Auditory Learning Manual for Malayalam Speaking Children with Hearing Impairment

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Abstract

Hearing is a powerful sensory modality, which enables language development in a natural way. Auditory impairment in an individual can seriously impede their ability to communicate. The aim of the present study was to develop an auditory learning manual for Malayalam speaking children with hearing impairment, and to check its usefulness on the target population. In addition, the study aimed at comparing the performance between a group of younger and older children with hearing impairment using the developed material. The participants included two groups of children with hearing impairment aged 4 to 6years and 6; 1 t0 10 years. They were selected only if they had a language ability of at least 4-6 years and were exposed to Malayalam from early childhood. Their aided speech spectrum was within 40-50 dB HL and their listening age was 1 year or more. The study was carried out in two phases. Phase I dealt with the development of the material for the auditory learning manual and Phase II was concerned with administration of the developed material on Malayalam speaking children with hearing impairment. The results of the present study showed that the performance of the younger group was better than the older ones in all the tasks except detection which can be attributed to the ease of activity. From the study it can be considered that all the tasks developed in the manual can be carried out by children with hearing impairment, who speak Malayalam. This can be administered on children as young as 2; 6 years.

Introduction

Hearing is a powerful sensory modality, which enables language development in a natural way. Auditory impairment in an individual can seriously impede their ability to communicate. As audition plays an important role in communication, audiological rehabilitation represents an extremely important process. One component of audiological rehabilitation that has been reported in the literature is auditory verbal training/auditory verbal learning, which aims at maximum use of a child's residual hearing. (Schow and Nerbonne, 1996).

Ling (1976); Erber (1982) reported that the auditory sense is the preferred sense to teach children with hearing impairment since it has been found to be the fastest, easiest and most direct means to acquire spoken language. Children with normal hearing develop speech and language as a result of auditory input combined with communicative experience. The auditory channel is the modality through which self monitoring of speech is done. The majority of children with hearing impairment have been noted to have some amount of residual hearing, which can be made use through auditory training. A critical factor considered in the acquisition of oral language for children with hearing impairment was the amount and quality of auditory experience

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Ling and Ling (1978) and Sanders (1993) opined that auditory training was an integral part of language and speech training. Ling (1986) recommended the term 'auditory learning' rather than 'auditory training'. This would enable those with hearing impairment to refine their perception of acoustic events that they heard naturally. Thus, the essence of auditory learning is considered to be learning through listening (Beebe, Pearson & Koch, 1984).

As reported by Ling and Ling (1978) and Pollack (1964) the focus of auditory learning is on maximizing the use of audition rather than vision, simply because audition is the most efficient and appropriate sense for speech reception and for developing functional verbal communication skills. Kretschmer (1974), Ling (1975) and Paterson (1982) suggested that auditory learning or the ability to use auditory channel to deduce meaning, must occur in the context of daily conversation and language learning.

The most effective stimulus which can be used to stimulate the auditory mechanism is speech because it serves as an effective mode of communication. Also, speech is the preferred stimulus for stimulation since it has been found by Ling (1976) that the use of non-speech stimuli do not help in the perception of speech stimuli. This was reported to happen because the acoustics of non-speech signals are different from speech. Also the two types of sounds are processed in different hemispheres of the brain; speech pattern provides a greater range of contrasts and similarities; training involving speech is a direct approach and; more precise and more durable auditory discrimination and identification skills results when a child's speech system is employed as a part of the listening process. The acoustical stimuli used to stimulate the auditory mechanism should have a variety of acoustical characteristics such as durational and frequency characteristics. This is to ensure that the training given enables the children with hearing impairment perceive speech sounds of different acoustical characteristics.

It is preferable that training be imparted in a meaningful context rather than in nonsense syllables. Hence, it becomes essential to have language specific manuals for listening training for children with hearing impairment. While manuals have been developed in India in Tamil by Anjana (1998), in Indian English by Anitha (2002) and in Kannada by Vijayalakshmi and Yathiraj (2008), no such manuals has been developed in Malayalam.

The aim of the present study was to develop an auditory learning manual for Malayalam speaking children with hearing impairment, and to check its usefulness on the target population. In addition, the study aimed at comparing the performance between a group of younger and older children with hearing impairment using the developed material.

Method

Participants: The participants included two groups of children with hearing impairment aged 4 to 6 years and 6; 1 to 10 years. They were selected only if they had a language ability of at least 4-6 years and were exposed to Malayalam from early childhood. Their aided speech spectrum was within 40-50 dB HL and their listening age was 1 year or more. None of them had any additional disability.

Procedure: The study was carried out in two phases**.** Phase I dealt with the development of the material for the auditory learning manual and Phase II was concerned with administration of the developed material on Malayalam speaking children with hearing impairment.

Phase I: Development of the material for auditory learning manual

Selection of material for the manual:

Initially, the phonemes of Malayalam were classified as low, mid and high frequency depending on the energy concentration of the major perceptual cues. Meaningful words comprising of these low, mid and high frequency consonants and vowels were selected from Malayalam preschool and Grade-I books. Simple phrases, sentences and stories were also constructed. The material for the manual was also collected from the caregivers of children in the age range of 2; 6 years to 4 years.

This material was administered on the 20 typically developing children aged 2; 6 years to 4 years. This was done to check if the vocabulary was familiar to the children. Those words which were identified correctly by more than 80% of the children were considered for the construction of the manual. Using the vocabulary, phrases, sentences and stories that were familiar, the manual was developed.

Content of the manual

The manual was divided in five sections progressing from a simple level to a more complex level (Figure A). The five sections were:

Section I – Detection
Section II – Discrimination
Section III – Identification
Section IV – Comprehension
Section V – Memory and Sequencing

Each section was designed to have one or more lessons. The number of lists varied from lesson to lesson (Figure A).

Section I: Detection Tasks

Lesson I
List 1

Section II: Discrimination Tasks

Part 1

Lesson 1	Lesson 2	Lesson 3	Lesson 4	Lesson 5
List 1	List 1	List 1	List 1	List 1
List 2	List 2	List 2	List 2	List 2

Part 2

Lesson 6	Lesson 7	Lesson8
List 1	List 1	List 1
List 2	List 2	List 2
List 3	List 3	List 3
	List 4	List 4

Section III: Identification Tasks

Lesson 9	Lesson 10	Lesson 11	Lesson 12	Lesson 13
List 1	List 1	List 1	List 1	List 1
List 2	List 2	List 2	List 2	List 2
List 3		List 3	List 3	List 3
		List 4	List 4	List 4
		List 5	List 5	List 5

Section IV: Comprehension Tasks

Lesson 14	Lesson 15	Lesson 16
List 1	List 1	List 1
List 2	List 2	List 2
List 3	List 3	
List 4		
List 5		

Section V: Memory and Sequencing

Lesson 17	Lesson 18
List 1	List 1
List 2	List 2
List 3	List 3

Figure A: Flow chart of the material used for training

Section-I (Detection)

Lesson 1*: Detection of verbal stimuli*

This section checks the ability of the children to perceive the presence or absence of verbal stimuli having different frequency characteristics. It has a list of 12 words, representing high, mid and low frequency phonemes.

Section-II (Discrimination)

This section had two parts:

Part I involved the discrimination between words of varying length of utterances while part II dealt with the discrimination of words varying in frequency characteristics.

Part I: Discrimination between words of varying length of utterance

It had four lessons each having two lists**.** The lessons had words of varying length of utterances, are arranged in hierarchal order. The initial lessons required the discrimination of utterances with larger difference in length, while this difference reduced in the later lessons. The four lessons were as follows:

Lesson 2 *- Discrimination of bisyllabic words versus 9-10 syllables phrases/sentences*
Lesson 3 *- Discrimination of 3 - 4 syllabic words versus 7 - 8 syllable phrases*
Lesson 4 *- Discrimination of bisyllable words versus trisyllable phrases/ sentences*
Lesson 5 *- Discrimination of words which differ in vowel length*

Part II- Discrimination between words based on frequency characteristics

This part has three lessons which are described below:

Lesson 6 *- Discrimination between words which differ in frequency characteristics of both consonants and vowels*
Lesson 7 *- Discrimination between words which differ in frequency characteristics of the vowels*
Lesson 8 *- Discrimination between words which differ in frequency characteristics of consonants**.***

Section – III (Identification)

This section had five lessons:

Lesson 9 *- Identification of simple words which differ in frequency characteristics*
Lesson 10*- Identification of minimal pairs of words which differ in duration / frequency*

characteristics of vowels

Lesson 11 *- Identification of minimal pairs of word which differ in frequency characteristics of consonants*

Lesson 12 *- Identification of non-minimal paired key words which differ in frequency characteristics of the consonants, in a sentence context*

Lesson 13 *- Identification of minimal paired key words which differ in frequency characteristics of the consonants, in a sentence context*

Section IV (Comprehension)

The section regarding comprehension had three different lessons:

Lesson 14 *- Comprehension of related sentences*

Lesson 15 *- Comprehension of commands which differ in frequency characteristics of consonants*

Lesson 16 *- Comprehension of unrelated questions*

Two lists of items are included under this lesson

Section V (Memory & Sequencing)

This section had two lessons:

Lesson 17 *- Auditory memory and sequencing of words within a lexical category, embedded in a sentence*

Lesson 18 *- Auditory memory and sequencing of words between lexical categories, embedded in a sentence*

Phase II: Administering the manual on target population

The developed manual was administered on ten children with hearing impairment in the range of 4 to10 years. They were divided into two age groups (4 to 6 years and 6; 1 to 10 years).

Each child was evaluated independently. They were seated at a distance of 3-4 feet from the clinician in a quiet room, free from distraction. All the lessons, starting from lesson I, were administered on each participant. Prior to each lesson appropriate instructions were provided. For children who did not follow the initial instruction, the same was explained using simpler language. The instructions varied depending on the tasks.

The responses were noted for each child separately. The number of sessions for a child varied between 5 and 7, with each session lasting for duration of about 45 minutes.

A score of '1' was given for every correct response and a score of '0' was given for a wrong response.

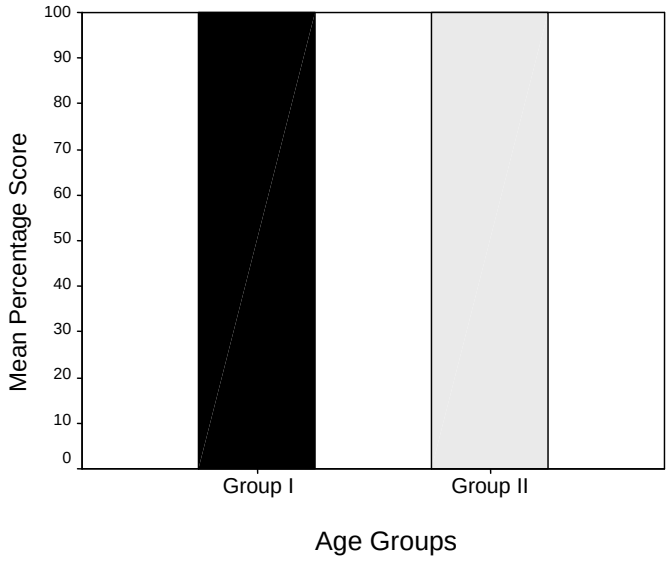
Results and Discussion

The responses of the ten children with hearing impairment, who were administered the auditory learning manual are provided and discussed. A comparison was made between the two age groups (4 to 6 years and 6; 1 to 10 years), using SPSS version 15.0, using the statistical test used was Mann Whitney U-test. The results are discussed under five sections for all eighteen lessons.

Section I: Detection

Comparison of the Group I (younger group) with Group II (older group) on the detection of verbal stimuli

The Mann Whitney U-test indicated that there were no significant differences in the performance of the two age groups, with both the groups obtaining 100% scores. This reveals that children with hearing impairment as young as four years of age are able to do detection tasks as well as the older group with hearing impairment. This can occur as long as children with hearing impairment have aided audiogram within the speech spectrum. Much earlier Goldstein (1939) and Ling and Ling (1978) reported that when properly aided, children who are hearing impaired can detect sounds effectively if their hearing is within the speech spectrum. Similar results were also reported by Anitha (2000) and Vijayalakshmi and Yathiraj (2008).



Section II: Discrimination

Comparison of Group I with Group II on the discrimination of varying length of utterances

All the participants in the Group I obtained significantly higher scores (72% to 90%) than Group II (64% to 78%) indicating that the temporal cue were more easily perceived by the former group. In general, as the task got more complex, the performance of the participants from both groups reduced. These results are in agreement with the findings of Anitha (2002) and Vijayalakshmi and Yathiraj (2008), who had also reported that temporal cues are easily perceived by individuals with hearing impairment when compared to spectral cues.

Comparison of Group I with Group II on the discrimination of words differing in the frequency characteristics of consonants and vowels as well as vowels alone.

There was no significant difference in performance between the two age groups on the discrimination of words that differed in the frequency of vowels and consonants s well as vowels alone. Though there was no significant difference between the groups, the younger group performed slightly better. This indicates that children as young as 4 years are able to discriminate words that have gross frequency differences. Similar results were reported by Vijayalakshmi and Yathiraj (2008) who found no significant difference between children aged 4 to 5 years and 5 to12 years on similar tasks. In contrast, Anitha (2002) reported a difference performance in children aged 4 to 5 years and 6 to13 years on a similar task. Her younger group performed better than the older ones. She attributed the superior performance of younger group to the early stimulation received by them.

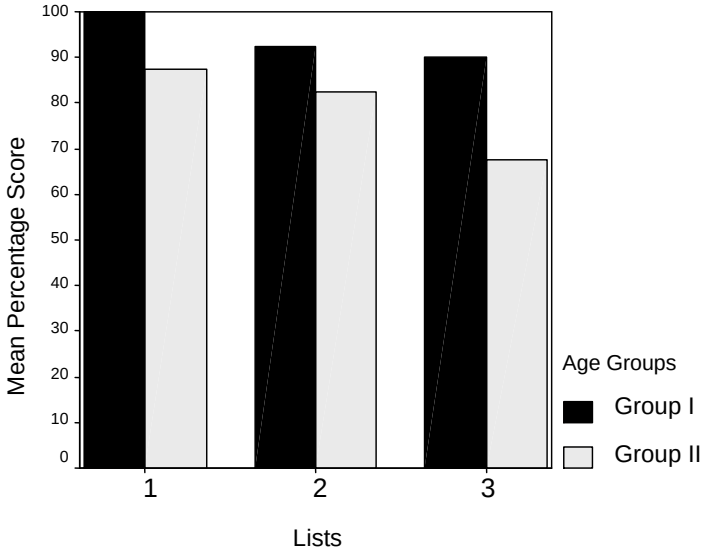
Comparison of Group I and Group II on the discrimination of words differing in the frequency characteristics of consonants

A significant difference ($p < 0.05$) in the discrimination of words differing in the frequency characteristics of consonants was observed between the two groups. The performance of the younger group was superior to the older group. This could be due to the early training in speech perception skills for the younger group (Group I). However, there was no significant difference between the two groups for the discrimination of high frequency consonants, with the performance of the younger children dropping. This probably occurred since the task required finer discrimination of consonants in the high frequency region which both groups found difficult. As the complexity of the tasks increased, the performance went down for Group I, but remained almost the same for Group II. Similar results were observed by Anitha (2002) and Vijayalakshmi and Yathiraj (2008).

Section III: Identification

Comparison of Group I and Group II on the identification of words which differ in frequency characteristics

In these tasks the results shows that there were significant differences in the performance by both the age groups for identification of words with low and high frequencies, with the younger children out performing the older group. However, for identifying mid frequency words, both groups performed almost equally well. On all the above three lists, the younger group (Group I) scored above 90%, whereas the performance of the older group ranged from 67% to 87%. Further, it was observed that all children required lesser time to carry out the identification tasks when compared to the earlier discrimination tasks. As mentioned by Anitha (2000) and Vijayalakshmi and Yathiraj (2008), this was probably due to the type of training provided to the children. The emphases of the training programs that the children had undergone were more on identification activities rather than discrimination tasks.



Comparison of Group I and Group II on identification of minimal pairs which differ in vowels

There was no significant difference in the performance between the two groups. This indicates that the younger (group I) and older (group II) children with hearing impairment perceived minimal pairs which differed in terms of the vowels equally well. However, both groups performed better on list 1 compared to list 2. List 1 differed in terms of the vowel length, while list 2 differed in terms of the frequency characteristics of the vowels. The better performance on list 1 reflects the children's ability to perceive temporal cues with greater accuracy than the frequency cues.

Most of the children exhibited some difficulty in the perception of certain vowels especially the high frequency vowels. Similar results have been reported by Anitha (2000) and Vijayalakshmi and Yathiraj (2008).

Comparison of Group I and Group II on identification of minimal paired words which differ in the frequency characteristics of consonants

There was a significant difference in the performance between two groups in identifying minimal pairs which differed in the frequency characteristics of consonants. This was observed across all the lists except list 3. List 3 contained words differing in mid and high frequency. As was observed in the earlier lesson, the performance of the younger age group was superior compared to the older age group. Further, it was generally seen in the present study that when the frequency contrasts between the pairs of words decreased the performance of the subjects declined. This was true for both the age groups (Group I and Group II). Similar results were also reported by Anitha (2000) and Vijayalakshmi and Yathiraj (2008). This could have occurred due to a difficulty in perception of spectral cues. Revolie, Pickett and Spyket (2002) reported that spectral cue perception was difficult for those with hearing impairment. They noted that the recognition of consonants were more difficult than vowel recognition as the former varied more in frequency characteristics.

Comparison of Group I and Group II on identification of non-minimal pair key words, which differ in the frequency characteristics in a sentence context

There was a significant difference in the performance between the groups on this task. Once again, the younger age group performed better than the older group for all the lists. This was similar to the results reported by Anitha (2000) and Vijayalakshmi and Yathiraj (2008). As mentioned earlier this could be due to the training method the subjects had undergone. The younger children probably learnt to use their auditory abilities a lot better than the older children. It was observed that as the complexity of the tasks increased, the performance of the older group worsened. However, in the younger group the performance was similar for the first three lists, but dropped markedly in last two lists which had more complexity.

Comparison of Group I and Group II on identification of minimal pair key words, which differ in frequency characteristics, in a sentence context

On the easier tasks of Lesson 13 (list 1 and 2), the two groups obtained similar scores, which were relatively high. In contrast, on the more difficult task (list 3, 4 and 5) the younger children performed significantly better. Thus, both the age groups were able to identify the grossly different pairs with similar ease, where as it was considerably more difficult for the older children to carry out the more difficult tasks. The difficulty seen in children with hearing impairment in perceiving finer spectral changes is evident from these results. Based on these findings, it is suggested that more emphasis should be

given to auditory training using material that have subtle differences in frequency characteristics.

Section IV: Comprehension

Comparison of Group I and Group II on the comprehension of related questions unrelated commands and unrelated questions

No significant differences in performance between the two age groups were obtained on the comprehension of related and unrelated commands. Both groups obtained mean scores of above 88% for comprehension of unrelated commands. The variability in performances seen by both groups for all five lists of lesson 14 was very low. However, the performance of the younger group was superior to the older group for the comprehension of unrelated commands and unrelated questions. It was reasoned that the better performance of the older group could be due their higher language abilities. Children in the two groups showed difficulty carrying out the commands with high frequency consonants. This was similar to their difficulty in perceiving high frequency words. It is suggested that more emphasis should be given in training the children using similar material. Similar results were obtained by Anitha (2004) and Vijayalakshmi and Yathiraj (2008).

Section V: Auditory Memeory and Sequencing

Comparison of Group I and Group II on auditory memory sequencing of words within a lexical category and between lexical categories, embedded in a sentence

The performance of the two age groups was observed to be poor for these tasks compared to the lessons discussed earlier. There was a significant difference in performance of the two age groups as the complexity of the task was increased. The overall performance of the younger group was better than that of the older ones. As the complexity of the tasks increased, the performance of all the children went down irrespective of the group. The poor performance in this lesson by two groups could be because the regular training they had undergone focused on sequencing isolated words and not in sequencing within sentences. Similar results had been reported by Vijayalakshmi and Yathiraj (2008) where the auditory memory and sequencing scores were poorer when compared to the other tasks carried out by them.

Conclusions

From the results of the present study it can be summarized that both the age groups performed equally well on the detection task. They performed the best on this task compared to all other tasks probably due to the ease of the activity. Discrimination of temporal cues was better perceived than discrimination of the spectral cues by both the groups. The younger children performed better on both temporal and spectral

discrimination tasks. On the task involving the discrimination of frequency characteristics of consonants and vowels, both groups displayed more difficulty in the discrimination of consonants when compared to the discrimination of vowels. The performance of both the groups was better in the identification lessons compared to discrimination lessons. Both the groups performed almost equally well on the comprehension tasks. The performances of both the group were comparatively poorer in the auditory memory and sequencing tasks when compared to all other tasks. It was observed that in most of the tasks, the performance of the younger group was superior to the older ones. This could be attributed to the kind of training program the younger children were enrolled in, which focused on listening skills. From the study it can be considered that all the tasks developed in the manual can be carried out by children with hearing impairment, who speak Malayalam. This can be done by children as young as 2; 6 years.

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