PHONOLOGICAL AWARENESS AND READING SKILLS IN CHILDREN WITH HEARING IMPAIREMENT

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A Dissertation submitted in fulfillment for the Master's Degree (Speech and Hearing), University of Mysore, Mysore.

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JUNE, 2003

CERTIFICATE

This is to certify that the Dissertation entitled **"Phonological Awareness and reading skills in children with hearing impairment"** is the bonafide work done in partial fulfillment of Master's Degree (Speech and Hearing) of the student (Register No. MSHM 0113).

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CERTIFICATE

This is to certify that the Dissertation entitled **"Phonological Awareness and reading skills in children with hearing impairment"** has been prepared under my supervision and guidance. It is also certified that this has not been submitted earlier in any other university for the award of any Diploma or Degree.

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DECLARATION

I hereby declare that this dissertation entitled **"Phonological Awareness and reading skills in children with hearing impairment"** is the result of my own study under the guidance of Dr. K.S. Prema, Lecturer in Language Pathology Department of Speech and Language Sciences, All India Institute of Speech and Hearing, Mysore and has not been submitted earlier or in any other University for the award of any Diploma or Degree.

Mysore
May 2003

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It's the smile that you bring on their faces,

it's the joy of being their ray of hope.

To help them talk and to help them listen,

that's what has made every moment glisten.....

ACKNOWLEDGEMENT

My sincere and heartfelt gratitude to Prema Mam who has been a guiding star in the true sense and helped me reach my destination.

I thank...

Dr. M. Jayaram, Director, All India Institute of Speech and Hearing, Mysore for permitting to carryout the study.

My family and 2791, for their unconditional love and support. A thank you would not suffice, but this is just to let you know. . . . I love you all.

Vani, Sethu, Chandni, Vimi, Ponnu, Savitha, Jessy, and Chaya, not to forget all the "YO" ians including the Ge[R]ms. . . . .

Each one of you have helped me Carve a new way, In difficult moment of the day. As our lives change come whatever, We will still be 'Friends Forever....

My teachers for taking me from darkness to light. . . . . .

The candle you lit still shines in me, to take me a head in my journey. . . . .

All those "Tiny bundles of Joy" who gave me hope and inspiration in completing this project.

Maruthi Computers, for their concerted effort inputting my thoughts to print.

And above all....AIISH. . . My Alma Mater.... For making a difference in my life and helping me a make a difference in the lives of others.

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INTRODUCTION

Hear counsel and receive instruction

That thou, may be wise in thy latter end. (Proverb)

This proverb from the Bible emphasizes the fact that it is through hearing that human gain knowledge to help them sail through the journey of life. Reading is one of the modes to gain this knowledge. Reading is a highly evolved task that is a unique endowment to the human race. Reading and writing build on the knowledge base and grammatical base of spoken language. The sense of hearing is unparalleled in its contribution to the acquisition of spoken language. Hence, when the modality of audition is impaired, not only oral speech but also reading and writing might be affected. Thus the hearing impaired population is a high-risk group for reading impairment.

Literacy skills in the hearing impaired have been researched since 1915. Due to emphasis on integration of this population, it has been realized lately that low reading achievement levels act as a hurdle in achieving this goal and therefore in the past decade, special emphasis has been given to assessment and training of reading for children with hearing impairment.

Phonological awareness has been reported to be a good predictor of reading skills in normal hearing children learning alphabetic scripts. In Indian languages that are not alphabetic, it is reported that "Phonological Awareness" is important but not a crucial factor for reading acquisition.

In children with hearing impairment along with phonological awareness, the degree of hearing impairment and speech discrimination skills are the other factors that contribute for reading acquisition. Evidences for a causal relation between phonological awareness and success in reading (Blachman, 1991) and success in reading with training of phonological awareness skills (Vellutino, 1991) in normal hearing children

has shifted the focus of research to assessment and training of phonological awareness in children with hearing impairment to facilitate literacy for mainstream purpose.

Majority of studies regarding phonological awareness in hearing impaired children have been restricted to western literature using alphabetic scripts. Indian studies (Patel and Soper, 1987; Prakash, 1987; Rekha 1987; Chandrika, 1990; Prakash, Rekha, Nigam and Karanth, 1993; Prema 1997, Akhila, 2000 and Seetha, 2002) have been restricted to phonological awareness in normal children.

The present study examines the issue of phonological awareness and reading in children with hearing impairment in the context of Kannada one of the major Dravidian languages.

Need for the Study

Children with hearing impairment need to be considered at risk for acquisition of reading and writing skills due to difficulty in developing age appropriate pre-requisites for literacy skills, one such being phonological awareness skill.

The present study focuses on this aspect and delves into the intricacies of reading acquisition in children with hearing impairment through the means of phonological awareness.

> Studies report that the majority of children with hearing impairment have since long failed to achieve age appropriate literacy levels. While literature on auditory training and education for the deaf has tended to focus on the specialized settings, the mainstreamed hearing impaired using the auditory mode are ignored. Due to the advent in technology there exists a range of high quality amplification devices for the hearing impaired population ranging from digital hearing aids to cochlear implants, such that more and more hearing impaired in the near future can be and will be mainstreamed. For this to be successful, these children should be able to reach age appropriate reading skills. There exists a dearth of literature regarding the role of phonological awareness in reading of hearing impaired children. Research studies in these areas could offer a scientific basis for inclusion of phonological

awareness in the auditory verbal therapy programme for these children. Thus in the present study in an attempt to highlight this issue, children trained via the oral/aural approach with special emphasis on orthography were included.

> Many models have been proposed to explain reading, which mainly emphasize on the auditory mode of reception. Webster (1986) noted that deaf children might have phonological coding systems based on visual features than purely auditory mode. In addition to this, in hearing impaired children, inaudible /imperfectly heard sound may not be represented accurately in their word lexicon which in turn would reflect on reading skills of these children. So the present study attempts to examine whether there exists a common phonological coding system irrespective of the type of sensory input (i.e. auditory or visual).

> The relationship between speech perception and phonological awareness has been debated for long as to whether speech perception is necessary for acquisition of phonological awareness or vice versa. Since in speech perception, the physical stimuli are perceived through the auditory modality and since this modality is affected in children with hearing impairment the present study attempts to probe into this relation between speech perception and phonological awareness.

> Indian studies have revealed that phonemic awareness that is crucial for alphabetic scripts, is not a crucial factor in learning to read Indian languages which have syllabic scripts, in normal hearing children. The present study focuses on children with hearing impairment learning to read and write Kannada a semi-syllabic script.

Objectives of the Study

> To evaluate phonological awareness in children with hearing impairment trained via oral aural approach with special emphasis on orthography in Kannada.

> To study the relation of phonological awareness with reading skills in children with hearing impairment.

REVIEW OF LITERATURE

Language is an essential component of normal development and a means for discovering the world. Normally hearing children use primarily the auditory modality for language development. They develop an inner speech code based on this auditory modality which helps them in acquiring primary linguistic skills like - speaking and listening, and the secondary linguistic skills - reading. Reading is a product of cultural evolution and involves interpretation of signs and arbitrary symbols deliberately created and used for the purpose of communication.

The phenomenon of reading acquisition by normal children and those with disability might differ due to various reasons. In children with hearing impairment interruption of auditory input interferes with patterns of linguistic interactions. Conrad (1979) suggests that influence of oral education and lack of an integration of relationship between auditory experience, language development and reading skill results in poor reading skills in children with hearing impairment. Despite the knowledge that reading acquisition could be different in normal children compared to those with disability, majority of the studies report on the process of reading acquisition in normal children.

A. READING ACQUISITION

Divergent views exist among the reading researchers regarding the manner in which children acquire the complete skill of reading. Chall (1983) explains that most of the approaches to reading acquisition can be divided into two groups, referred to as the "code emphasis" & the "meaning emphasis".

For the code emphasis group the initial stages in reading instruction should emphasize the mastery of the code, the alphabet of the language and this is called as the " Bottom-up" Model.

The meaning emphasis group states that children learn to read best when the meaning of the printed matter is emphasized from the beginning, also called as the Top-Down Models.

(a) "BOTTOM-UP" Models

They explain reading by a phonics approach. They emphasize on recognition of letters and words. The process is referred to as bottom up because it begins with the perception of letters and words and then proceeds through the analyses at several successive levels involving larger units (e.g. phrases, sentences) and culminates with the construction of meaning at the top, in the reader's minds. This type of processing is Linear and Hierarchical thus, readers need to be successful with the processing of the smallest units (letters, words) before they can proceed to the next level of analysis.

Relative to the processing of words, two types are often debated in the literature, the processing of a word as a whole unit i.e. whole word look -say method or the processing of letters/strings of letters such as letter clusters like (cl, bl) as in phonics method (Chall, 1983). The goal of this system is to teach students about the nature of the alphabetic principle. Knowledge of the alphabet system does entail a working knowledge of letter- sound correspondence.

Bottom up models assert that meaning resides in the text and it is the reader's task to "extract" meaning from the page/whole passage. Despite the shortcomings and criticisms of these models (Grabe, 1988) they have demonstrated the importance of knowledge of the alphabet system. In addition, it has even shown that the use of context clues plays a minor role in lexical access in highly literate readers

(b) "TOP-DOWN" models

It explains reading by a whole word approach. Reading is said to begin with the information that is in the reader's head and not with print (Smith, 1978; Goodman, 1976). Goodman, (1976) asserted that reading is a psycholinguistic guessing game in which readers make more accurate guesses about meaning based on a sample of the text. Smith (1978) presented four main arguments for the primary role of prior

knowledge, context prediction in reading and against the precise sequential or hierarchical view of reading. First, individual words are often polysemous (have multiple meanings) and their intended meanings can only be obtained from context aided by prior knowledge. Second, there are more than 300 "spelling to sound correspondence rules" of English and there is no precise way of knowing when any of the rules must apply. Third, the amount of visual information from print that the mind can process at any given moment in reading is limited to four to five letters or other units. Despite the shortcomings of top- down models, they have shown that reading is a predictive process & that an adequate knowledge of the culture and *specifically the language* in which one is trying to read are important.

c) "INTERACTIVE" models

Current models of skilled reading are based on a prominent theoretical framework. In these structural models, the skilled reading is viewed as consisting of many separate but interacting components such as letter identification, visual word recognition unit, grapheme phoneme conversion unit, semantic unit etc which are called modules (Ellis 1985).

According to Ellis (1985), a skilled reader has mainly 2 routes from print to lexicon- a direct visual route & an indirect phonic route. Both routes are operative in a skilled reader. The direct route operates through the modules of visual analysis system, visual word recognition system, semantic system and phonemic word production system. This pathway is important while reading familiar words. On the other hand the indirect route through visual analysis system to grapheme phoneme conversion (GPC) system is mainly employed while reading unfamiliar words. However, generally it is assumed that both the visual and phonic routes are automatic, the phonic route is slower than the direct route and that the direct route plays a more important role in skilled readers. (Doctor and Coltheart, 1980; Coltheart, 1980), Based on interactive models various reading models have been proposed which are described as follows.

Reading Models

Various reading models have been proposed to explain the subtle aspects of reading. Following are three models which specifically mentioned the role of audition in reading.

i) Crosby Model (1968)

ii) Macworth Model (1971)

iii) Kamhi and Catts Model (1989)

i) The Crosby Model (1968)

Crosby and Liston (1968) presented a model of the reading process based on a definition of reading as a translation of graphic symbols into sound according to a recognized system. The author believes that reading, so defined, and reading comprehension are mediated by differing brain functions.

A child learning to read must make use of existing neurological abilities, but as facility increases some of the functions may be eliminated.

The Author's description of the process is as follows:

The image on the page is picked up by the eyes and transferred to the visual areas in the brain. Then in visual perception the individual letters are distinguished from all other marks. Next, the reading function occurs, in which the child recognizes that which he has perceived to be word and compares it to other known word images to identify it. At this point he says the word aloud, going through the functions of motor speech. He then hears himself say the word and makes use of his *long established ability to hear,* recognize and comprehend the spoken word.

The second level of reading is used by most individuals all of the time and all individuals some of the time. He no longer says the word aloud and hears himself say it, although vibrations may be set up in his larynx and some portions of the mechanics of

speech occurs. He goes through the mental process of saying the word without actually saying it, and similarly he uses the hearing or sensory speech function without using his ears and temporal context to reach language comprehension.

The third level of reading is reached by a small minority of readers . Here the person goes directly from visual perception to language comprehension, omitting any reference to the sound of the word. A new pathway to language comprehension has been established which permits rapid reading for meanings.

Crosby and Liston also present details of the neurological process involved in such tasks as reading without comprehension, writing from dictation, copying a known or unknown etc.

ii) The Macworth Model (1971)

This model details the systems that operate sequentially in processing the reading stimuli. The visual input, taking place during the fixational pause, is an active process involving selection, attention, expectancy and prediction. During the resulting sensory visual trace, which lasts for approximately 250 msec; the information contained in the trace is processed in parallel prior to its destruction by the data from the next fixation. Recognition of the input occurs by matching it to memory traces in long-term memory so that the input is stabilized as the iconic image. The iconic store, with a temporal capacity of one to two seconds, is capable of holding several inputs simultaneously, thus smoothing the further processing of multiple discrete inputs. From the iconic store, words are coded into short-term memory by motor speech programs which activate the matrix of sensory associations and verbal probabilities that gives rise to verbal expectancies. Short-term memory has a temporal capacity of several seconds but a limited informational capacity. The information is finally stored in long -term memory, which is connected to all prior processing through feed back systems. *The auditory path way operates with the same short and long-term memory systems* and plays in important role in learning to read, a lesser role in skilled reading (Fig. 4).

iii) Kamhi and Catts Model (1989)

Kamhi and Catts model is an interactive model which consists of perceptual analysis, word recognition and discourse level processes. The input to the perceptual analysis is speech or print. In order for this input to be recognized, it must be detected and analyzed. The sensory mechanisms involved in the detection of speech and print are distinctive; the ear is used to detect speech and the eye is used to detect print. *Sensory deficits involving hearing or vision place a child at risk for spoken and written language problems.* Children born deaf cannot detect the speech signal through the auditory modality and, as a result, have considerable difficulty developing intelligible speech.

The above mentioned three models illustrate specifically the critical role of audition in learning to read. Thus in children with normal hearing the auditory mode of input builds the lexicon which is accessed while reading irrespective of whether it is a phonics/whole word approach. Such an ability to apply the knowledge gained through auditory input to the reading process which is a metacognitive activity requires good language and metalinguistic ability i.e. the ability to reflect upon language. Tunmer and Bowey (1984) among many others consider metalinguistic ablity as an important prerequisite for being able to learn to read. Four broad levels of linguistic awareness have been identified and proposed by Tunmer and Bowey (1984) which are -

1) Word Awareness

2) Form Awareness

3) Pragmatic Awareness

4) Phonological Awareness

B. Phonological Awareness

Phonological Awareness can be defined as the ability to reflect on and manipulate the phonemic segments of speech. It refers to the ability to perform mental

operations on the output of speech perception mechanism whose input is from auditory receptors. Phonological awareness is considered to be critical to the subsequent acquisition of good word recognition skills.

There are many conflicting views about relationship between phonological awareness and learning to read an alphabetic orthography. First view is that phonological awareness is a crucial factor in literacy acquisition in alphabetic systems in that phonological awareness is causally related to reading acquisition. (Kavanagh and Mattingly, 1972; Calfee Lindamood and Lindamood, 1973, Gouch and Tunmer 1986). Second view is that phonological awareness is merely a consequence of reading acquisition (Ehri and Wilce, 1980; Read Zhang, Nie and Ding, 1986; Yopp, 1988; Bowie and Francis, 1991). Combining the above two is the third view that a reciprocal relationship exists between phonological awareness and learning to read; i.e. phonological awareness is both a cause and a consequence of reading acquisition (Alegria, Pignot and Morais, 1982; Ehri, 1984).

a) Importance of phonological awareness in learning to read

There are atleast three ways that phonological awareness contributes to the growth of early reading skills.

i) It helps children understand the alphabetic principle.

ii) It helps children notice the regular ways that letter represent sounds in words. It reinforces knowledge of individual sound letter correspondences and second it helps in forming mental representation of words that involved a close amalgamation of their written and spoken forms.

iii) It makes it possible to generate possibilities for word in context that are only partially sounded out. For eg: considered the child who comes to a sentence such as "the boy 'r - - - his bike' and cannot recognize the third word but knows the sound represented by the first which will help him in searching the lexicon for words with similar sounds.

This analysis suggests that phonological awareness has its primary impact on reading growth through its contribution to childrens ability to use sound letter correspondences to decode words in text. Although the ability to phonetically decode words is not an end in itself (phonetic decoding is too slow and effortful to support fluent reading and good comprehension), recent accounts of reading growth indicate that phonetic reading skills play a critical role in supporting overall reading growth, particularly the growth of a rich vocabulary that can be recognized orthographically, or "by sight" .

b) Procedures used to asses phonological awareness

Phonological awareness is generally tapped through tasks involving manipulation of rhymes, syllables and phonemes in the form of deletion, synthesis, counting, identification etc. Majority of studies involving alphabetic orthography report on measurement of phonemic awareness. Catts, Wilcox, Wood- Jackson, Larrivr & Scott, (1997) found 3 broad categories for measuring phonemic awareness:

i) Phonemic segmentation task

ii) Phonemic synthesis task

iii) Sound comparison task

There is considerable flexibility in choosing the task to credit a child with a certain level of phonological awareness. Golinkoff (1978) speculates that "recognizing the absence/ presence of a unit should be easier than adding/deleting the element itself. Performing a deletion and recombining the elements is easier than performing the deletion and replacing the deleted element with another element.

Although some research (Yopp, 1988) has indicated that the tasks may vary in the complexity of their overall cognitive requirements and there may the some differences between analysis and synthesis tasks at certain ages for the most part they all seem to be measuring *different levels of growth* in the same general ability (Stanovich, Cunningham and Cramer, 1984).

C. *Reading and Hearing Impairment*

The acquisition of literacy skills begins prior to the mandatory school period. Such pre-literacy skills are dependent on well founded language skills. Therefore, children who have hearing impairment need to be considered 'at risk' because they have difficulty in developing age appropriate language as well as literacy skills. As the risk is also determined by the level of hearing impairment, it is essential to consider the traditional subdivision between hard of hearing and deafness. Two types of criteria are used to make these distinction-

a) Effect of hearing loss on ability to process linguistic information

b) Audiometric results(Northern & Down's,1991).

Using the criterion of linguistic processing, hard of hearing children are those who can develop basic communication skills through the auditory channel whereas deaf children are those whose hearing impairment is so severe that it is impossible to process linguistic information through hearing alone, with /without amplification (Ross, 1982). Most of these children but not all don't exhibit age appropriate developmental skills (language, cognitive, social and sensory) as they progress through the early childhood period. Learning to read and write effectively is a challenging task for the deaf and hard of hearing. Inspite of concerted efforts by educators to facilitate the development of literacy skills in deaf individuals, most deaf high school graduates read English at roughly at third or fourth grade as determined by standardized reading assessments. (King and Quigley, 1985).

Geers and Moog (1989) reviewed the association between pre-lingual hearing loss and reading deficiency which has been abundantly documented, beginning as early as 1916. Demographic studies of reading performance by hearing impaired children show that a plateau reaches at about the 3^{r} grade reading level (Schildroth and Karchmer, 1986). Most hearing impaired children reach the plateau by 15 years of age and remain there atleast through age 18 (Geers and Moog, 1989).

a) Phonological awareness in hearing impaired children

The literature on literacy acquisition by hearing impaired students (King and Quigley, 1985; Wood, Wood, Griffith and Howarth, 1986) is far from positive regarding the demonstrated effectiveness of alternatives to phonologically based reading processes. Hence usage of non-phonological based instruction strategies for mainstreaming hearing impaired students has been suggested as being unwise.

Evidences of a causal relation between phonological awareness and success in reading (Blachman, 1991) and reported success in training of those skills (Vellutino, 1991) in normal hearing children has changed the focus of research. Studies on assessment to training of phonological awareness in children with hearing impairment suggest that it helps them to attain high literacy levels that contribute to better mainstreaming. To children with hearing impairment, to have a sensory deficit/condition but an intact auditory - articulatory loop albeit facilitative, is not sufficient for developing literacy skills, although it does contribute to the understanding of the sound system of a Language. Ultimately an individual needs to have cognitive awareness of the representation system, even if it is not developed peripherally via the auditory-articulatory loop.

Stern and Goswami (2000) measured phonological awareness in deaf children (mean age 11 years). 3 experiments were carried out at 3 linguistic level of syllable, rhyme and phoneme. The first experiment showed that deaf children's syllable awareness can be equivalent to that of chronological age matched hearing control. In the second experiment deaf children's ability to make rhyme judgements was above chance but poorer than younger reading matched hearing controls. The third experiment showed that deaf children could phonologically record nonsense words at a level above chance, suggesting that they could draw on phonemic skills in certain conditions. They concluded that deaf children do develop phonological awareness skills but lag behind hearing children and may develop it in different ways.

Aghabian, Valerie, Nazir, Lancon, Chrisstophe and Tarchy (2001), conducted a single case study involving a profoundly deaf girl who was given special training to

enhance understanding of grapheme -phoneme relation following which reading skills changed from a logographic strategy to that of normal readers.

Samanta and Ray (2001) conducted a study to examine the differences in performances in tasks of phonological awareness in normal children and in children with severe to profound sensorineural hearing loss using total communication. The tasks chosen were-

> Final consonant deletion

> Syllable segmentation

> Syllable blending

> Phoneme counting

Results indicated that the hearing impaired subjects performed significantly poorer than normal subjects in all the four tasks.

Harris and Beech (1998), reported on a longitudinal study of reading progress in a group of 5 year old hearing impaired children and a group of hearing controls. All the children were pre readers at the beginning of the study and IQ of the 2 groups were matched. The deaf children varied considerably on a number of measures including implicit phonological awareness, oral ability and familiarity with British sign and finger spelling. Overall, the deaf children made significantly less reading progress than their hearing peers over the first year of schooling and they also scored significantly on the test of rime and onset awareness. However considerable variation in the reading process of the deaf children was positively correlated with oral skills, rime and onset awareness and language comprehension. Language comprehension was positively correlated with signing and finger spelling .The deaf children were assessed again one year later and even then learning to read continued to be delayed and pattern of correlation was same.

b) Factors affecting phonological awareness in children with hearing impairment

i) Degree of hearing loss

Children who are hard of hearing are better at phonological processing than children with greater hearing losses because they can make use of word sounds. (Perfetti and Sendak, 2000). Among children with more severe losses however phonological skills do not appear to be related to degree of hearing loss. Miller, 1997 suggests that there must be another route to the decoding of individual words i.e. that might be using a mixture of strategies based on mode of communication.

ii) Mode of communication

Research has shown that deaf readers can access phonological information through information accumulated from lip reading, finger spelling, articulation and exposure to writing, no one of which is sufficient in itself (Dodd, 1980, Hanson, 1989, Leybaert, 1993).

The traditional communication system for the children with hearing loss include

1. Oral/aural

2. Total communication

3. Cued speech

4. Manual communication

Use of hearing and speech is basic to all the system listed and hand gestures and formal signs are important as a means of adding cues to the spoken signal for the child who cannot completely rely on the use of hearing and/or the combination of audition and speech reading. Cued Speech was developed by Cornett 1967, and consists of gestural cues for each signifying a phoneme such that it allows for a phonological equivalent for identifying new words (Nichols, 1979).

Webster (1986) notes that deaf children who have inner coding systems, but they may be based on signs, finger spelling, visual features, or a mixture, including sounds. But non-speech course may be less effective in dealing with print, which is derived from speech in the first place.

Miller (1997) conducted a study on two groups of pre-lingually deaf children (one trained via the oral mode and one group using acquired sign language as their primary language) to examine the effect on communication mode on the development of phonological awareness. The performance of the two deaf groups indicates that permanent auditory deprivation leads to substantially reduced phonological awareness but does ***not entirely block its*** development. Contrary to expectation, the development of phonological awareness in individual impaired hearing was not significantly effected by their preferred communication mode.

Miller (1997) thus suggest that for the individuals with excellent skills in sign languages the functional impairment caused by prelingual deafness may be restricted to the processing of phonological information. Leybaert (1998) further states that development of phonological representation in deaf children does not necessarily depend on auditory speech experience neither at the perception nor at the production level instead this development depends on early experience of an input in which all phonological contrast are well specified, independent of input modality.

Charlier, Bnigette and Leybaert (2000) conducted a similar study and compared three input modalities

a) Cued speech

b) Oral /aural method

c) Sign language

Rhyme judgment and rhyme generation tasks were included and result revealed that their children educated early with cued speech perform better at both the tasks than the other groups, which supported the hypothesis that rhyming ability

depends on early exposure to a linguistic input specify all phonological contrast, independent of the modality (visual/auditory).

Thus, the general conclusion of the relation between mode of communication and phonological awareness is that irrespective of the modality of communication, it is the linguistic input that specifies all phonological contrasts and decides the acquisition of phonological awareness in deaf and hard of hearing

iii) Speech perception ability

Speech perception and reading, both involve the processing of verbal language transmitted in a coded form. Although the physical stimuli received by the auditory and visual system are of a different nature, they both evoke the same linguistic percepts. At some level of processing there must be therefore equivalence between the two intake modes.

In comparing speech perception and reading, one important exception to be noted in these comparable processes is that the child acquires understanding of spoken language naturally while reading has to be learned.

Mattingly (1972) points out that speech is a primary linguistic activity while reading is a secondary activity grafted on to primary linguistic code. Reading is therefore heavily dependent on the reader's familiarity with the primary linguistic code, usually acquired through auditory perception. Congenitally deaf children experience considerable difficulty in learning to read because of marked retardation in the ability to detect and discriminate sound associated with the particular language. Because of the overlap of processing between speech perception and hearing ability, children with severe to profound hearing impairment also have poor speech discrimination skills and children who possess poor discrimination skills have difficulty acquiring phonological awareness. Speech perception in hearing impaired involves the two component model of hearing loss has suggested by Plomp (1978).

> Decreased Sensitivity: It is caused due to elevation of auditory thresholds, which exists in both conductive and sensorineural loss. It causes speech

sounds of low sensitivity to be heard less clearly than normal or not at all. In general this affects predominantly the high frequency component of speech, the softer consonants and higher formants of some vowels.

> **Decreased clarity:** The sensorineural hearing mechanism is impaired with respect to detection and discrimination of three major parameter of speech sound - frequency, intensity and duration.

In cases of increased sensorineural loss, even with best amplification and optimal speech signal (correct elevated thresholds), speech may still be heard less clearly than normal. In addition the typical mainstream classroom presents far from optimal acoustic environment (Olsen, 1998). In such classrooms, increased noise levels and increased reverberation times detract still further the ability of the hearing impaired to perceive speech accurately. Therefore, in such children, inaudible/imperfectly heard sounds may not be represented in the students phonologically encoded mental lexicon. During early stages of reading acquisition, to form a correspondence between a word in a print and that words sound representation, the child has to access the mental lexicon which if not accurately encoded can affect reading skills.

Gibbs (1995) conducted a study to investigate the relationship between categorical speech perception and phonological awareness in the early stages of learning to read in hearing impaired children and children with normal hearing aged between 5-7 years and found no evidence of concurrent association between abilities to categorically labeled speech sounds and abilities in the measures of phonological awareness in both the groups.

Engel - Eldar and Rosenhouse (2000) conducted a study to examine reading difficulty in Hebrew in three reading impaired children between 2^{nd} to 6^{1} grades.

a) Dyslexics with impaired auditory perception

b) Dyslexics with impaired visual perception

c) Severe hearing impaired children

The results reveled a similarity in the reading difficulties of auditory perception and hearing impaired students when compared to the visually impaired.

In general because of the overlap of processing between speech perception and hearing ability, children with severe to profound hearing impairment have poor speech discrimination skills. Even children with intact hearing may have difficulty making discriminations among speech sounds and some children who posses poor speech discrimination skills may have difficulty acquiring phonological awareness. In addition, many young children with typical hearing who perform satisfactorily on tests of speech discrimination may exhibit poor phonological awareness. Therefore, in essence, for young children, phonological awareness and not speech perception or discrimination is a good predictor of subsequent success in reading during the first few grades of school.

iv) Phonological processing or coding

Phonological proficiency is clearly related to reading development. We can see the use of phonological processes for eg in older deaf students being more likely to make phonologically accurate misspellings (for eg pakige for package) than younger deaf students indicating higher level recognition and not near production abilities. Children with good articulation also make such errors more frequently than children with poor articulation. Such findings are not limited to children who use spoken language but are also found in students who use sign language. (Hanson, 1986; Leybaert, 1993).

v) Cognition and Working Memory

Language influences and facilitates cognitive development. Ramkishan (1990) concluded that existence of a metalinguistic ,cognitive developmental relationship can be inferred indirectly from data on phonological awareness, reading achievement and concrete operations. Chaney(1992) reported that performance on Phonological awareness tasks by hearing preschoolers was highly correlated with general language ability. It was highly correlated with general language ability. It was observed that the syntactic and semantic skills rather than speech discrimination and articulation strongly

predicted phonological awareness differences among the hearing children. *These findings suggest the phonological awareness and other metalinguistic skill develops in tandem with that of general language skills during the preschool years.*

Radhika (1987) reported that in hard of hearing children, irrespective of mode of communication-oral vs. sign (Total communication) it was noted that they performed poorly on certain cognitive tasks that were verbal in nature abilities. With experience and practice letter combinations become familiar, and recognizing them as syllables and words becomes a routine. The faster and more routine the better, because, working memory is limited to approx the amount of information that can be articulated in 2 sec, regardless of whether that information is stored in the form of speech or sign language. If individual word or meaningful parts of words are lost before a meaning has been assigned to them phonological processing becomes less efficient, less accurate and may break down all together.

A variety of investigations have indicated that deaf readers like hearing readers use a combination of whole word recognition, phonological or sound based recoding and orthographic (spelling based) recoding to hold information temporarily in working memory (Hanson and Fowler 1987; Hanson, 1989). Some deaf readers also recode English print in to sign at least some of the time, (Marschark and Mayer, 1988). Most hearing children begin reading by building up a limited sight vocabulary of words from TV, road signs and books (Marschark and Harris, 1996). Then they gradually develop a sound based strategy for figuring out new words, the result is a growing inventory of sound letter correspondence that supports decoding the text. A similar, but delayed, process appears to occur in many deaf readers who use phonics as well as sight vocabulary (Miller, 1997). Harris and Beech, 1998 found a positive correlation between speech intelligibility and reading during their first year of school, i.e. young deaf children who are more consistently and accurately producing speech tend to read better than those who do not. They said improved articulation and speech reading are not enough to account for improvements in reading over the long term. Exposure to finger spelling and writing experiences act as alternative to maintain reading progress

(Campbell, 1992). One study involving deaf college students demonstrated the combination of word decoding strategies used in reading.

Lichenstein, 1998 analysed questionnaire responses from 86 first and second year students and found that meaning of text, as it was read, was retained in a speech based code (in a working memory). This was supplemented by the use of signs and finger spelling and students were more likely to report using two or more codes rather than only one, Deaf students who made use of speech coding were also better able to remember and reproduce a sequence of English words. This latter reflects the now confirmed finding that speech coding appears to be optimal means of briefly retaining linguistic information in working memory, a central component of reading comprehension and mechanism underlying memory span (Perfetti and Sendak, 2000).

vi) Nature of Script

Much of the work on phonemic awareness in relation to reading is confined to alphabetically transcribed languages such as English, Russian, French and Italian emphasizing its role in reading, but the issue is still un resolved. Studies by Chandrika (1990), Patel and Soper, (1987), Prakash (1987), Rekha (1987), Prakash, Rekha, Nigam and Karanth (1993), Prema (1997), Akhila (2000) and Seetha (2002) revealed that phonemic awareness is not a crucial factor in learning to read Indian Languages. With respect to Kannada, Prema (1997) states that syllable awareness is the earliest to develop in a non alphabetic script and that phoneme awareness is late to develop and when developed it could be due to the influence of alphabet like features of the script and or exposure to alphabetic script in addition to maturational factors. The lack of consensus between the studies on alphabetic script and those employing non-alphabetic script suggests that the issue of phonological awareness in relation to reading is yet unresolved.

Reading is the product of cultural evaluation and blend of many components, which have been researched since long. It has been proposed that a beginning or novice reader makes use of the 'Bottom-up' process while as he or she becomes a skilled reader they shift to 'Top-down' models. The auditory input during the stage of reading

acquisition facilitates 'Bottom-up' processing which is critical for the child to become a skilled reader, since it is responsible for good language abilities which in turn contribute to the development of metalinguistic abilities. Of the metalinguistic abilities , Phonological awareness is considered to be critical to subsequent acquisition of reading skills due to deficit in Phonological awareness. Phonological awareness has been reported to be crucial to acquisition of language skills in alphabetic scripts though not so in Indian languages with semi syllabic scripts . However, there is no consensus about the exact nature of the relationship . In hard of hearing children, research has shown that reading levels have been below their normal hearing peers. In the hearing impaired due to a deficit in the linguistic input, the metalinguistic processing is also affected leading to poor phonological awareness . The level of phonological awareness in the hearing impaired is influenced by various factors explained earlier.

Thus, the present study was taken up to evaluate phonological awareness in children with hearing impairment, medium of instruction being Kannada, a Dravidian language with a semi syllabic script.

METHOD

The aim of study was to probe into the relation between reading skills and phonological awareness in children with hearing impairment.

A. Subjects

The research design consisted of an experimental & control group described as follows.

1. Experimental group

> It consisted of 5 children (aged 5-6 yrs) with moderately severe (56 70 dB) to severe (70-90 dB), congenital sensorineural hearing loss, diagnosed by a qualified audiologist at AIISH.

> Average hearing thresholds for frequencies 500Hz, 1000Hz & 2000Hz for both ears were 74dB.

> The children were using binaural behind the ear aids and were receiving education in special school for around three years following the oral - aural mode of communication with special emphasis on reading & writing skills.

> They had normal pre- peri and postnatal history except that they have congenital hearing loss diagnosed between 2 ½ to 3 ½ yrs of age.

> None of them had any neurological problem.

> All subjects had normal hearing parents and siblings.

Table - 1 Subjects chosen as part of experimental group

SI No	Age/Sex	Age at Initiation of intervention	Degree of hearing loss	
			Left ear	Right ear
1	5.1/male	3 years	85 dB	75 dB
2	6/female	3.6 years	70 dB	80 dB
3	6 /male	3 years	60 dB	70 dB
4	6/male	3 years	80 dB	75 dB
5	5 /female	3 years	70 dB	75 dB

2. Control Group

> The control group consisted of chronological age and sex matched children with normal hearing.

> They were taken from city based Kannada Medium School children representing middle socio-economic status.

B. *Criteria for selection*

1. Experimental group

The experimental group for the study was chosen from the "Rotary school for the mother & deaf child"- a special school in Bogadi, Mysore. It follows a "Whole-word" approach in teaching reading. The reading instruction is introduced right from the beginning of schooling along with auditory learning starting from whole words rather than Kannada letters. The mothers of the children with hearing impairment are trained to teach the child based on guidelines by the teachers (special educators) of the

school. The mothers are housed in the premises of the school and are involved in intensive training.

For selecting children from this school, the following parameters were checked, details of which are shown in figure 1 :

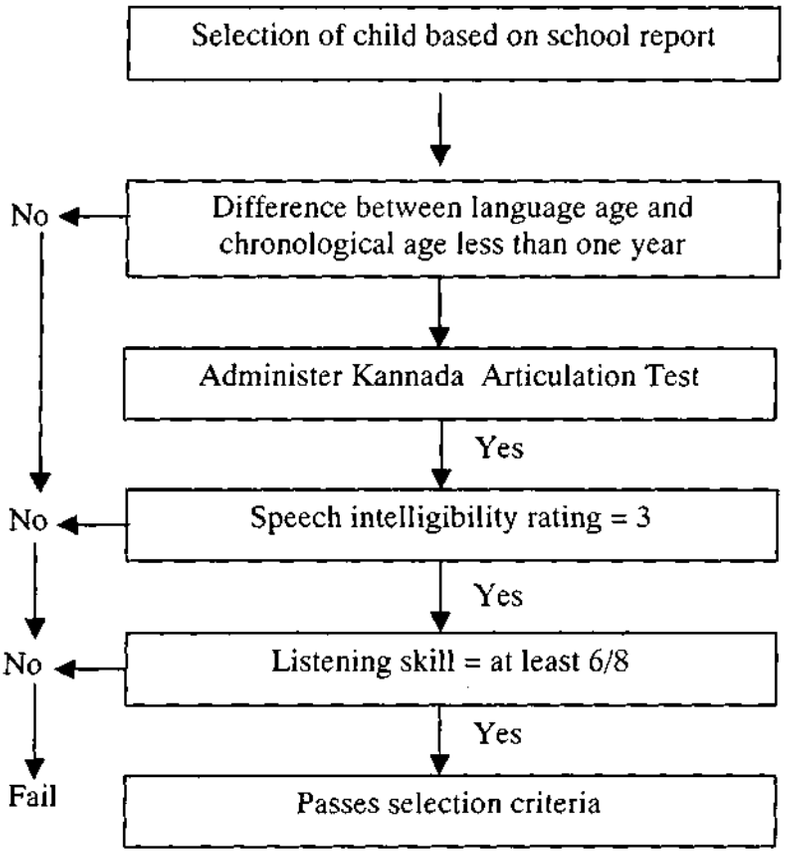
> **Language level-** A language test was administered i.e. Scale for Early Communication Skills for hearing impaired children (SECS)- Moog & Geers, 1975 to obtain a language age. Children with not more than one year difference between the language age and chronological age were chosen for the study.

> **Articulation** - The children were screened on Kannada Articulation Test (picture).

> **Intelligibility** - The speech sample of the children was rated using an informal 3 point rating scale with 0 (unintelligible) to 3 (good intelligibility) by a qualified speech language pathologist. A rating of 3 was the criteria for selection.

> **Listening skill** -The listening skill of the children was tested using the Picture identification test (developed in AIISH) consisting of pictures within the vocabulary of the child. The stimuli were presented through the auditory mode and a correct identification score of 6/8 i.e. 75% was chosen as selection criteria.

Fig. 1 SELECTION CRITERIA



Thus, a set of 5 children were chosen as in Table-1 and administered the reading readiness test and metaphonological tests.

2. Control group

a) "Language test in Kannada for expression in Children"- developed by (Kathyayani,1984), was used for screening language of the control group.

b) The class teacher's opinion of the student with respect to reading & writing skills was obtained. Students rated as average were chosen for the study.

C) Tests:

The subjects selected in the experimental & control group were administered a battery consisting of reading readiness test (Devi,1978) and metaphonological tests (Prema, 1997).

1. Pilot study

> A pilot study was conducted using tests for metaphonology subtest of the Reading Acquisition profile in Kannada (Prema, 1997) . Around four hearing impaired children from the same school were chosen randomly for the pilot study along with four normal children. As none of the children could perform on non-word material, this subsection was removed, since children had difficulty comprehending the task.

> Syllable oddity was not administered since the hearing impaired children and children with normal hearing found the task very difficult. Instead syllable reversal task was added consisting of bisyllabic words

> Both normal and children with hearing impairment could not perform on phoneme tasks. Hence, this subsection was also eliminated and after these modifications, the test was finalized .

2. Final test

> It consisted of Reading readiness test & modified metaphonological test.

> The details of instruction & scoring enclosed in Appendix.

> Table 2 is a summary of the various sub tests used.

Table - 2 Summary of total scores in reading readiness test and phonological awareness test

SI No.	Subtests	No of Items
I	Reading	
1	Vocabulary	22
2	Visual discrimination	28
3	Auditory discrimination	64
II	Metaphonological Tests	
1	Rhyme recognition	10
2	Syllable reversal	10
3	Syllable deletion	10
4	Syllable oddity	10
5	Phoneme reversal	10
6	Phoneme deletion	10
7	Phoneme oddity	10

D. *Procedure*

1. Experimental Group

> The mothers of selected children were sensitised to the 2 main tests and given a week's time for training the children with illustrations. For the training, a

different set of 6 items were given as examples to enable the children to understand the task .

> The testing was carried out in an audiometric two room situation with ambient noise within permissible limits(ANSI 1991).

> The test stimuli were presented through Maico MA-53 calibrated dual channel diagnostic audiometer with free field speakers at a comfortable level of 60dBSPL.

> Although, during demonstration audiovisual mode was used, in actual testing, each stimulus was presented only through the auditory mode (without visual cues) and each stimulus was presented for a maximum of 3 times.

> The responses were recorded using broad phonetic transcription.

2. Control Group

> The testing was done in school premises/at home.

> Oral responses were recorded using broad phonetic transcription.

In general all the subjects were tested individually. Testing for each subject lasted for around 2 hours. The testing was carried for 2-3 sessions each lasting around 30 minutes. At the end of each session the child was rewarded with tangible reinforcers. The obtained data was subjected to statistical analysis.

RESULTS AND DISCUSSION

The primary objective of the study was to evaluate phonological awareness in children with hearing impairment. The secondary objective was to study the relation between phonological awareness and reading skills in the above children who are trained via oral-aural approach but supplemented with orthographic modality in Kannada. Quantitative and qualitative analysis was done. The details of which are explained as follows.

Quantitative Analysis

The data obtained from experimental and control group was subjected to statistical analyses of mean and standard deviation.The mean and standard deviation was computed for both reading skills and phonological awareness skill. The details are shown in Table 3 (overall), Table 4 (Reading Readiness Test) and Table 5 (phonological awareness).

The results are discussed according to subtests of the Reading and phonological awareness test.

a) Reading Readiness Test

Table 3 indicates the difference between experimental and control group on Reading readiness and Phonological awareness. While the mean of the experimental group was 66.45 for a maximum of 114 on reading readiness tasks that of the control group is 114. Similarly the Standard deviation is also high in the experimental group (4.92) in comparison to the control group (0.00) which was homogenous in nature. The results suggest that the control group is ahead of the experimental group in reading readiness skills with minimal variation within the group. This is further supported by 't' test of significance of difference between means that indicates a significance difference between two groups at 0.01 level.

Table 3: Comparison between reading readiness and phonological awareness

Sub test		Control group	Experimental group	t-value	S/NS
Reading	Mean	114.00	66.25**	27.44	S
	Standard deviation	0.00	4.92		
Phonological awareness	Mean	27.37	12.00**	4.07	S
	Standard deviation	2.87	10.29		

Significance at 0.01 level (2 tailed)

The Reading Readiness Test consisted of mainly three subtests were which are explained below as in table 2.

Table 4: Comparison between experimental and control group on test of reading

Sub test		Control group (N=5)	Experimental group (N=5)	t-value	S/NS
Vocabulary (22)	Mean	22.00	22.00	-	NS
	Standard deviation	0.00	0.00		
Visual discrimination (28)	Mean	28.00	27.75	1.53	NS
	Standard deviation	0.00	0.46		
Auditory discrimination (64)	Mean	64.0**	16.50**	26.95	S
	Standard deviation	0.00	4.98		

**Significance at 0.01 level (2 tailed)

> Vocabulary: The mean score for both the groups was same (Mean = 22.0) which was the maximum score of the test.

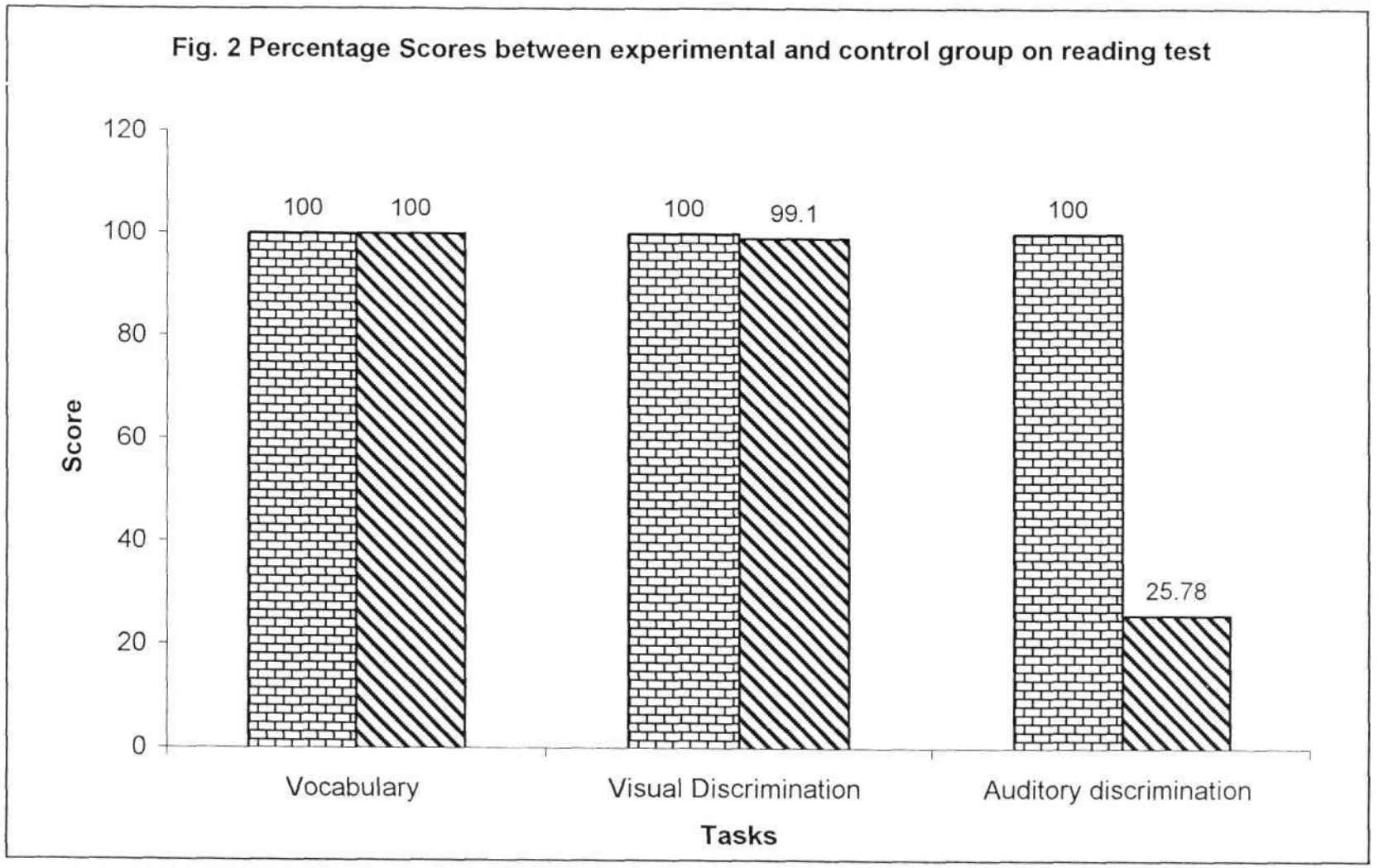
- Visual Discrimination: The mean for both the groups did not differ significantly i.e., both groups performed on par with each others. The experimental group obtained a mean(Mean = 27.75) slightly below that of the control group(mean=28.00) out of a maximum score of 28. So the performance of both the groups was similar.

- Auditory discrimination: A statistically significant difference in performance was seen, with the mean for experimental group being 16.50 and that of control being, 64.00 for a maximum score of 64.

Fig.2 shows a graphical comparison between experimental and control group on the various subtests. In order to evaluate whether the scores of the experimental group on Reading Readiness tasks could be masked by subtest of auditory discrimination an attempt was made to compare both the groups on two subtests viz. visual discrimination and vocabulary. It was found that when converted to percentage scores the results indicate that the performance of the two groups equate suggesting that while evaluating Reading Readiness skills of children with hearing impairment one should cautiously avoid tasks that demand auditory discrimination skill in order to get a true picture Fig.3 and Fig.4 support this observation.

Overall, statistically, A significant difference in performance was observed between the experimental and control group ($p>0.01$) on the subtest of auditory discrimination. Excluding this subtest, the two groups can however be equated for their reading readiness skills. The above finding is quite justified considering that the control group consists of 5 children with moderately severe to severe hearing impairment who could not perform on the auditory discrimination task when stimuli were presented through the aural mode.

Fig. 2 Percentage Scores between experimental and control group on reading test



b) Phonological Awareness

Table -3 shows the overall performance in the phonological awareness task. The mean score of experimental group is 12.00 for a maximum of 30 and that of the control group is 27.37. The difference in performance of the two groups was statistically significant on 't' test of significant difference between means (0.01 level), Suggesting that the control group has high level of phonological awareness when compared to the experimental group. The standard deviation is also high in experimental group (10.29) in comparison to the control group (2.87). which indicates the large variation in performance within the experimental group that could be attributed to differences in degree of hearing loss, as all other variables are kept constant.

Based on the results of the pilot study, only rhyme recognition, syllable reversal and syllable deletion was included in the study. It is evident from Fig.5 that except for task of rhyme recognition, the children with hearing impairment performed significantly poorer in other tasks viz. syllable reversal and syllable deletion when compared to the normal hearing children.

Table 5 depicts the mean and standard deviation for each of the subtests on test of phonological awareness.

Table 5: Shows comparison between control and experimental group on test of phonological awareness

Sub test		Control group (N=5)	Experimental group (N=5)	t-value	S/NS
Rhyme recognition (10)	Mean	8.50	5.87	1.41	NS
	Standard deviation	1.85	4.91		
Syllable reversal (10)	Mean	10.00**	4.12**	4.61	S
	Standard deviation	0.00	3.60		
Syllable Deletion (10)	Mean	8.50**	2.00**	6.50	S
	Standard deviation	1.85	2.13		

**Significance at 0.01 level (2 tailed)

> Rhyme Recognition: Mean score on this task approximated the maximum score of 10 for the control group (Mean = 8.5) the standard deviation being 1.85 while for the experimental group, the mean score was 5.87 with standard deviation being 5.91.

However the difference in performance of the two groups was not statistically significant.

> Syllable Reversal: The mean for the experimental group was 4.12 (SD=3.6) while control group achieved the maximum score of 10 (SD=0). The difference between the two groups was statistically significant.

> Syllable deletion: The experimental group performed the poorest in this task (mean = 2.0) while the control group obtained a score of 8.50 for a maximum of 10. This difference was statistically significant.

Overall the experimental group performed poorest in the subtest of Auditory Discrimination in the Reading Test, while on the other tests, they were on par with the control group as evident in fig-3 and fig -4. In Phonological Awareness, the hierarchy of

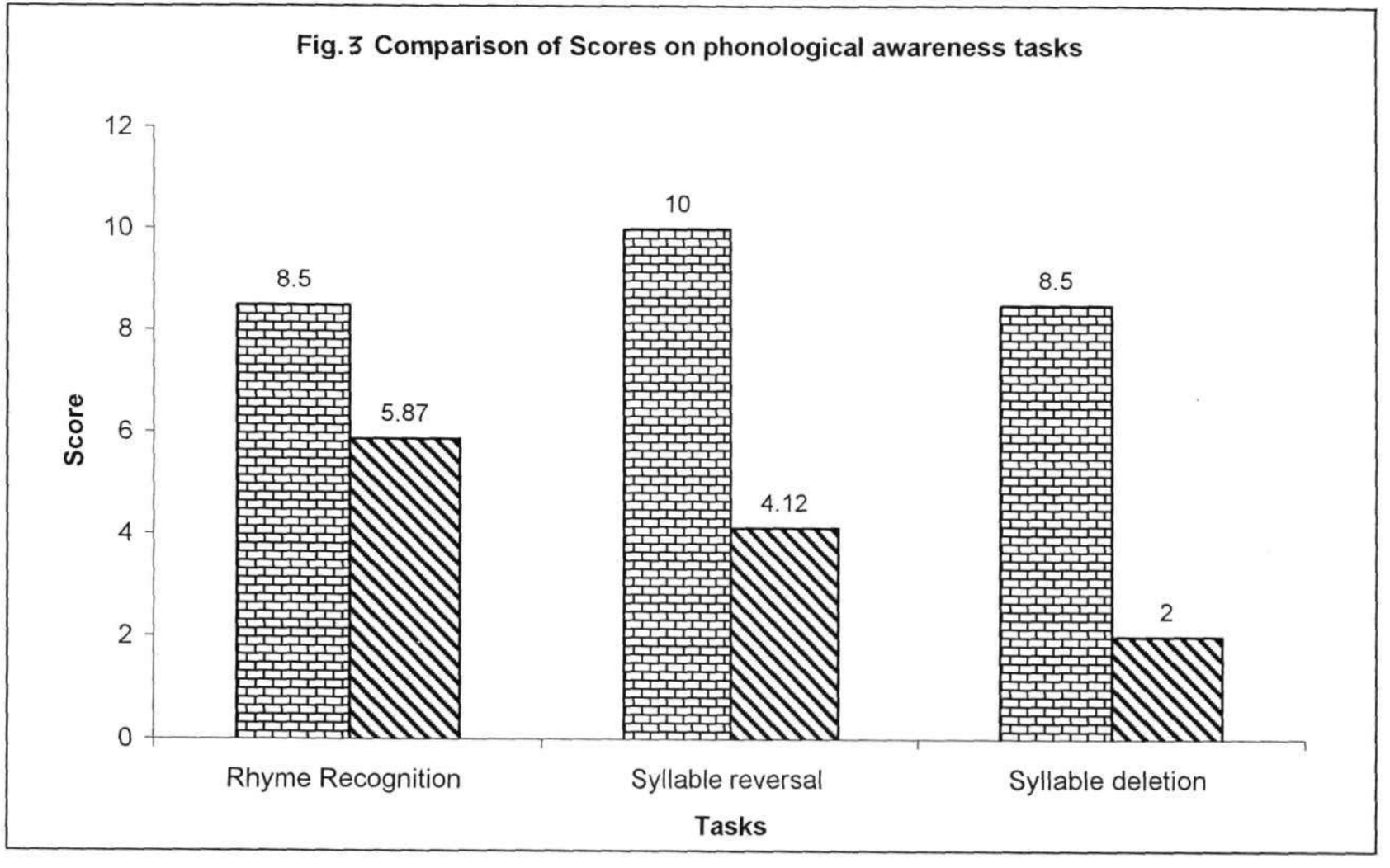
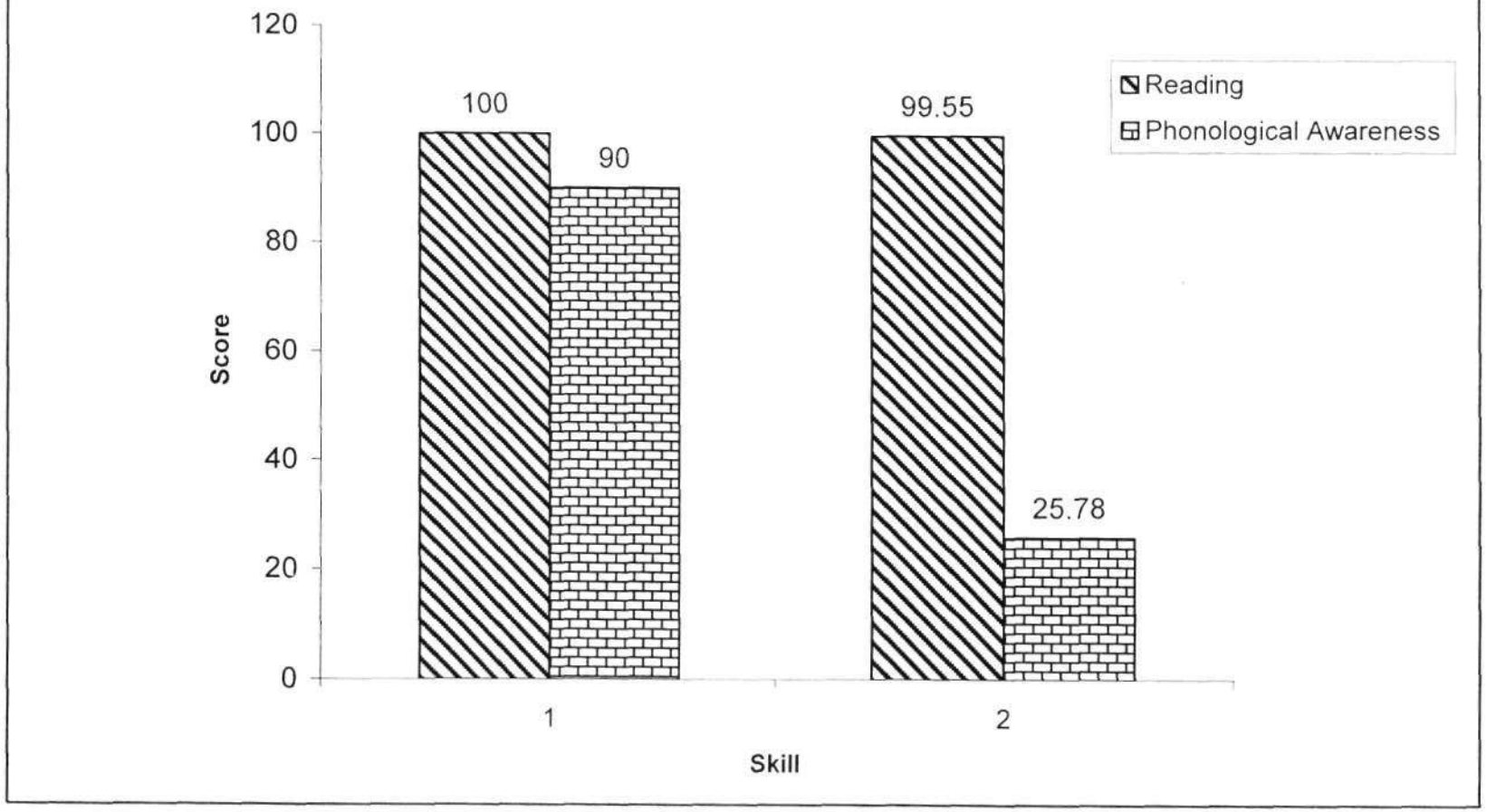


Fig. 3 Comparison of Scores on phonological awareness tasks
12
10
8
6
4
2
0
Score
8.5
5.87
10
4.12
8.5
2
Rhyme Recognition
Syllable reversal
Syllable deletion
Tasks

Fig. 4. Comparison of overall reading and phonological awareness (excluding auditory discrimination)



task performance observed was rhyme recognition, syllable reversal and syllable deletion with rhyme recognition being the best and syllable deletion poorest (Fig.3). Syllable reversal was easier than syllable deletion in the experimental and control group. In syllable deletion, deletion of initial syllable was done best and medial syllable deletion was poorest.

Thus, the performance of the children with hearing impairment was poorer than their age matched normal hearing peers in both the skills i.e., reading readiness and phonological awareness. At the outset the results appear to be in consonance with the findings of Harris and Beech, 1998; Stern and Goswami, 2000; Samanta and Ray,2001 who observed that hearing impaired perform poorly compared to their hearing peers on phonological awareness. Yet a closer look at the individual performance on subtests of reading readiness test shows that the performance of the hearing impaired was similar to the normal hearing children when the auditory discrimination task was overlooked i.e children with hearing impairment were on par with normal children in reading skills as in Fig. 4.

In the Phonological awareness tasks, at times the results were confounded by the stimulus item that might not have been in the vocabulary of the child or the frequency composition of the test stimulus, which was not perceived owing to the hearing impairment. All these factors are discussed below specifically with respect to reading and phonological awareness.

A) Reading

Studies of reading performance by hearing impaired children following total communication show that a plateau occurs at about third grade level (Schildroth and Karchmer, 1986) and they generally show a lag in their reading skills from the beginning of reading instruction which is seen in the present study also wherein the subjects are equivalent to 1st graders.

It was also observed when the auditory discrimination subtest of the reading readiness test was overlooked, then both groups performed on par with each other. That

is children with hearing impairment were on par with normal children in reading skills as in Fig.4. Thus the limitation within the test material for measuring reading readiness might have led to the lowering of the overall score on the reading test, which suggests that normal and hearing impaired children might actually be similar in reading skills. This conclusion should be taken with caution since the experimental group consisted of a sample of children who have received intensive training in reading and writing skills. Which has made them on part with normal children though literature in this filed suggest that children with hearing impairment usually lag behind normal children in reading skills (Geers and Moog, 1989).

B) Phonological Awareness

> ***Rhyme recognition***

Phonological awareness abilities were found to be significantly poorer than the normal hearing peers in children with hearing impairment except in rhyme recognition task, which is a sound comparison task such as rhyme. Perfetti,(1991); Goldsworthy,(1996) and Stackhouse,(1997) have presented developmental perspectives for the emergence of phonological awareness skills in children in alphabetic scripts which suggests that at 3 years of age children can recognize rhyming and alliteration even prior to exposure to formal reading instruction. Prema (1997) found that the correlational analysis indicated rhyming skills as having negative relationship with reading ability that is suggestive of minimal role of rhymes in normal hearing children in process of learning to read Kannada. Thus the hearing impaired group performed at par with normal children in rhyming task and in reading which suggests that they are able to appreciate the rhyme though it might not be necessarily related to reading skills and that the processing of rhyme recognition might be different from syllable level tasks in children with hearing impairment.

> ***Syllable tasks***

The poor performance of hearing impaired children in syllable segmentation tasks is in accordance with the finding of Catts and his Colleagues who reported that

most kindergarten children have difficulty with segmentation tasks, but many can perform sound comparison tasks successfully. Segmentation task involved counting, pronouncing, adding and *reversing* (Catts, Wilcox, Wood-Jackson, Larrivee and Scott, 1997). Phoneme deletion is said to be a more complex task than segmentation tasks.

Liberman and Mann, (1981) found syllable awareness as the significant predictor of reading ability in kindergarten where as Blachman ,(1984) found that syllable segmentation was not a significant predictor at first grade for alphabetic reader. In the present study in context of a semi syllabic script , it was found that in spite of being good readers the children with hearing impairment performed poorly on syllable level tasks which is in agreement which suggests that in syllabic scripts phonological awareness might not be crucial.

1. *Syllable reversal*

Based on the pilot study the test stimuli for the reversal task was modified by using bisyllabic words rather than trisyllabic which were there in the original test.Both the groups performed better in syllable reversal tasks than deletion tasks .

2. *Syllable Deletion*

Prema (1997) found that the poor readers from higher grades had very poor scores in syllable stripping tasks which indicates that for syllabic scripts, syllable stripping tasks could be more sensitive indicators of reading ability, which was also seen in the present study. She further observed that in syllable deletion task, initial syllable and the final syllable deletion was easier than the medial syllable deletion. Similar results were found in the present study with stripping of initial and final syllable deletion being easier than the medial syllable. These results are in agreement with Goswami's (1994) observation that the onset (initial syllable) and the rime (final syllable) are relatively easier to delete than the coda (medial syllable, which the attributes to the inability to perceive the intrasyllabic differences.

Overall it was seen that among the phonological awareness tasks, rhyme recognition was the easiest and subjects responded faster too. Among the syllable reversal and deletion tasks, subjects needed more illustrations.

To get a better insight into the data collected and its interpretation, qualitative analysis was also carried out. The issues are discussed below.

A) *Phonological Awareness*

In the Phonological Awarenesstests the following tests were administered for the pilot study.

a) Rhyme Recognition

b) Syllable Reversal

c) Syllable Deletion

d) Syllable Oddity

Tasks b,c and d were done with meaningful and nonsense material

Phoneme level tasks were not taken since both the experimental and control group could not carry out the task and literature also states that development of phoneme awareness is at a later stage of reading (around Grade V).

Based on the results of the pilot study, only rhyme recognition, syllable reversal and syllable deletion was included in the main study.

> *Omission of syllable oddity*

Syllable oddity was not included since the test consisted of items each containing 4 trisyllabic words eg carata, camacha, seragu, castura and the child had to say the odd word out, which required the child to attend to the stimuli in the open set task. Marschark and Mayer, 1998 suggest that deaf children and adults tend to remember less in various short term memory tasks than do hearing peers, since working memory

functions best with speech based memory codes. In the present study also, the hearing impaired children exhibited poor auditory memory and retention span leading to poor performance in the syllable oddity task. Also if individual words or meaningful parts of the word are lost before a meaning has been assigned to them, phonological processing breaks down.

> ***Omission of nonsense material***

In general, for any of the tasks irrespective of type of syllable manipulation it was observed that the hearing impaired children and normal children could not manipulate nonsense material.

The various reading models suggest (Crosby, 1968 ; Mcworth, 1971) , that the reader recognizes words through auditory input based on comparison with known word images and memory traces in the long term memory and taken relies less on comparison as he/she becomes a proficient reader. In the present study, the hearing impaired children and children could not manipulate non sense segments which supports the mentioned model since the children are beginning readers and might not have a lexicon for comparison while dealing with nonsense material, and also the fact that they have not developed phonene segmentation abilities.

> During the qualitative analysis it was observed that the children of the experimental group had carried out certain phoneme reversal tasks unknowingly on certain syllable reversal tasks while similar finding was not observed in the control group.

Stimulus	Response	
	Phoneme reversal	Syllable reversal
/gida/ - plant	/gadi/	/dagi/
/mane/- house	/name/	/nema/

Thus the children of the experimental group carried out phoneme reversal inspite of not being exposed to an alphabetic script. The presence of such findings in experimental group and absence in control gap can be attributed to the mode of response.

Children of both the groups were instructed to give a verbal response, but it was observed that on presentation of stimulus, *normal hearing children rehearsal the stimulus* presented loudly while the hearing impaired children though did not rehearse loudly, they took a longer time to respond. Wagner and torgessen,(1987) report that syllables are the smallest independently articulated segments of speech whereas phonenes cannot be produced in isolation which makes syllables perceptually salient. Thus the normal children relied on auditory feed back which was syllabic in nature to carry out the task while the hearing impaired children might have relied on the visual representation of the stimulus presented i.e., orthography which might have led to unknown phoneme reversals. Learning to read might have sensitized the hearing impaired to phonenes though there was no explicit instruction given suggesting that phonological awarenes is a consequence of reading.

> *Auditory vs Auditory visual mode*

It was observed that on giving audio visual cues ie., speech reading children could perform better than auditory cues alone. Reading Models especially 'Bottom-Up' models (Crosby, 1968 ; Mcworth, 1971 ; Kamhi & Catts Model, 1989) stress that the input (Visual and auditory input) interact with each other especially in the beginning reader while later, the skilled reader goes directly from visual perception to language comprehension. Though this is for normal readers, the same might be true for the hearing impaired and as said in literature (Webster, 1986), hearing impaired children might have inner coding systems based on visual and auditory features, visual referring to speech reading, orthography etc. and auditory to input of speech sounds.

> *Auditory discrimination vs Phonological Awareness*

In the present study, speech perception was measured via speech discrimination subtest of the reading readiness test and picture identification test carried out during subject selection.

It was observed that inspite of performing well on the speech identification t ask, the subjects of the experimental group performed poorly on the phonological awareness task. To compare the performance of auditory discrimination and phonological awareness, the following qualitative analysis was done.

Table-6 Comparison of scores on auditory discrimination and phonological awareness

Sl.No	Degree of Loss (Mean)	Auditory Discrimination					PA
		1	2	3	4	Total	
1	80 dB	-	-	4/6	2/3	6/17	16/30
2	75 dB	-	-	1/6	2/3	3/17	17/30
3	65 dB	1/7	-	4/6	1/3	6/17	22/30
4	77.5 dB	1/6	-	2/6	1/3	4/17	17/30
5	72.5 dB	1/6	-	4/6	2/3	7/17	24/30

1 manner (voicing) - e.g. ku:Du/gu:Du

2 - place e.g. halli / haLLi

3 - place and manner e.g biga/bija

4 - short vs long vowel e.g. ole/o:le

As evident in Table, subject 1 (had maximum hearing loss (80 dB) but got good scores in auditory discrimination and performed poorely in PA taste.

Subject 3, had minimum hearing loss in the group (65dB) and performed well in auditory discrimination and PA taste.

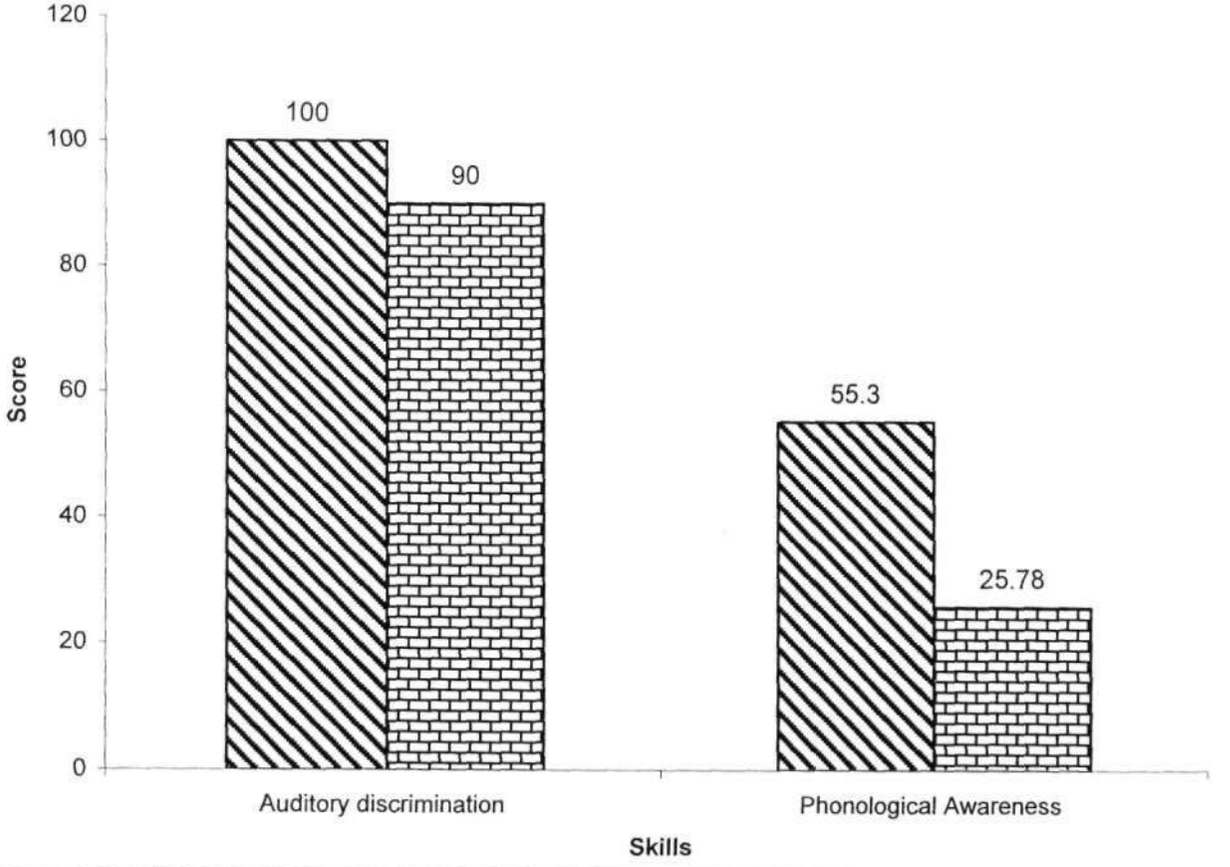
Subject 2 and 4 with similar degree of loss performed similarly in both rely and PA taste.

Subject 5, inspite of the degree of loss (72.5 dB) performed well in Auditory discrimination and PA task. Subject 5 with higher hearing loss was reportedly an above average student, while subject 4 with lesser degree of hearing loss was average in studies ; but both performed equally well in the two tasks of reading and PA suggesting that Auditory discrimination i.e., speech perception interacts with phonological awareness and influences reading which is in consensus with literature (Engel Eldar and Rosenhouse, 2000).

Thus it was observed that due to hearing impairment, the experimental group showed poor performance in the PA task and auditory deprivation led to substantially reduced PA but did not entirely block its development as also supported by Miller, 1997(fig.6). Perfetti and Sendak 2000 state that the children who hard of hearing are better at phonological processing than children with greater hearing losses because they can make use of word sounds but in the present study it was seen that the subject 5 inspite of high degree of hearing loss had good writing skills and he had also developed good phonological awareness which supports the premise that writing experiences act as alternative to maintain reading progress. Thus, a combination of audition and orthographic mode might have led to development of phonological awareness.

Overall it was seen that inspite of not being exposed to an alphabetic script and severe hearing loss, the experimental group did exhibit a certain level of PA at syllable level. The factor which might have led to development of PA can be the linguistic capacities of the child. Chaney (1992) has reported that performance on PA tasks by hearing pre-schoolers was highly correlated with general language ability viz. syntactic and semantic skills. Since in the present study, the experimental group had good language skills, their linguistic knowledge might have assisted them in carrying out the metalinguistic task of PA.

Fig. 5 Auditory discrimination v/s phonological awareness



It might also be noted, that the teaching instruction, being given to the experimental group was strictly "top-down" Which is not as facilitative as "bottom-up" for developing PA.

It can be said that an interaction of factors like speech perception skills, degree of loss, approach to training and language abilities influences development of PA. The other factors include

> Mode of communication

The children taken in the present study were using an oral - aural approach. Leybaert (1995), states that development of phonological representation in deaf children does not necessarily depend on auditory speech experience neither at the perception nor at the production early experience of an input in which all phonological contrasts are specified, independent of input modality, suggesting that oral - aural approach is the best. But still poor performance in phonological awareness task was observed. Herein, Plomp's two component model of hearing loss which states about sensitivity and clarify might have played a role leading to observed results.

Plomp suggests that sensorineural hearing loss leads to decreased sensitivity and clarity in perception of sounds which inturn effects the perception of frequency, Intensity and Duration. Other factors like poor S/N ratio, increased reverberation time in classrooms etc. might also lead to faulty auditory input. Therefore in such children, inaudible/imperfectly heard sounds may not be represented in the phonologically encoded mental lexicon thus affecting PA.

Nature of Script

In consensus with previous findings (Patil & Sopur, 1987; Prakash 1987; Rekha 1987; Prakash, Nigam and Karanth 1993, Prema 1997, Akhila 2000 and Seetha, 2002) revealed that phonemic awareness is not a crucial factor in learning to read in Indian scripts, but Syllable awareness thus develop the earliest and is crucial factor in learning to read but not sufficient one.

> *Relation between phonological awareness and reading.*

The above discussion has reveled that the experimental group has performed poorly in the phonological awareness task. In reading skills, though a statistically significant poor performance voice seen in the experimental group, if the auditory discrimination subtest was excluded the performance of the experimental group was as good as the control group.

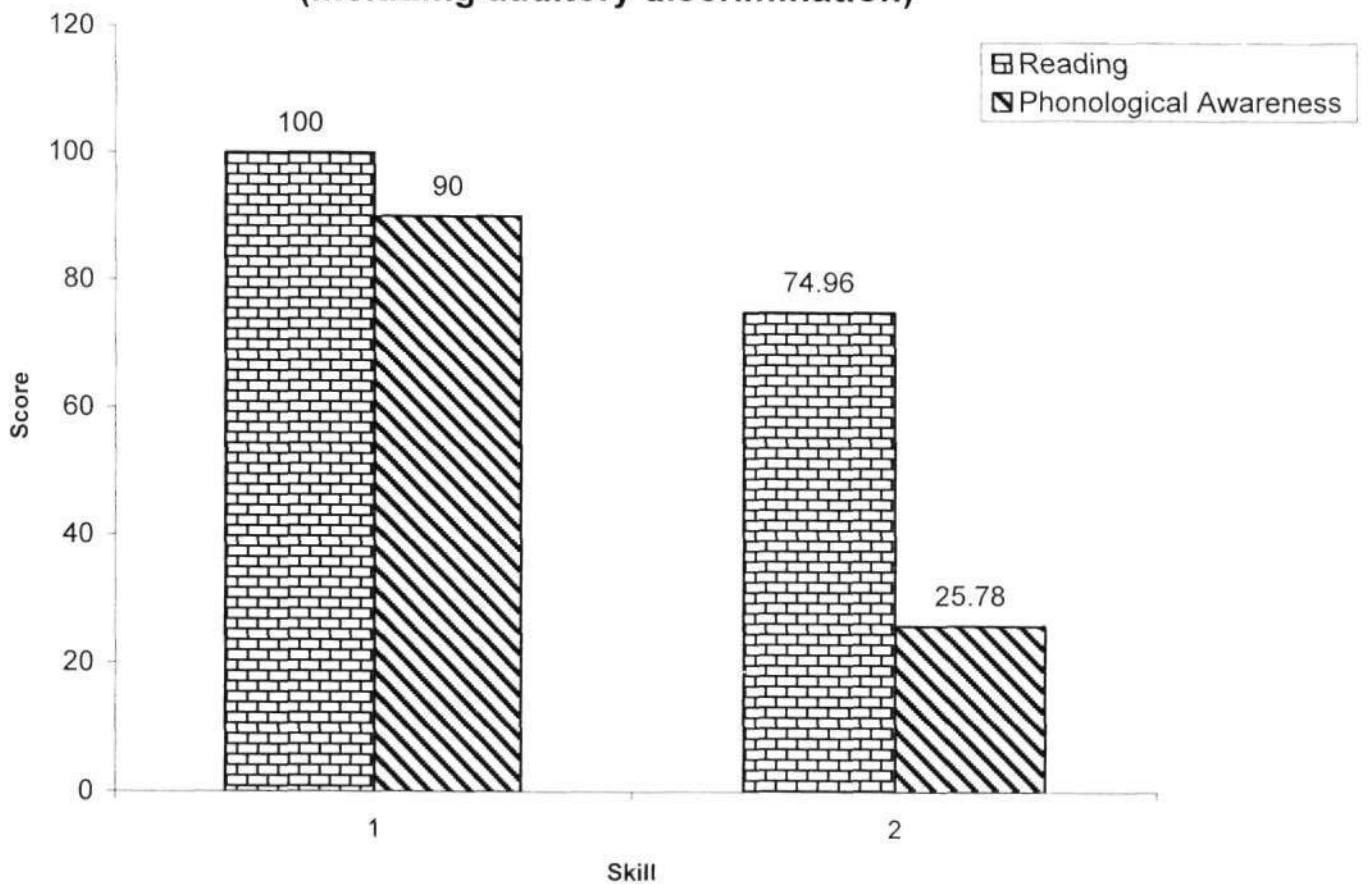
The table below shows a summary of the overall performance

Skill /Group	Phonological awareness	Reading readiness
Experimental	25.78%	74.96%
Control	90%	100%

Overall it was seen that inspite of not being exposed to an alphabetic script and severe hearing loss, the experimental group did exhibit a certain level of PA at syllable level. The factor which might have led to development of PA can be the linguistic capacities of the child. Chaney (1992) has reported that performance on PA tasks by hearing pre-schoolers was highly correlated with general language ability viz. syntactic and semantic skills. This speculation can be further confirmed by considering the model of reading given by Kamhi and Catts (1989) according to which input of the perceptual stage i.e. auditory or visual goes to the phonological processing stage that consists of a mental lexicon which has the phonological and or visu al representation of the sound. This representation is based on the syntactic and semantic information.

It might also be noted that the teaching instruction, being given to the experimental group was strictly "top-down" i.e. wholistic approach which is not as facilitative as "bottom-up" i.e. analytic approach for developing phonological awareness. This supports the premise that learning to reads is not an 'either-or' of code - emphasis versus meaning - emphasis but one of a continuum of different levels of processing involving top-down and bottom-um. Another factor which might have led to

Fig. 6 Comparison of overall reading and phonological awareness (including auditory discrimination)



the development of phonological awareness was that the children with hearing impairment trained in aural-oral approach with orthographic modality might have visualized the orthographic structure of the word or lexicon that would have facilitated phonological awareness.

In the control group phonological awareness and reading were on par with each other. But similar relation was not observed in the experimental group. Though literature suggest that in normal hearing children their exists a causal and or consequential relationship between reading and phonological awareness, the same cannot be concluded in the present sample these children do have some phonological awareness but or not as good as normal hearing children. This can be attributed to the factors like hearing impairment, mode of communication, linguistic factors, speech perception which have already being discussed and might have masked the assessment of phonological awareness during testing.

Thus though there exists a relationship between phonological awareness and reading, the concept of causality v/s consequence cannot be supported due to the limited sample and limitation of the test battery used which might not have tapped metaphonological abilities to the best. In conclusion their exists an interaction between phonological awareness and reading.

SUMMARY AND CONCLUSION

Reading skills in the hearing impaired children has received considerable attention in the past decade due to the demands of placing / mainstreaming this population. Research studies have shown that various factors affect the acquisition of reading skills, Phonological awareness being one of them. Phonological awareness has been related to reading as a cause or consequence or as having a reciprocal relation in alphabetic scripts. Research in Indian semi syllabic scripts has shown that Phonological awareness is an important but not a crucial predictor of performance in reading in normal hearing children.

The present study aimed at evaluating Phonological awareness in children with hearing impairment in children trained with oral aural approach orthographic medium being Kannada, a semi syllabic Dravidian language.

A population of five hearing impaired children (3/M , 2/F) studying in Kannada medium were selected as part of the experimental group and age and sex matched normal hearing children formed the control group.All children were assessed on a large battery of tests adapted after suitable pilot testing.

Test of reading viz. Reading Readiness test and Metaphonological tests were administered. Results were assessed qualitatively and quantitatively. The results indicated

a) The experimental group children with hearing impairment performed poorly in tasks of phonological awareness and reading when compared to normal hearing children which can be attributed to the factors, like hearing impairment, speech perception, mode of communication etc which have already been discussed.

b) The children with hearing impairment did exhibit a certain level of phonological awareness inspite of having been taught in a Top Down approach which emphasizes the fact that learning to read is not an either-or of code

emphasis versus meaning emphasis, but one of a continuum of different levels of processing.

c) In the phonological awareness task, children performed best in rhyme recognition and poorer in syllable level tasks indicating that syllable segmentation tasks are sensitive predictors of reading than sound comparison tasks like rhyme recognition, which is in accordance with previous findings in alphabetic and semi syllabic scripts.

d) Phonological awareness skills and auditory discrimination interact in development of reading skills

The hearing impaired children could carry out the phonological tasks on being given auditory and visual cues than auditory cues alone which indicates that mode of presentation plays an important role in assessing phonological awareness and that the representation of the lexicon in the hearing impaired can be a mixture of auditory and visual cues.

e) No apparent cause and effect relation was observed between phonological awareness and reading. But it was observed that better reading skills coexisted with better phonological awareness and it is assumed that they complement each other and acquisition of one facilitates the other.

Limitations of the study

1. The study consists of a small sample with specialized intensive training given for reading and writing skills so results might not hold good for a larger sample of children with hearing impairment who usually do not receive intensive reading and writing instruction.

2. The reading test used consisted of auditory discrimination subtest, which led to the impression that the hearing impaired have poor reading skills. So inclusion of

auditory modality in reading test for the considered age group might have influenced the assessment of actual reading levels.

Suggestions for future research

1. The study consisted of a sample of children with hearing impairment who had received intensive reading and writing instruction so, there is need to extend the study with a larger population.

2. Similar study can be carried out after the Children have been exposed to an alphabetic script like English and assessing the level of phonological awareness post exposure.

3. A similar study can be carried out in children with visual impairment to probe in to the effects of impairment of the visual modality in developing phonological awareness.

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APPENDIX

TEST BATTERY

After the subjects were selected, a battery of tests were administrated consisting of reading readiness test and metaphonological tests:-

A) Reading Readiness Test

- Developed by Devaki Devi (1978) in Kannada.
- It consist of the following subtest

1. Vocabulary

It is a measure of child's vocabulary and concept development. It consist of 23 items including 1 practice items consists of stimulus cards, each containing 4 pictures. In the first part of the test, the children are asked to point to the word spoken by the tester and in the second part, they are shown a picture & asked to name it. Thus both receptive and expressive vocabulary are tested.

Instruction: I will show you same picture cards. In each card there are 4 pictures. I will show you, one of the pictures & ask you to point to the picture named by me.

Scoring:

A score of one was given for each correct respone. Maximum possible score=22.

2. Visual discrimination

Measures child's ability to compare different shapes, letters, printed words and match them.

It consists of 30 items including 2-practice item. Each stimulus card consists of 5-6 pictures of different shapes, letters and words. The children are asked to point out the 2 pictures which are similar.

Instruction:

I will show you some pictures. In each picture card there will be some pictures of different shapes, letters/words. But in each card, 2 of the pictures will be similar. You have to point to those 2 pictures which are similar.

Scoring:

A score of one was given for each correct response. Maximum possible score is 28.

3. Auditory discrimination

> Developed by Kumudavalli (1973).

> Tests auditory discrimination via use of 17 sets of pictures. In each set there are four pairs of pictures used to represent each word pair. For any stimulus word pair a,b,the 4 picture pairs are aa, ab, ba and bb.

Instruction:

I will say 2 words one after another. Listen carefully. You should point to the picture pair named by me. If I say /bi : ga/ / bi : ja/. Lock and seed. Point to bi:ga first and then to /bi:ja/. If you did not follow, please tell me and I will repeat.

Scoring:

A score of one was given for each correct response. Maximum possible score is 16.

B. **Phonological** awareness

It consisted of the following subsets:-

Rhyme Recognition

The test material consisted of 16 pairs of stimuli words. 6 Rhyming & 8 non rhyming of which 6 were practice items. Each pair was orally presented and the subject had to tell whether they rhymed or not. A number of practice items and demonstrations were given to ensure that the subject understood the nature of task & axial cuts were given to aid the children.

Instruction:

I will present a pair of words, listen carefully and tell me whether they sound similar/not. With these instructions, the test material was orally presented to the subject & the response was recorded in a separate recording sheet.

Scoring

A score of one was given for each correct response. Maximum possible score was 10.

2. Syllable deletion

The test material consisted of trisyllabic 10 words. The task was to tell the remaining of a word after deletion of first/second/third syllable. A number of demonstration trials were given to order to make the child understand the nature of task.

Instruction: "I will remove a part of the word, tell me what remains" with this instruction, the test material was orally presented & response was recorded scoring

A score of one was given for each correct response and maximum possible score was 10.

3. Syllable Reversal

It consisted of 10 bisyllabic words. The task was to reproduce the word in reverse order at the syllable level. The child was given practice trials & demonstrations to ensure the child understood the nature of the task.

Instruction:

"I will present a word and you have to reproduce the same word in reverse order by splitting it."

The material was then orally presented & response was recorded.

Scoring : A score of one was given for each correct response. Maximum possible score was ten.

APPENDIX

The list of words chosen for the picture vocabulary test as part of the reading readiness test

Vocabulary test

೧. ಕುರ್ಚಿ, ಬಾಳೆಹಣ್ಣು, ಮಿ:ನು, ಕೈ

1.kurchi, ba:LehaNNu, mi:nu, kai

೨. ಬ್ರಷ್, ಟೇ:ಬಲ್, ಕಾರು, ಮಗು

2. braSh, te:bal, ka:ru, magu

೩. ಅಟ, ದೋಣಿ, ಗರಗಸ, ಛತ್ರಿ,

3. a:ta, do:ni, garagasa, chathri,

೪. ಚಾಕು, ಸೋಪು, ಬೀಗ, ಬಸ್ಸು

4. cha:ku, so:pu, bi:ga, bassu

೫. ಮೂಳೆ, ಎಲೆ, ದಾರ, ಹಣ್ಣು

5. mu:le, ele, da:ra, haNNu

೬. ಗಡಿಯಾರ, ಕತ್ತರಿ, ರೂಪಾಯಿ, ಲೋಟ

6. gaDiya:ra, kattari, ru:paai, lo:Ta

೭. ಸೈಕಲ್ಲು, ಬಸ್ಸು, ಕಾರು, ರೈಲು

7. saikalu, bassu, ka:ru, railu

೮. ಕಿವಿ,ಬಾಯಿ, ತಲೆ, ಕಣ್ಣು

8. kivi, ba:yi, tale, kaNNu

೯. ಬೆರಳು, ಹಲ್ಲು, ಕೈ, ಮೂಗು

9. beraLu, hallu, kai, mu:gu

೧೦. ಷೂ, ಟೋಪಿ, ಬೆಲ್ಟು, ಹುಡುಗ

10. Shu, To:pi, belTu, huDuga

೧೧. ಲಂಗ, ಷರಟು, ಚಕ್ರ, ಲೋಟ

11. lan ga, sharatu, chakra, lo:Ta

೧೨. ಜನ, ಮನೆ, ಬಾಗಿಲು, ಕಿಟಕಿ

12. jana, mane, ba:gilu, kiTaki

೧೩. ಸೂರ್ಯ, ಚಂದ್ರ, ಚಕ್ರ, ಲೋಟ

13. su:rya, chandra, chakra, lo:Ta

೧೪. ಕತ್ತರಿಸುತ್ತಿದ್ದಾನೆ, ಹೊಲಿಯುತ್ತಿದ್ದಾಳೆ, ಬರೆಯುತ್ತಿದ್ದಾನೆ, ಓದುತ್ತಿದ್ದಾನೆ.

14. kattarisuttidda:ne, holiyuttidda:Le, bareyuttidda:ne, Oduttidda:ne.

೧೫. ಕಪ್ಪೆ, ಕೋಳಿ, ಕುದುರೆ, ಹಸು

15. kappe, ko:Li, kudure, hasu

೧೬. ಬೇರು, ಕೊಂಬೆ, ಎಲೆ, ಹೂವು

16. be:ru, kombe, ele, hu:vu

೧೭. ಡಾಕ್ಟರ್, ಮಕ್ಕಳು, ಗಣೇಶ, ಹುಡುಗ

17. da:ktar, makkaLu, gaNe:sha, huDuga

೧೮. ಕುಳಿತಿದ್ದಾನೆ, ನೋಡುತ್ತಿದ್ದಾನೆ, ನಿಂತಿದ್ದಾನೆ, ಹಾರುತ್ತಿದ್ದಾಳೆ

18. kuLitidda:ne, no:Duttidda:ne, nimtidda:ne, haaruttidda:Le

೧೯. ಔಷದ, ಬ್ಲೇಡು, ಬುಗುರಿ, ಶಂಖ

19. ouShadha, ble:Du, buguri, shanka

೨೦. ಓದುತ್ತಿದ್ದಾನೆ,ನಡೆಯುತ್ತಿದ್ದಾನೆ, ದಾರಿ, ಸ್ನಾನ ಮಾಡುತ್ತಿದ್ದಾಳೆ

20. oduttidda:ne, nadeyuttidda:ne, dha:ri, sna:na ma:Duttidda:Le

೨೧. ನಗು, ಅಳು, ನಮಸ್ಕಾರ, ಓದುತ್ತಿದ್ದಾನೆ

21. nagu, aLu, namaska:ra, oduttidda:ne

೨೨. ನಗು, ಅಳು, ನಮಸ್ಕಾರ, ಕುಳ್ಳ

22. dappa,. SaNNa, udda, kuLLu

೨೩. ಮೇಲೆ, ಕೆಳಗೆ, ಪಕ್ಕ, ಒಳಗೆ

23. me:le, keLage, pakka, oLage

The list of word pairs used in the auditory discrimination test as part of the reading readiness test

೧. ಬೀಗ, ಬೀಜ

1. bi:ga, bi:ja

೨. ದನ, ಜನ

2. dana, jana

೩. ಚಪ್ಲಿ, ಚಕ್ಲಿ

3. chapli, chakli

೪. ಓದು, ಊದು

4. odu, u:du

೫. ಇಪ್ಪತ್ತು, ಎಪ್ಪತ್ತು

5. ippattu, eppattu

೬. ಛತ್ರಿ, ಕತ್ರಿ

6. chatri, katri

೭. ಕೂಡು, ಗೂಡು

7. ku:Du, gu:Du

೮. ಪೆನ್ನು, ಬೆನ್ನು

8. pennu, bennu

೯. ಬಳೆ,ಮಳೆ

9. baLe, maLe

೧೦. ಕತ್ತು, ಕಟ್ಟು

10. kattu, kaTTu

೧೧. ಕಾಲು, ಕಾಳು

11. ka:lu, ka:Lu

೧೨. ಇಲಿ, ಇಳಿ

12. ili, iLi

೧೩. ಹಲ್ಲಿ, ಹಳ್ಳಿ

13. halli, haLLi

೧೪. ಬೀದಿ, ಬೀಡಿ

14. bi:Di, b:iDi

೧೫. ಓದು,ಓಡು

15. odu, oDu

೧೬. ಎಲೆ, ಒಲೆ

16. ele, ole

೧೭. ಕಾಲು, ಕಾರು

17. ka:lu, ka:ru

METAPHONOLOGICAL TESTS

I. Rhyme Recognition

ಮಾದರಿ

Example :

RHYMING NON-RHYMING

a. ಕಾಗದ-ತಾಗದ kaagada-taagada	a. ಕಾಗದ-ಕೆಳಗೆ kaagada-kelage
b. ಹತ್ತಿದ-ಬತ್ತಿದ hattida-battida	b. ಒಳಗೆ -ಬತ್ತಿದ oLage-battida
c. ಒಳಗೆ-ಕೆಳಗೆ oLage-keLage	c. ಹತ್ತಿದ-ಒಳಗೆ hattida-keLage

TEST ITEMS

1. ಜವಳಿ-ಬವಳಿ(R) javaLi-balaVi	2. ತರಕಾರಿ-ಕುಡಿತ(NR) tarakari-kudita
3. ಭುಗಿಲು-ಮುಗಿಲು (R) bhugilu-mugilu	4. ಹರಡಿ-ಕರಡಿ (R) haraDi-karaDi
5. ಕೆಸರು-ಮುಗಿಲು (NR) kesaru-mugilu	6. ತರಕಾರಿ-ಸರಕಾರಿ (NR) tarakaari-sarakaari
7. ಜವಳಿ-ಹೆಸರು (NR) javaLi-hesaru	8. ತುಡಿತ-ಬವಳಿ (NR) tuDita-bavali
9. ಕೆಸರು-ಹೆಸರು (R) kesaru-hesaru	10. ಭುಗಿಲು-ಕರಡಿ (NR) bhugilu-karaDi

II. Syllable Reversal

Example :

a)	ಹೊಲ	b)	ಸುಖ
	hola		sukha
c)	ಗಾರೆ	d)	ಮೀನು
	gaare		meenu
e)	ಬೇಗ	f)	ಸೇರು
	bEga		seeru

1.	ಮರ	6.	ಪಶು
	mara		pashu
2.	ಹಾಲು	7.	ತಲೆ
	halu		tale
3.	ಸರ	8.	ಹಟ
	sara		hata
4.	ದನ	9.	ಗಿಡ
	dana		gida
5.	ಬಳೆ	10.	ಮನೆ
	bale		mane

III SYLLABLE DELETION

Example :

ಮಾದರಿ

a.	ಒಡೆಯ -ಒ = ಡೆಯ	d.	ಜವಳಿ-ಳಿ=ಜವ
	oDeya-o=Deya		javaLi-Li=java
b.	ಅಗಲ-ಅ=ಗಲ	e.	ಇಳಿದ-ಇ=ಳಿದ
	agala-a=gala		iLida-i-Lida
c.	ನಿಕಟ ಕ-ನಿಟ	f.	ದಾಖಲೆ - ಲೆ= ದಾ ಖಲೆ
	nikaTa-ka=niTa		daakhale-le=daakha

TEST ITEMS

1. ನೀಯಲು - ನೀ=ಯಲು
neeyalu-nee=yalu

2. ದಾ ರಾಳ - ರಾ=ದಾಳ
dhaaraaLa-raa=dhaaLa

3. ದಾಟಿದ - ದಾ -ಟಿದ
daaTida-daa=Tida

4. ತಾಲ್ಲೂಕು - ಕು = ತಾಲೂ
taaluuku-ku=taaluu

5. ನಡತೆ - ತೆ =ನಡ
naDate-te=naDa

6. ಇಣಿಕಿ ಇ = ಣಿಕಿ
iNiki-i=Niki

7. ಬಿಡದೆ- ಬಿ=ಡದೆ
biDade-bi-Dade

8. ಅಗಲು - ಅ=ಗಲು
agalu-a=galu

9. ತೊರೆದು - ರೆ- ತೊದು
toredu-re=todu

10. ಎಳೆಯ - ಎ=ಳೆಯ
eLeya-e=Leya

Language test in Kannada for expression in Children

Test Materials: It consisted of 30 picture cards showing different daily activities. All were coloured cards. Cards contained the following elements.

1. A boy sleeping
2. A boy and girl getting us from sleep.
3. A girl writing
4. A boy eating
5. A boy brushing his teeth
6. A boy playing with ball.
7. A girl with flowers smiling
8. Children playing different games
9. A boy reading a book
10. A man washing the clothes.
11. Children at classroom with the teacher.
12. A boy running
13. Children going to school
14. A family at dining table
15. A boy and a dog playing in water
16. A boy and a girl reading
17. A doctor testing a boy
18. A girl in swing
19. One boy sitting on other.

The children had to described the picture.

SCORE SHEET

Data sheet used for evaluating reading and phonological awareness

Name :

Age :

Sex :

Date of Birth :

Class :

Years: Months

School

Medium :

Teachers estimate of children's readings

	RE	LE
Degree of hearing loss		
Years of intervention		

Response sheet for reading readiness test

1. Vocabulary test score sheet

Items	Responses	Scores
1	Practice Item	
2		
23		

2. Visual discrimination test score sheet

Items	Responses	Scores
1	Practice Item	
2		
30		

3. Auditory discrimination test score sheet

Items	Responses			Scores
	1	2	3	4
1	Practice Item			
2				
17				

Total scores obtained ... ...

Response Sheet for phonological awareness tasks

1. Rhyme recognition / syllable reversal / syllable deletion

Stimulus	IPA transcription of response	Description of error	Score
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			