14 \).

Table

<table>
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<tr>
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Computation

\[ R_1 = 56 \]
\[ R_2 = 49 \]

\[ U_1 = n_1 n_2 + \frac{n_1 (n_1 + 1)}{2} - R_1 \]
\[ U_2 = n_1 n_2 + \frac{n_2 (n_2 + 1)}{2} - R_2 \]

\[ U_1 = 49 + 28 - 56 \]
\[ U_1 = 21 \]

\[ U_2 = 49 + 28 - 49 \]
\[ U_2 = 28 \]

Interpretation

Critical \( U \) values (for \( N = 7,7 \)), are 11 and 38. Since the observed \( U \) values are 21 and 28, the \( H_0 \) is accepted.
APPENDIX G

DIFFERENCES BETWEEN GROUP A'S POST-TREATMENT LISTENING SKILLS SCORES AND GROUP B'S PRE-TREATMENT LISTENING SKILLS SCORES

Hypothesis

$H_0 =$ Group A's post-treatment listening skills do not differ significantly from Group B's pre-treatment listening skills.

Decision Rules

Given: A two-tailed alternative, the .02 level, and $N = 14$

Table

<table>
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</table>

Computation

$R_1 = 33.5$
$R_2 = 71.5$

$U_1 = n_1 n_2 + \frac{n_1 (n_1 + 1)}{2} - R_1$
$U_2 = n_1 n_2 + \frac{n_2 (n_2 + 1)}{2} - R_2$

$= 49 + 28 - 33.5$
$= 49 + 28 - 71.5$

$U_1 = 43.5$
$U_2 = 5.5$

Interpretation

Critical U values (for $N = 7,7$) are 6 and 43. Since the observed U values are 5.5 and 43.5, the $H_0$ is rejected.
APPENDIX H

DIFFERENCES BETWEEN GROUP A'S TIME LAPSE AND GROUP B'S TIME LAPSE

Hypothesis

\[ H_0 = \text{There is no significant different between Group A and Group B in the amount of time lapse between initial treatment and initial report.} \]

Decision Rules

Given: A two-tailed alternative, the .05 level, and \( N = 14 \)

Table

<table>
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</table>

Computation

\[ R_1 = 37 \]
\[ R_2 = 68 \]
\[ U_1 = n_1n_2 + \frac{n_1(n_1 + 1)}{2} - R_1 \]
\[ U_2 = n_1n_2 + \frac{n_2(n_2 + 1)}{2} - R_2 \]
\[ U_1 = 49 + 28 - 37 \]
\[ U_2 = 49 + 28 - 68 \]
\[ U_1 = 40 \]
\[ U_2 = 9 \]

Interpretation

Critical \( U \) values (for \( N = 7,7 \)) are 8 and 41. Since the observed values of \( U \) are 9 and 40, the \( H_0 \) is accepted.
APPENDIX I
DIFFERENCES BETWEEN GROUP A'S AMPLIFICATION USAGE AND GROUP B'S AMPLIFICATION USAGE

Hypothesis

\[ H_0 = \text{There is no significant difference between Group A, post-treatment and Group B, pre-treatment, in the amount of monthly time that amplification was worn.} \]

Decision Rules

Given: A two-tailed alternative, the .1 level, and \( N = 14 \).

Table

<table>
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</tbody>
</table>

Computation

\[ R_1 = 57 \]
\[ R_2 = 48 \]
\[ U_1 = n_1n_2 + \frac{n_1(n_1 + 1)}{2} - R_1 \]
\[ U_2 = n_1n_2 + \frac{n_2(n_2 + 1)}{2} - R_2 \]
\[ U_1 = 49 + 28 - 57 \]
\[ U_2 = 49 + 28 - 48 \]
\[ U_1 = 20 \]
\[ U_2 = 29 \]

Interpretation

Critical \( U \) values (for \( N = 7,7 \)), are 11 and 38. Since the observed values of \( U \) are 20 and 29, \( H_0 \) is accepted.
VITA

Susan Gail Crant Carne

Candidate for the Degree of

Master of Science

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