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Effectiveness of an FM system on a preschool hearing-impaired child's story comprehension during storytime

Melissa Ann Janigo

The University of Montana

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THE EFFECTIVENESS OF AN FM SYSTEM ON A PRESCHOOL 
HEARING-IMPAIRED CHILD'S STORY COMPREHENSION 
DURING STORYTIME

By
Melissa Ann Janigo
B.A., University of Montana, 1986

Presented in partial fulfillment of the requirements 
for the degree of Master of Arts
University of Montana
1990

Approved by
Chairperson, Board of Examiners

Dean, Graduate School

Date Aug. 14, 1990

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The purpose of the present study was to determine if an FM system was effective in increasing the story comprehension abilities of a hearing-impaired preschool child during storytime. A multiple baseline across behaviors was utilized with a single subject. The FM system was the independent variable and the two target behaviors; story comprehension and following directions were the dependent variables. Baseline measurements were obtained on the two target behaviors using hearing aids alone. Treatment measurements were then obtained for the two target behaviors with introduction of the FM system, and were compared to baseline measures. The findings of this study indicated that the FM system had no effect on the hearing-impaired child’s story comprehension ability. However, changes in non-targeted behaviors such as an increase in attention to the speaker and an increase in the number of verbal responses were noted during the treatment phases.
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ACKNOWLEDGEMENTS

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CHAPTER I

INTRODUCTION

The Hearing-Impaired Child in the Classroom

A hearing-impaired child who is placed in the regular classroom environment is faced with less than optimal acoustic conditions for speech, language and academic development (Hawkins 1984, Bess, Sinclair, and Riggs 1984). As a hearing-impaired child enters a classroom with a deficient auditory mechanism, the hearing loss significantly reduces transmission of acoustic information and the child's ability to process this information auditorily.

Hearing losses vary in both type and severity. The hearing loss may be a sensorineural impairment which is defined as a lesion within the cochlea or the inner ear. A conductive hearing loss is characterized by the interference of the transmission of energy from the external ear to the inner ear. While the inner ear mechanism is functioning normally, the sound transmission is impeded as it passes through the external and/or middle ear structures. A mixed hearing loss is characterized by the presence of both conductive and the sensorineural components. The severity of a hearing loss may range from mild to profound. The severity of the hearing loss often determines the nature and degree of difficulties the child may experience during the acquisition of speech and language skills. A child with mild or moderate degree of hearing loss may have less difficulties learning spoken language when compared to a child with a more severe hearing loss. The development of normal or near-normal language
competence depends partially upon early and appropriate amplification and an extensive program of language stimulation (Sanders, 1982). Language competency is often the primary goal of an intervention program as the child's cognitive development, speech perception, and learning abilities is dependent on his language skills. Amplification is, therefore, a critical factor in the habilitation process of a hearing-impaired child. A personal hearing aid system, whether monaural or binaural, may be insufficient if the habilitation program focuses on the hearing aid fitting as its sole component. One common problem with analog hearing aids is that they not only amplify the primary speech signal, they amplify all sounds. These hearing aids are most effective in situations where background noise is minimal or non-existent and the speaker is in close proximity to the hearing-impaired child.

**Effects of Classroom Noise on the Hearing-Impaired Child**

A child with a normal mature auditory system can typically "block out" background noise, use subtle environmental cues and process linguistic information in order to communicate in degraded acoustic environments. The hearing-impaired child with auditory and linguistic deficits lack these skills. While a child may effectively use his/her residual hearing to perceive speech appropriately in quiet environments, he/she is often placed in high noise environments with their normal hearing peers. As a result, the signal-to-noise ratios are significantly reduced and speech discrimination are dramatically affected (Davis & Bladsell, 1975). The resulting degradation in speech
discrimination caused by the combination of impaired hearing and poor listening environments is one of the primary factors which affect the learning and language development of hearing-impaired children (Sanders 1982).

The effect of noise on auditory learning in hearing-impaired children is becoming increasingly relevant to educators of hearing-impaired children and educational audiologists as more and more of these children are mainstreamed with normal hearing peers. As early as 1966, Rabbitt suggested that the increased effort necessary for speech discrimination under poor listening conditions reduces the amount of attention that is available for processing the cognitive content of the spoken message. He demonstrated that when noise was introduced into the acoustic environment, his subjects had poorer memory recognition of words even when those words could be correctly discriminated in the noise. When a child is already handicapped by reduced auditory language-processing competencies, the effect of noise on learning and memory merits serious concern. An educator of a hearing-impaired child may witness the effects of such a handicap in behaviors such as inattention, depressed learning ability, increasing developmental lag, and inability to remember the content of auditorily presented information. The child may become frustrated, lose interest, become bored, and either withdraw from the situation or exhibit behaviors that are distracting to the teacher and other peers (Sanders, 1982).

A classroom is characteristically a noisy environment, with many factors which interfere with a hearing-impaired student's ability to effectively receive
and process speech information (Sanders, 1965). The three main factors that most impede the perception process are reverberation, distance from the speaker, and the signal-to-noise ratio.

Reverberation

Reverberation is the process of sound energy decay in a room. It is defined as the time from the cessation of the sound source until the sound energy is reduced by 60 dB from its original intensity (Katz, 1985). Reverberation is a result of multiple reflections of the sound signal from the ceiling, floors, walls and objects in a room. The amount of reverberation depends upon the surfaces the sound signal strikes. Hard smooth surfaces characteristically reflect most of the signal, thus increasing the amount of reverberation. If the surface is more absorbent, such as soft, porous materials, more acoustic energy is absorbed (Katz, 1985). Reverberation time may be stated simply by the following relationship:

\[ T = \frac{V}{a} \]

where \( T \) is the reverberation time, \( V \) is the volume of the room, and \( a \) is the total absorption (Durrant & Lovrinic, 1984). Reverberation is always present in a closed room. It is measured in units of time, as a rate of decay.

Reverberation time increases as the volume of a room increases and decreases with the amount of sound absorption. Classrooms with lower ceilings, less volume, and surfaces fabricated with more absorbent materials will decrease reverberation time. The sound which is being continually reflected
from one hard surface to another can overlap and interfere with perception of speech sounds. Reverberation introduces additional energy to the energy of the direct sound. When speech is present in a room, this energy is introduced to the speech signal. Because of reverberation, speech sounds will overlap one another. The acoustic energy of the vowels is prolonged and the consonants are masked. If speech is rapid and/or if reverberation time is long, even the pauses between words may be eliminated with reverberant energy and the tails of words preceding the pauses overlap with the beginning of the words following them (Katz, 1985). The presence of reverberation influences the quality of speech. Speech under reverberant conditions appears muffled and or much less "crisp" than without reverberation. These quality differences may be small and easily tolerated by normal hearing listeners, as they are able to utilize all the information present in speech sounds, and speech is highly redundant for normal listeners. That is, not all cues have to be audible in order to provide very good speech discrimination. Since hearing-impaired listeners have never perceived all of the phonetic features of speech and speech is not redundant for them even under ideal listening conditions, the elimination of additional cues by noise and reverberation has a severe effect on their speech perception. For adequate discrimination, therefore, they need the remaining cues to be preserved as much as possible (Katz, 1985).

In 1982, Nabelek and Robinson studied the effects of the age of the listener and different reverberation conditions on speech intelligibility. They
found that normal hearing children and the elderly had poorer speech intelligibility scores in reverberation than that of young adults. The data also suggested that reverberation effects are similar to masking noise effects, yet children under 10 years of age may have more difficulties with reverberation than they do with masking noise. The effects of reverberation, particularly in noise, is even more deleterious for the hearing-impaired child (Finitzo-Hieber and Tillman, 1978). The reverberation time in the classroom is therefore an important factor to consider in the management of the hearing-impaired child. One study found that a mean average reverberation time of nine public schools ranged from 0.47 to 1.21 seconds for 178 classrooms (McCroskey and Devens, 1975). A reverberation time of 0.4-0.6 seconds is the recommended maximum for classrooms (Borrild, 1978; Finitzo-Hieber and Tillman, 1978; John, 1960; Niemoeller, 1968). At the above recommended reverberation time, mean word recognition scores of hearing-impaired children was 74%, while the normal hearing group mean score was 93% (Finitzo-Hieber & Tillman, 1978). Several studies have indicated that the recommended reverberation time is generally exceeded in the classroom situation. Therefore, hearing-impaired children in the regular classroom are receiving, on the average, far less than 74% of the speech information which is available, due to reverberation effects alone.

Noise

The introduction of noise into any room can be expected to further degrade a hearing-impaired child’s ability to perceive speech. Noise may be
broadly defined as "any undesirable sound (or signal)" (Durrant & Lovrinic, 1984). Noise which is simply inherent in the classroom environment interferes with a hearing-impaired student's ability to perceive and process speech information. Noise sources may include sounds generated outside the school building, sounds generated within the building, and sounds in the classroom. Sounds generated such as traffic, children on the playground, heating systems, children in the hallway, shuffling papers, and competing speech, all make up unwanted noise for a hearing-impaired child in the classroom. Several studies have shown that on the average, classroom noise levels range from 52 to 69 dBA (Sanders, 1965; McCroskey and Devens, 1975). At these levels, a teacher talking at an average conversational level (60-65 dB SPL) may be effectively masked by background sounds reducing the transmission of verbal information to the hearing-impaired child. It has been suggested that noise levels in those classrooms used by hearing-impaired children should not exceed 30 to 35 dBA (Bess and McConnell, 1981), levels 17 to 34 dB quieter than what was found in the studies cited above. The effect of a poor signal-to-noise ratio is the reduction of speech understanding even for normal hearing individuals.

A minimum signal-to-noise ratio of +12 to +15 dB (i.e. the level of speech is +12 to +15 dB greater that the level of noise) has been recommended for classrooms (Finitzo-Hieber and Tillman, 1978; Gengal, 1971; Sanders, 1965; Crum and Matkin, 1976). However, most schools are not constructed to achieve a positive signal-to-noise ratio in the classroom (Davis
Finitzo-Hieber & Tillman (1978) compared the word recognition scores from a group of normal hearing children and a group of hearing-impaired children. They found that at +12 S/N the mean percentage of word recognition scores for a group of normal hearing children was 89%, whereas for the hearing-impaired group, it was 70%. At +6 S/N, the mean word recognition score for the normal hearing group was 80%, whereas the mean fell to 60% for the hearing-impaired group. Thus, even the normal hearing children with intact linguistic and auditory systems had difficulty with speech perception in the presence of background noise.

A positive signal-to-noise ratio of at least +12 to +15 dB is essential in classrooms with hearing-impaired individuals who have deficient auditory and linguistic systems. Classrooms with noise levels of 40-50 dB SPL are not conducive to learning. The unstressed words, plural endings, and voiceless consonants in these noise levels become obscure to the hearing-impaired student (Ray, 1987). Further, verbal instruction may be misunderstood, causing the student to become confused in this environment (Ray, 1987). Finally, various studies have shown that noise and reverberation have a synergistic effect, such that word recognition scores when obtained in a combination of poor signal-to-noise ratios and reverberation are significantly poorer than the sum of the isolated noise and reverberation effects (Finitzo-Hieber & Tillman, 1978).
Distance

The distance between the speaker and the listener also affects speech understanding. As the distance between the speaker and listener increases, the S/N deteriorates as the intensity of speech decreases. Whenever the distance between the speaker and listener is doubled, speech intensity decreases by 6 dB and causes a decrease in the intensity of speech at the ear of the hearing-impaired child (Calvert and Silverman, 1978; Ling, 1980). This relationship is referred to as the inverse square law. For example, a teacher standing one foot from the student and maintaining a speech intensity of 60 dB SPL at the ear of the child may be easily perceived. If the teacher moves to a position two feet from the student, and if she maintains the same speech intensity level, the child will perceive the intensity at 52 dB; at four feet 46 dB; and at eight feet, 40 dB (May & Brackett, 1987). According to Olsen (1977), a teacher should be within 6 to 8 inches of the hearing-impaired child's hearing aid microphone for optimal communication; however, this distance is neither practical nor reasonable in most circumstances. In the average classroom, a teacher presents her material from a variety of locations, frequently changing the distance between her and the hearing-impaired child. This behavior, therefore, places a hearing-impaired child in the classroom in a less than optimal educational environment.

It is apparent that classroom acoustics are an important factor to consider in placing a hearing-impaired student in an appropriate educational
setting. It is also apparent that a classroom with poor signal-to-noise ratio, reverberation, and changing speech intensity levels due to the variance in the distance between the teacher and child has serious effects on a hearing-impaired child. These factors further reduce an already deficient auditory system of the hearing-impaired student from receiving the information needed for a successful education.

Solutions

Educators of hearing-impaired children must address the problem of delivering adequate auditory stimuli in the classroom. The acoustic environment is one variable that educators can indeed improve and therefore improve the speech understanding and learning in hearing-impaired children. Architectural improvements can be made in the schoolrooms to help reduce unwanted noise and limit reverberation but, as more hearing-impaired children are mainstreamed, it is unlikely that all classrooms can be modified to meet the needs of the few hearing-impaired students. Modifying a classroom to meet the needs of the hearing-impaired student would be a costly venture that a majority of the schools can not afford. The availability of an expert in acoustical engineering may also be a limiting factor. Other options in addressing the problem of providing an adequate acoustical environment include the fitting of personal hearing aids, as it is the most common means of providing classroom amplification.
The personal hearing aid offers many benefits for the hearing-impaired child by amplifying sounds so that certain aspects of speech will be audible to the hearing-impaired individual. However, the hearing aid is ineffective at amplifying beyond six feet. In order to achieve a high signal-to-noise ratio, the speaker should be as close to the hearing-impaired child as reasonably possible. This is difficult to control in a classroom where a teacher moves around the classroom changing the distance from the hearing-impaired child constantly during a period of a day. With an increase in the distance between the teacher and the hearing-impaired student, the speech signal is decreased by the inverse square law. A student may try to compensate for the decrease in speech intensity by increasing the gain of her hearing aid(s). As the gain is increased, not only is the signal intensity increased but also the background noise. Therefore an improvement in the signal-to-noise ratio is not achieved, thus masking out the speech signal (Kothman 1981). These problems are difficult to control in most classroom situations and therefore leaves the hearing-impaired student with an inadequate acoustic environment for learning.

Educational Placement

Traditionally, hearing-impaired children have been placed in self-contained classrooms. These programs are typically highly structured and oriented towards the needs of each individual child. In self-contained classrooms within the public schools, the hearing-impaired child is often placed in the same classroom containing students with other handicapping conditions (which also
may vary in severity) such as cerebral palsy, vision impairment, severely limited language skills, and mental retardation. The individualized programs and small classroom size may be a conducive academic environment and facilitate learning for many hearing-impaired students. Still, it may restrict the students from being educated in a setting which most closely approximates their normal peers. As PL 94-142 mandated that students should be educated in the least restrictive environment, hearing-impaired students are now being mainstreamed into the regular classroom and placed in the resource room or self-contained classrooms for those areas where they cannot be successfully mainstreamed (Heward and Orlansky, 1984).

Use of FM System

The problems encountered by hearing-impaired children in the classroom has lead to the development of radio frequency FM transmission units, otherwise known as auditory trainers. Personal FM systems are not new developments in the education of the hearing-impaired student. The purpose of this equipment is to provide the primary speech signal to the child's ear as if the speaker were only inches away from that ear, thus resulting in an improved signal-to-noise ratio. The microphone, worn by the speaker, strengthens and stabilizes the reception of the speaker's voice while simultaneously minimizing the effect of background sounds (Powers, 1984). The microphone is worn approximately 3-6 inches below the chin, which effectively increases the S/N ratio by decreasing distance. The microphone is
connected to a transmitter. The teacher's voice is then transmitted to a receiver worn by the hearing-impaired student.

The personal FM systems may be coupled to the child's hearing aids in a variety of ways. The personal miniloop is a coupling system in which the student wears a mini-induction loop around her neck which is, in turn, hardwired to the FM receiver. The miniloop broadcasts an electromagnetic signal to the telecoil of the personal hearing aid (the personal hearing aid must be set on the telecoil position in order to receive the signal). Another method of coupling is the direct electrical connection from the student's FM receiver unit to the child's hearing aid. This is done by modifying the personal hearing aid to accept an electrical plug or jacket that is hardwired from the student's receiver unit that is also worn by the child. The miniloop has many drawbacks such as the functioning of the telecoil in the hearing aid and the distance of the hearing aids to the neckloop, all of which may cause poor reception. These problems are eliminated with the direct input and is therefore a more preferable coupling option (Hawkins, 1984).

The advantages of the FM system include complete indoor/outdoor mobility within the 150 feet to 650 feet of the broadcast range of the teacher unit (Katz, 1985; Northern and Downs 1984). The FM system works to reduce the loss of signal due to distance and minimize environmental noise. This provides a consistent speech signal for the hearing-impaired child regardless of the teacher's position in the classroom. The student's FM receiver may be
adjusted to make them adaptable to a wide range of individual acoustic and amplification needs. The student's receiver has controls to adjust volume and to set options. Options include FM only, FM and hearing aid, and hearing aid only. In the FM only position the child receives only the speaker's voice and any other noise in the vicinity of the speaker's microphone. In the FM/HA position the child receives both the speaker's voice and the sounds coming in through the environmental microphone positioned on the receiver. The environmental microphone may also be used alone without input from the teacher microphone. The environmental microphone allows the student to perceive sounds going on around them rather than just the teacher's speech signal. The sounds amplified through the environmental microphone will decrease the S/N ratio, by adding noise to the improved speech signal achieved by use of the FM system. The disadvantages of the FM unit include its initial cost and the cost of its maintenance and repair. Still, due to consequence of the degraded acoustic environment of the regular classroom, FM systems have gained a wide acceptance as the most appropriate device for achieving an optimal signal-to-noise ratio in the classroom (Bess, Sinclair and Riggs, 1984).

Effects of Amplification and Classroom Environments on Speech Perception

Blair (1977) questioned the effects of amplification, speechreading, and classroom environments on speech perception. The results of his study suggested that the use of speech reading cues increased hearing-impaired
individuals scores for the reception of speech under all combinations of classroom noise levels and amplification systems (personal hearing aids and auditory trainers). The use of auditory trainers with headphones and wireless microphone, combined with the speechreading cues, produced the highest scores in the reception of speech. The study suggested that the reduction in classroom noise levels and the provision of speech reading cues can improve the reception of speech as measured by sentence repetition tasks. The results also found that an amplification system which places a microphone close to the teacher’s mouth can help to overcome severe ambient noise problems.

In 1984, Hawkins compared the speech recognition abilities of mild-to-moderate hearing-impaired children in noise using hearing aids and FM systems. The results of his study suggested that the advantage of the FM system over hearing aids was equivalent to a 12-18 dB improvement in the signal-to-noise, even when the child was seated in a favorable classroom location. When placed in a less than optimal location, an even greater FM advantage was suggested. The study also found that when the environmental microphone on the FM system was activated, the S/N ratio advantage was reduced substantially. Hawkins suggested that the environmental microphone should not be activated unless absolutely necessary. The directional environmental microphone was suggested for the least interference from background noise. Hawkins also suggested that a directional teacher’s microphone should be used as it creates a significant improvement (3.3 dB) in S/N ratio compared to the
omnidirectional microphone. It was found that the FM advantage over the personal hearing aid alone decreased as the classroom S/N ratio improved. However, even in a relatively quiet classroom when a child is seated close to the teacher, an FM advantage was still observed.

Bess, Sinclair and Riggs (1984) investigated classroom acoustic conditions and the status of FM-wireless systems in schools for the hearing-impaired children. They found that classroom noise was unacceptably high, exceeding acceptable noise level criteria by 26 dB. Physical inspection of the FM units revealed that half the teachers and half the students units revealed at least one defect. The electroacoustic measurements on the FM systems showed wide variability in performance among systems. Some systems were moderate output instruments, while others would exceed acceptable tolerance limits. Unfortunately, standard tolerance limits for FM wireless equipment do not exist. Bess and his colleagues demonstrated that there was no apparent systematic relationship between the degree of hearing loss of the children and the amount of unit gain being employed by each specific amplification system. They suggested that school programs should intensify their efforts to monitor, troubleshoot, and maintain the educational amplification systems of hearing-impaired children.

Blair, Myrup and Viehweg (1989) compared the listening effectiveness of hard of hearing children using sound field FM amplification, personal hearing aids, and personal FM systems with a miniloop. Word recognition scores were
compared while in a classroom environment, under the three conditions of amplification. Results indicated that word recognition scores were poorest when using hearing aids alone, scores improved 10% on the average when the sound field FM system was used, and another 5% when the personal FM system with the miniloop was used.

**Statement of the Question**

Research in the area of FM system effectiveness in the classroom is fairly recent and many questions remain unanswered. Research to date has focused on the effects of FM systems on speech perception in the classroom, comparisons between different coupling options, microphones, and between types of FM systems. This research has provided the necessary information to intelligently choose between different systems and to select those options which may best serve the students in need. However, research has not yet focused on the effects of the FM system on the broader aspects of the hearing-impaired child's academic performance and linguistic abilities in the classroom. Research has shown that in the classroom environment a hearing-impaired child wearing and FM system has improved S/N ratio's and has significantly improved word recognition scores. Therefore, it can be assumed that this will improve academic performance, yet there is no research to support this assumption.

The purpose of this study is to determine if an FM system is effective in increasing the story comprehension abilities of a hearing-impaired preschool child during storytime. The literature suggests that FM systems are effective
amplification systems in the classroom due to the significant improvement in the S/N ratio. However there is no research which shows the effects of the FM system on the academic performance of preschool aged hearing-impaired children into the mainstreamed classroom.
CHAPTER II

METHODS

Subjects

A four year, one month old boy, with a bilateral moderate to severe sensorineural hearing loss participated in the study. The subject has been aided binaurally with Bernafon Calibri 2 behind-the-ear hearing aids since 1987. He has never used a personal FM amplification system. The subject was enrolled in a private preschool which he attended twice a week. The subject has also been enrolled in speech and language therapy since 1987. A summary of the audiological and speech-language status is presented in Table 1.

Equipment

A Phonic Ear 461 personal FM amplification system was selected as the auditory trainer for the study. This system consisted of a 461R receiver and a 461T transmitter. The FM system was coupled to the subject's ears with button receivers and lucite standard earmolds. The subject's hearing aids were electroacoustically evaluated prior to the beginning of the data collection and a listening check was performed on the hearing aids prior to each session. While an electroacoustic analysis was not performed on the FM system, a listening check was performed on the FM system before each session. Acoustic immittance testing was performed once every two weeks with a Microaudiometric Earscan to monitor middle ear status.
Table 1. Subject Characteristics

<table>
<thead>
<tr>
<th>TEST</th>
<th>STATUS</th>
<th>Right Ear</th>
<th>Left Ear</th>
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<tr>
<td><strong>Hearing</strong></td>
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<td>500 Hz 75 dB HL</td>
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<td></td>
<td>4k Hz 75 dB HL</td>
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<td></td>
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<tr>
<td>Thresholds</td>
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<td></td>
<td>2k Hz 40 dB HL</td>
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<td>4k Hz 30 dB HL</td>
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<td>3/14/90 FM System w/ Button</td>
<td>SRT</td>
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<td>Receivers</td>
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<td>Soundfield</td>
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<td><strong>Language</strong></td>
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<td><strong>Expressive</strong></td>
<td>Mean Length of Utterance</td>
<td>MLU = 2.43,</td>
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<td>C.A. = 42 mos.</td>
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<td><strong>Vocabulary</strong></td>
<td>Peabody Picture</td>
<td>7/89-No basal</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vocabulary Test</td>
<td>was achieved</td>
<td>indicating delay</td>
</tr>
<tr>
<td></td>
<td>Revised</td>
<td>C.A. = 42 mos.</td>
<td></td>
</tr>
<tr>
<td><strong>Phonology</strong></td>
<td>Language Sample</td>
<td>Able to produce</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>all sounds</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>expected at 48</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>month level.</td>
<td></td>
</tr>
</tbody>
</table>
Materials

The books used during all phases of treatment were chosen at least two weeks in advance by a children’s librarian. The children’s librarian was used to aid in book selections appropriate for the age of the child and comprehension level. The librarian was also used in selecting authors who had published several books to help maintain a style of writing with the books used in the study. Any book which the subject had personal access to in his home or that had been used for teaching purposes at his preschool or in his speech and language therapy was excluded for use in this study. These books were identified by the subject’s mother, preschool teacher and speech language pathologist. The list of directions used in the second treatment phase were developed based upon the child’s speech and language goals.

Experimental Design

A multiple baseline across behaviors (McReynolds & Kearns, 1983) was chosen to study the effects of an FM amplification system on this preschool child’s story comprehension and his ability to follow directions. The purpose of the design was to determine if a single treatment was effective in changing two behaviors in the same manner for one subject. The control in a multiple-baseline design comes from a replication of treatment effects on another behavior. There were three phases: baseline, treatment of behavior one, and treatment of behavior two. The use of the FM system during the treatment phase was manipulated as the independent variable. Dependent variables were defined as:
(1) The subject's ability to respond to ten questions asked about a story that was just read. The ten questions consisted of "Wh" questions. The subject's responses were scored as correct if he demonstrated his understanding of the correct concept. The subject's ability to use or understand the syntax and phonology of the question was not scored.

(2) The subject's ability to carry out a set of 15 oral directions. The directions consisted of two and three part commands requiring an action and/or manipulation of an object. The format of the directions was the same across all phases. See Appendix A.

Environment

The subject was placed in a "one on one situation" with a research assistant. The subject was placed across from the research assistant during the story and instruction phase.

Procedures

A research assistant was used for data collection. The assistant was trained to administer the stories, ask the ten questions, and administer the oral directions. The assistant was also trained on the criteria for correct and incorrect responses, and to do a listening check on the hearing aids and FM system prior to the data collection session.

Baseline. The FM system was worn during the baseline phase, however, the child received input only from his hearing aids and not from the FM system during this period. During the first baseline phase, data was collected on two
behaviors. The first behavior was the subject's ability to respond to ten questions about a story that was just read to him. The book was read to the subject but the subject was not shown the pictures. The subject was asked ten questions about the story. The questions consisted of Wh questions (who, what, why, when and where). These questions were administered immediately after the story was read. The responses were scored based on the subject's ability to provide the correct concept in response to the question. The appropriate use of syntax nor the correct pronunciation of words were considered as incorrect responses. The subject merely had to communicate the appropriate concept to acquire a correct response. The sessions were videotaped and hand scored. Each question was repeated once if the subject did not initially respond to the question. However, if the subject incorrectly responded to the first question it was not stated again.

After the story comprehension task, baseline data were collected on the second behavior. The second behavior was the subject's ability to follow directions. A total of 15 instructions consisting of two and three part commands, were given to the subject. The subject was instructed to listen to the whole direction and to respond only after the prompt: "you do it now." The subject was instructed and, if necessary, cued to focus on the objects on the table in front of him rather than on the experimenter. The complexity of the directions was based on the subject's comprehension level (two-three part commands). The format of the directions was consistent through all phases.
The subject was given a point for each part of a completed command. If the subject achieved 70% or greater on baseline measurements, the questions and directions were revised to increase the difficulty and the baseline measurements were repeated.

Baseline criterion was set at three sessions or until a behavior remained sufficiently stable to treat both behaviors simultaneously (McReynolds & Kearns, 1983).

**Treatment.** The subject received input from the FM amplification system during the treatment phase. Following story time, ten questions about the story were asked of the subject. Baseline data were taken on behavior two (following directions) during the treatment of behavior one. On the fourth session the subject received input through the FM system during the oral directions. The subject was given 15 directions in the form of two and three part commands while using the FM system. The treatment phase then continued for four sessions (McReynolds & Kearns, 1983). During the treatment phase on behavior two, data were also collected on behavior one.

**Reliability**

Inter-rater reliability was measured across all subject responses during all phases. Responses to oral directions were videotaped by the experimenter. The responses on the tape were then scored by a second observer and compared to the original scores. The criterion between observers was set to be equal to or greater than 90%.
CHAPTER III

RESULTS

The purpose of this study was to investigate the effectiveness of an FM system on the story comprehension ability of a preschool hearing-impaired child. A single subject design across two behaviors was utilized.

Performance

The raw data obtained during baseline and the following treatment sessions are presented in Table 2. The performance data are also illustrated in Figure 1.

Baseline Baseline measurements of the subject's performance on targeted behaviors was obtained prior to treatment. Two behaviors were measured during this study. Behavior one was the subject's ability to respond to ten "Wh" questions about a story which was read to the subject. Behavior two was the subject's ability to follow 15 two- and three-part commands. The subject was amplified with his hearing aids only during the baseline measurements. A stable baseline was defined as no more than an average of 2 data points (20%) variation within the basal period and showing no consistent improvement in performance. A stable baseline was achieved for both behaviors in four sessions. Baseline measures for behavior one remained at 0% throughout all four baseline sessions. Baseline measures for behavior two ranged from 20% to 26%. Visual inspection of the data indicated a stable performance across behaviors during baseline.
Table 2. Raw data for baseline and treatment phases

<table>
<thead>
<tr>
<th>Series</th>
<th>List. Check</th>
<th>FM - HA</th>
<th>% Correct</th>
<th>Foll. Direc.</th>
<th>Story Comp.</th>
<th>Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sess.#1</td>
<td>Pass</td>
<td>20%</td>
<td>0%</td>
<td>99%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sess.#2</td>
<td>Pass</td>
<td>20%</td>
<td>0%</td>
<td>98%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sess.#3</td>
<td>Pass</td>
<td>26%</td>
<td>0%</td>
<td>99%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sess.#4</td>
<td>Pass</td>
<td>20%</td>
<td>0%</td>
<td>99%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment #1 Story Comprehension</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sess.#5</td>
<td>Pass Pass</td>
<td>13%</td>
<td>0%</td>
<td>98%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sess.#6</td>
<td>Pass Pass</td>
<td>26%</td>
<td>0%</td>
<td>99%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sess.#7</td>
<td>Pass Pass</td>
<td>26%</td>
<td>0%</td>
<td>99%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sess.#8</td>
<td>Pass Pass</td>
<td>20%</td>
<td>0%</td>
<td>98%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment #2 Following Directions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sess.#9</td>
<td>Pass</td>
<td>20%</td>
<td>0%</td>
<td>99%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sess.#10</td>
<td>Pass</td>
<td>13%</td>
<td>0%</td>
<td>100%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sess.#11</td>
<td>Pass</td>
<td>20%</td>
<td>0%</td>
<td>99%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sess.#12</td>
<td>Pass</td>
<td>26%</td>
<td>0%</td>
<td>99%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Figure 1. Subject performance on story comprehension and oral directions tasks.
Treatment  Treatment consisted of two phases. The first phase consisted of placing the FM system on the subject while a story was being read to him. Baseline measurement was continued on the second behavior, following directions. A total of four treatment sessions were administered during the first phase. The visual inspection of the data during this phase of treatment indicated that the subject did not change in his performance on a story comprehension task. Treatment measures on this behavior remained at 0% across all four treatment sessions. Baseline measurements on oral directions also remained stable during the first treatment phase, as baseline measurements for behavior two continued to range from 13% to 26% during this treatment phase.

The second phase of treatment consisted of placing the FM system on the subject during the oral direction session. Measurements of the first treatment phase continued during this treatment phase. A total of four treatment sessions were administered during the second treatment phase. The visual inspection of the data during this phase of treatment indicated that the subject did not change in his performance on an oral direction task. Treatment measurements on this behavior ranged from 13% to 20%, as the first phase of treatment continued to remain unchanged from baseline with measurements at 0% during this phase.
Reliability

The subject's responses were scored during each session by a trained research assistant. The sessions were videotaped and following each session the videotape was viewed and subject responses were scored again by a second observer. Inter-rater reliability was 98% or greater across all sessions. Table 2 presents the reliability data.
CHAPTER IV
DISCUSSION

This study addressed the effects of an FM system on a preschool hearing impaired child's story comprehension ability. Specifically, the study examined the impact of the fitting of an FM system on a four year old hearing-impaired subject's ability to listen to a short story without pictures and then answer ten "Wh" questions about the story. This study also investigated the subject's ability to follow fifteen, two and three part commands.

Interpretation of Data

Treatment consisted of fitting a personal FM system on the subject during a oral story reading session and during an oral direction session with the subject.

The results of this study indicated that the treatment had no effect on the subject's story comprehension skills or his ability to follow directions. Baseline measurements met the specified stability requirements (within two data points or 20% variation) during the first four sessions for both behaviors measured. The level at which these behaviors occurred during baseline was appropriate for use in this study, as the behavior did not occur at a high level (20% average for behavior two and 0% average for behavior one) during pretreatment measures.

Treatment measurements remained essentially unchanged from baseline. The results of this study suggest that the FM system did not affect this
subject's ability to correctly respond to questions about a story or affect this subject's ability to follow two and three part directions. While these results may be due to a variety of variables, the need for better assessment of the subject's language skills prior to the study's initiation may be the most significant factor leading to these findings. The subject's skills in comprehending "Wh" questions was not sufficiently present to measure as a dependent variable. In addition, the subject's behaviors of inattention and distractibility suggest that the subject may have been too young to sit and attend to the structured tasks presented to him. As a result, the study may not have been truly measuring this subject's story comprehension skills nor his ability to follow oral directions.

The literature to date has not focused on the effects of the FM system on the broader aspects of the hearing-impaired child's academic performance and linguistic abilities in the classroom. However, studies have shown that the personal FM system does increase speech recognition ability in hearing-impaired individuals (Blair, 1977; Hawkins, 1984; Blair, Myrup, and Viehweg, 1989). The findings of this study do not support cited research. However, other nontargeted changes in the subject's behavior during the introduction of the FM system were observed during the study and may serve as a better means to measure the effectiveness of FM systems in a preschooler, or as a principle design change for a replication of this study. The most notable behavior change possibly due to the introduction of the FM system occurred during the fourth session of the first treatment phase when the subject first began to
repeat the question directed to him. At this time, he began to respond with a "yes" or "no" response. This behavior was subsequently measured and ranged from 10% to 50% across the last five treatment sessions. These data are presented in Table 3. The visual inspection of this data indicated a sharp slope upward from 10% to 50% and then the slope dropped from 50% to 30% from the third to fourth session. These data are illustrated in Figure 2. Informal observation and the data that was collected on these nontargeted behaviors suggest that the subject was more verbal and more attentive while using the FM system. According to examiner report, the subject also appeared to be more attentive to the speaker and seemed to be aware that a response was expected of him. In these cases, the subject often used a yes/no response or would simply repeat the question. This type of behavior was not present during the baseline measurements when the subject received auditory information only through his hearing aids.

At the time treatment began the subject wore the FM system to his preschool, both his teachers and his speech pathologist reported dramatic changes in his behavior during circle time and during any group activities. He reportedly was more attentive to the speaker and participated more in the group activities. Before using the FM system the subject's teachers described the subject as being "lost" in circle time.
### Table 3. Raw data-verbal responses to story questions

<table>
<thead>
<tr>
<th>Series</th>
<th>Percent Verbal Response</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Baseline</strong></td>
<td></td>
</tr>
<tr>
<td>Session 1</td>
<td>0%</td>
</tr>
<tr>
<td>Session 2</td>
<td>0%</td>
</tr>
<tr>
<td>Session 3</td>
<td>0%</td>
</tr>
<tr>
<td>Session 4</td>
<td>0%</td>
</tr>
<tr>
<td><strong>Treatment 1</strong></td>
<td></td>
</tr>
<tr>
<td>Session 5</td>
<td>0%</td>
</tr>
<tr>
<td>Session 6</td>
<td>0%</td>
</tr>
<tr>
<td>Session 7</td>
<td>0%</td>
</tr>
<tr>
<td>Session 8</td>
<td>10% (1/10)</td>
</tr>
<tr>
<td><strong>Treatment 2</strong></td>
<td></td>
</tr>
<tr>
<td>Session 9</td>
<td>10% (1/10)</td>
</tr>
<tr>
<td>Session 10</td>
<td>40% (4/10)</td>
</tr>
<tr>
<td>Session 11</td>
<td>50% (5/10)</td>
</tr>
<tr>
<td>Session 12</td>
<td>(3/10)</td>
</tr>
</tbody>
</table>
Figure 2. Subject's percentage of verbal responses to questions during story comprehension task.
Considerations and Suggestions

There were various shortcomings to this study. The type of questions (wh) for the story comprehension may not have been appropriate for this particular child. Although he was able to answer this type of question when interacting with both his speech pathologist and his close relatives, "Wh" questions may have been too difficult for him to understand and answer under the circumstances of this study. To choose a more appropriate measurement of the subject's story comprehension skills, an assessment of his skills using both formal and informal measures may have provided a more appropriate target behavior (dependent variable). In this study, the investigator's informal observations and interactions with the subject suggested that he was much better in responding to questions that requested a simple yes/no response.

A second possible flaw to this study was the inconsistency of maintaining the subject's interest. While reading the story to the subject, it was very difficult to keep the subject's attention directed to the reader. The subject was not interested in simply listening to a story. Rather, he demanded that the reader provide access to the illustrations to maintain his interest and continuity. A review of the books used in this study and the questions generated from their stories suggest that the pictures in the story books rarely provided the whole storyline. That is, if the questions were chosen appropriately the pictures did not tell the story alone. One would need to hear the story to gain full comprehension of it. By using the pictures coupled with the oral
presentation of the story, this subject may have been simply more attentive. This, in turn, may have led to a more accurate measurement of this subject's story comprehension ability.

A third flaw in this study was the total number of oral directions in each session. While the level of directions seemed appropriate for this child, the overall number of these directions (fifteen) may have been too taxing for this child or for any child at this developmental stage. The subject in this study had difficulties participating in structured tasks. Loss of interest and fatigue, therefore, may have been primary factors which influenced the results of this study.

Another factor that may have contributed to the results of this study was the "shy and quiet" behavior the subject exhibited around unfamiliar people. It may have been better to use an examiner who was more familiar to the subject (i.e. speech clinician, brother, teacher or mother) to facilitate a more "natural" interaction, wherein the child may have been more talkative and more readily responded to questions. During many of the data collection sessions, the subject exhibited passive resistance when the story was being read. The subject would pull out the button receivers during the story or would just sit and look at his mother. During the second treatment phase, the subject would play with a toy and disregard the directions entirely. Many of these behaviors may also have been due to the time of day at which the sessions were initiated. At times, the sessions were scheduled either right before nap time or
immediately following nap time. During these particular sessions, his behavior
was either more lethargic or disruptive. Finally, on those days the mother had
warned that he was having a "bad day" the subject was more resistant to the
structured tasks. That is, the subject often resisted to listening to the story
because he knew he could not look at the pictures.

Further Research

The findings of this study do not warrant a replication without first
making some significant changes in the study's design. When using a preschool
child in a study, one may benefit in first investigating any changes in attention
or "on task" behaviors during the child's group activities or circle time in his
preschool setting. A study investigating changes in these behaviors may be
more successful with informal measures and observation of target behaviors as
the means of data collection. With informal measures, one would not need to
rely on the cooperation of a small child. The subject's fatigue and loss of
interest may not be a confounding factor if the subjects time attending to a
story is the dependent variable. Additional dependent variables may include the
subject's eye contact with the speaker, or the amount of time spent on task in
a group activity. In addition, the present study may have been more
successfully implemented with an older, more linguistically advanced child
without having to change the methodology. A prior language assessment to
identify the level of story comprehension would have proven to be beneficial in
the present study and should be recommended in further studies.
Another means to address the question of the effectiveness of an FM system on the academic abilities of hearing-impaired children is to investigate the changes of behaviors in a larger number of hearing-impaired children. If a larger number of subjects is included, the investigator may choose to move from a single subject design to a group experimental design. In moving to a group design, the intrinsic control of extraneous variables (e.g., heterogeneity of subjects) of the single subject design is lost, yet the findings are more easily generalized as the results represent a larger more diversified group.

There has been very little research in the area of the effectiveness of personal FM systems, yet most hearing-impaired children are using them daily in their school placements across the country. The literature documenting the effectiveness of the FM system is simply inadequate to empirically support these efforts by educational audiologists to advocate wholesale use of personal FM systems for the hearing-impaired student. Clearly, additional data based research would be beneficial for the educational audiologists in convincing school districts to purchase FM systems for the hearing-impaired children. Any additional literature supporting the early use of FM systems in the home for preschool hearing-impaired children during their early language acquisition would be beneficial for audiologists and speech pathologists in helping to provide these children with the best acoustical environment for acquiring language.

Research aimed at the effectiveness and application of FM systems is clearly needed. Areas for further research may include fitting considerations for
FM systems and hearing aid microphones versus the FM system environmental microphones in group situations. Research in any one of these areas could significantly improve the treatment protocols available for the educational audiologist, speech pathologist, classroom teachers and parents of hearing-impaired children.

**Clinical Applications**

The findings of this study showed no changes in the behaviors measured with the introduction of the FM system to a hearing-impaired preschool child. However, notable changes in behaviors were observed with the introduction and use of the FM system both during the structured sessions of the research program and during the subject's other activities in the preschool setting. The subject became more verbal during the treatment sessions with the FM system on versus with the hearing aids on. The subject repeated the question that was asked of him or responded with a yes/no response or repeated key words of the question. With this change in response behavior and the subject's repetitions of questions, it may be hypothesized that, during FM amplification, the subject heard the questions well enough to repeat them, whereas during the hearing aid amplification, the subject did not make any verbal responses leading to the conclusion that the subject did not hear the questions at all. The subject's teachers, speech pathologist, and parents reported significant changes in the subject's behavior at school with the FM system. The subject was more verbal in the group activities and followed along with the group games and made eye
contact with the speaker. These behaviors were not present prior to using the FM system. During the group activities, the subject was previously described as being "lost" and inattentive. In addition, he would not follow along with group songs or games. Finally, the subject would often look at the person next to him rather than attending to the speaker. With the FM system the subject attended to the story during story time rather than fidgeting and looking around the room. The preschool teacher's were reportedly very impressed with the results of the FM system. In reviewing these observations, it may be hypothesized that the FM system was effective in improving the subject's ability to hear the speaker and therefore, increase the time spent attending to the speaker and engaging in the activities around them. While the direct findings of this study do not suggest any benefit from the FM system, the observations made in the preschool and during the treatment sessions warrant some notice and encourage further investigation of the effects of the FM system on the broader aspects of the hearing-impaired child's academic and listening behaviors. These findings encourage the use of FM systems in the preschool setting during circle time and group activities.

Summary

This study investigated the effectiveness of a personal FM system on a preschool hearing-impaired child's story comprehension ability. A single-subject, multiple baseline was utilized. The two behaviors measured were the subject's ability to answer ten questions about a story that was read to him
with only auditory input. The second behavior measured was the subject's ability to follow fifteen two and three part commands. There were three phases to this study: During the initial baseline phase, measurements were taken using only hearing aids for amplification. These recorded the subject's ability to listen to a story and respond to ten "Wh" questions about the story. Baseline measurement was also taken on the subject's ability to carry out 15 two- and three-part oral directions. During the treatment phase, the introduction of an FM system served as the independent variable and was only used during the story reading session. Both dependent variables continued to be measured during both treatment phases. During the last treatment phase the FM system was also used during the oral direction session. While the results showed that the FM system was ineffective at changing the behaviors identified by this study's hypotheses, changes in other behaviors not previously defined in this study's methodology suggest that the FM system is beneficial in improving the subject's ability to hear the speaker and to increase the time the subject directs his attention to the speaker. These changes resulted in an overall increase in "on task" behavior during group activities. The subject became more verbally responsive to questions directed to him by repeating the question or replying with a yes/no answer. These behaviors suggest that the FM system indeed had an effect on the subject's ability to hear the speaker. These observations and those reported by the subject's teachers indicate that the FM system was effective for this subject in improving his listening skills accompanied by
observation of increases in attention, verbal responses, and "on task" behaviors during both group and individual activities.
REFERENCES


APPENDIX A

Oral direction form and story questions used in research study

Session 8

Story

This is a story about a bear. The bear is very brown and very big and furry. The bear lives in the woods and likes to eat honey and berries. The bear likes to climb trees and catch fish in the river. In the winter the bear sleeps all day. The bear sleeps in a cave where it is warm. The bear wakes up in the summer and plays with all his friends.

Questions

1. Hugh, What animal was the story about? Response:

_____ Repeated Q.

2. Hugh, What color was the bear? Response:

_____ Repeated Q.

3. Hugh, Where does the bear live? Response:

_____ Repeated Q.
4. Hugh, What does the bear like to eat?
Response:

Repeated Q.

5. Hugh, What does the bear like to do?
Response:

Repeated Q.

6. Hugh, What do bears catch in the river?
Response:

Repeated Q.

7. Hugh, What does the bear do in the winter?
Response:

Repeated Q.

8. Hugh, Where does the bear sleep?
Response:

Repeated Q.

9. Hugh, When does the bear wake up?
Response:

Repeated Q.
10. Hugh, Who did the bear play with when he woke up?
Response:

_____Repeated Q.

Session 8
Directions

Hugh, we are going to play a game. I have some toys here (a mouse, truck and a car) I am going to tell you to do some things with these toys. You listen and then do it when I tell you.
REINFORCE AFTER EACH RESPONSE EVEN IF IT IS INCORRECT.

1. Hugh, show me the car and then show me the mouse, you do it.
   _____show me car
   _____show me mouse
   _____Repeated direction

2. Hugh, put the mouse on the truck and put the car on your chair. You do it.
   _____mouse on truck
   _____car on chair
   _____repeated direction

3. Hugh, put the car on the truck and give me the mouse. You do it.
   _____car on truck
   _____give me mouse
   _____repeated direction

4. Hugh, put the mouse on the car and put the truck in the box. You do it.
   _____mouse on car
   _____truck in box
   _____repeated direction

5. Hugh, put the car under the truck and put the mouse under your chair. You do it.
   _____car under truck
   _____mouse under chair
   _____repeated direction
6. Hugh, give me the car and put the truck and the mouse in the box. You do it.
   __give me car
   __truck and mouse in box.
   __repeated direction

7. Hugh, put the mouse in the truck and put the car under your chair and then put the truck in the box. You do it.
   __mouse in truck
   __car under chair
   __truck in box
   __repeated direction

Session 11
Directions

Instructions: Hugh, we’re going to play a game. I have some toys here (fish, lunch box, ball). I am going to tell you to do something with my toys. You listen and when I tell you, you do it. Repeat the direction only if the child does not respond. Give him time to respond before you repeat the question. ALWAYS REINFORCE AFTER EACH RESPONSE EVEN IF ITS WRONG.

1. Hugh, give me the fish and then open the lunchbox. You do it.
   __give me fish
   __open lunch box
   __repeated direction

2. Hugh, Put the fish under the lunch box and put the ball on the lunch box. You do it.
   __fish under lunch box
   __ball on lunch box
   __repeated direction

3. Hugh, Put the fish under the chair and put the ball in the lunch box. You do it.
   __fish under chair
   __ball in lunch box
   __repeated direction
4. Hugh, Put the ball and the fish in the lunch box and give me the lunch box. You do it.
   ___ball and fish in lunch box
   ___give me lunch box
   ___repeated direction

5. Hugh, Throw me the ball and put the fish on your chair. You do it.
   ___throw me ball
   ___fish on chair
   ___repeated direction

6. Hugh, Put the lunch box on the floor and put the ball on the lunch box. You do it.
   ___lunch box on the floor
   ___ball on the lunch box
   ___repeated the direction

7. Hugh, put the fish in the lunch box and put the ball on the floor and turn the radio on. You do it.
   ___fish in lunch box
   ___ball on the floor
   ___turn on the radio
   ___repeated direction

Session 11
Story

This story is about a fish. The fish's name was Sam. Sam lived in a very big lake with his family. Sam liked to eat plants that grew in the lake. Sam could swim very fast around the lake. Sam liked to swim with his brother and his sister. Sam was bigger than all the fish in the lake. Sometimes Sam would swim very fast up to the top of the lake and then he would jump out of the water. Sam liked to jump out of the water because he saw lots of beautiful things. He saw trees and birds and flowers. When Sam jumped out of the water and came back down again he would tell all the little fish what he had seen.
Questions

1. Hugh, Who was in the story?  
Response:

___check if you repeated the Q.

2. Hugh, What was the fish’s name?  
Response:

___check if you repeated the Q.

3. Hugh, Where did Sam the fish live?  
Response:

___check if you repeated the Q.

4. Hugh, Who did Sam live with?  
Response:

___check if you repeated the Q.

5. Hugh, What did Sam like to eat?  
Response:

___check if you repeated the Q.

6. Hugh, Who did Sam swim with?  
Response:

___check if you repeated the Q.
7. Hugh, What did Sam do when he was swimming?
Response:

(check if you repeated the Q.)

8. Hugh, Why did Sam jump out of the water?
Response:

(check if you repeated the Q.)

9. Hugh, What did Sam see when he jumped out of the water?
Response:

(check if you repeated the Q.)

10. Hugh, what did Sam do when he jumped back in the water?
Response:

(check if you repeated the Q.)