READING ABILITY AND PHONOLOGICAL AWARENESS IN DOWN'S SYNDROME

Sethu Karthikeyan

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ALL INDIA INSTITUTE OF SPEECH AND HEARING
NAIMISHAM CAMPUS, MANASAGANGOTHRI
MYSORE - 570006

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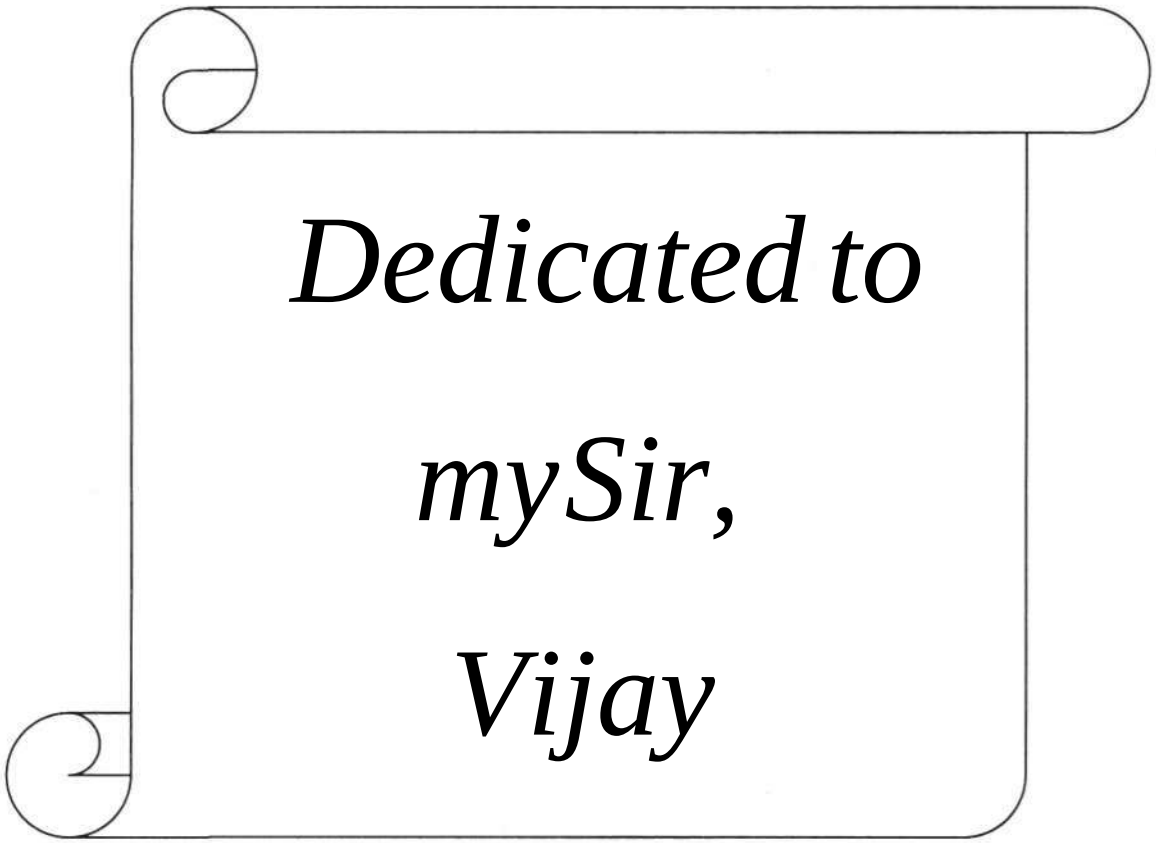
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CERTIFICATE

This is to certify that this Dissertation entitled **"READING ABILITY AND PHONOLOGICAL AWARENESS IN DOWN'S SYNDROME"** is a bonafide work in part fulfillment for the degree of Master of Science (Speech and Hearing) of the student (Register No. MSHM 0121).

Dr. M. Jayaram
Director
All India Institute of Speech and Hearing
Mysore - 570 006

Mysore

May, 2003

CERTIFICATE

This is to certify that this Dissertation entitled **"READING ABILITY AND PHONOLOGICAL AWARENESS IN DOWN'S SYNDROME"** has been prepared under my supervision and guidance. It is also certified that this Dissertation has not been submitted earlier in any other University for the award of any Diploma or Degree.

Guide

Shyamala K C

Dr. Shyamala K.C.
Reader and H.O.D. - Speech Pathology
All India Institute of Speech and Hearing
Mysore - 570 006

Mysore

May, 2003

DECLARATION

This Dissertation entitled **"READING ABILITY AND PHONOLOGICAL** AWARENESS IN DOWN'S SYNDROME" is the result of my own study under the guidance of Dr. Shyamala K.C. Reader and H.O.D. - Speech Pathology, All India Institute of Speech and Hearing, Mysore and not been submitted earlier in any other University for the award of any Diploma or Degree.

Mysore,

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INTRODUCTION

INTRODUCTION

Down's syndrome results as a consequence of genetic abnormality. As a result of having an extra chromosome 21, and the consequent abnormal gene dosage, structural and functional abnormalities occur in the CNS which result in varying degrees of cognitive and other neurological dysfunctions in children with Down's syndrome (DS).

Research, (Buckely, Bird & Byrne, 1996) however says that the majority of children with DS can learn to read and that progress in reading can also help speech and language skills, auditory perceptual skills and working memory function - all areas where children with DS usually display difficulties (Fowler, 1990; Hulme & Mackenzie, 1992).

Three reading strategies that are used are visual, phonological and context. Firstly as printed words become familiar to the reader, they are stored in a visual word store in the brain and are then recognized directly, when reading, by comparison with the stored visual images. This is called the "direct visual route" for reading. Secondly, once letter-sound rules are known, then an unfamiliar word can be read by sounding it out to identify its spoken form using the store of spoken word forms that have been established in the brain during learning to talk. This is called the "phonological route" to reading. When faced with an unfamiliar word in a sentence, a third strategy for encoding it can be used, that of 'context'.

Children with DS often seem to be good 'visual' readers, finding it relatively easy to establish a sight vocabulary from as early as two years of age. Using the phonological route and the context strategy depends on any child having an adequate knowledge of vocabulary and grammar. Children with DS will usually have considerably less language knowledge than other children at their reading level, so be less able to use context and phonological decoding strategies to access word and meaning.

Despite these additional difficulties experienced by children with DS compared with typically developing children, they do progress to being able to use phonological decoding for reading and spelling and they arc able to use context.

The concept of phonological awareness (PA) has loomed large in recent discussion of the acquisition of literacy in alphabetic orthographies (Bryant & Goswami, 1987). The term is usually taken to imply overt knowledge of how spoken words can be analysed into their constituent sounds. This awareness is assessed by such tasks as requiring the child to produce or recognize rhymes, to indicate how many sounds there arc in a particular word, or to delete a constituent (phone or syllable) of a word and pronounce the remaining. It has been asserted that these skills play a causal role in the development of reading ability (Bradley & Bryant, 1983).

In terms of theoretical approaches to reading development, the association between PA and early oral reading is consistent with a 'dual route' model whereby children acquire two qualitatively different mechanisms for reading single words

aloud (e.g., Harris and Coltheart, 1986). The routes are Grapheme - Phoneme conversion or GPC route and lexical route.

The situation with regard to connectionist models of reading is markedly different. In these models, there is no defined level of phonological representation that is necessary (or even desirable) to access during the course of reading (or learning to read) (eg. Hinton & Shallicc, 1991; Patterson, Seidenberg & McClelland, 1989). In apparent support of such models, Cossu and Marshall (1990) and Cossu, Rossini, and Marshall (1993a, 1993b) argued against the existence of a necessary association between PA and oral reading on the basis of data from individuals with intellectual disability.

Cossu et al., (1993a) reported a study of 10 Italian children with DS. These children were matched with 10 younger, normally developing children on their ability to read aloud both regular and irregular words. The children were assessed in four phonological awareness tasks like phoneme counting, phoneme deletion, oral spelling and phoneme synthesis. Children with DS performed significantly below the level of the normally developing children on all the four PA tasks, leading Cossu et al., to conclude that they had learned to read despite their gross failure on tests of phonological awareness.

This study is in contrast with a number of training studies that have shown that instruction in PA before learning to read can facilitate subsequent reading development (e.g., Ball & Blachman, 1991; Bradley & Bryant, 1983; Byrne & Fielding-Barnsley, 1993). On the one hand, it has been argued that alphabetic reading

instruction results in higher levels of PA (e.g., Morais, Cary, Algeria & Bertelson, 1979). On the other hand, it has also been suggested that there is a reciprocal relationship between reading and PA. (Morais, Algeria & Content, 1987).

Need

Taxonomically present day writing systems can be classified into three major types based on their level of orthographic representation. They are ideographic, syllabary and alphabetic. Indian orthography docs not fall into any one of these. It represents an interesting case of a mixture of syllabic and alphabetic principles. Malayalam is one of the major Dravidian languages. It is the state language of Kerala. Modern Malayalam has an orthographic structure comparable to other Indian scripts. It has 51 letters of the Malayalam script which are arranged in the same spectacular phonetic manner like in other Indian scripts.

Malayalam language differs from other Dravidian languages in that, alphabetic scripts, where graphemes represent language at the basic sound level are put down. To make this point clear, we can compare it with Kannada, another major Dravidian language. Kannada is chosen because already a few similar studies have been done in this language (Karanth & Suchitra, 1993; Prakash, Rekha, Nigam & Karanth, 1993; Rekha, 1987).

When Malayalam and Kannada are compared we can see that even though both arc semisyllabic, there is a difference in their alphabetic script layout. In Kannada script, the consonants have an independent graphemic form while, the associated vowels arc attached on to the consonants in the secondary forms (vowels

are fused with the consonant to form the syllabic letter). That is, it is easy to visualize the consonants in an utterance for a kannada speaker, while it is not so for the associated vowels in their secondary form. In the case of Malayalam script, consonants have an independent graphcmic form and the associate vowels are not attached onto the consonants in their secondary forms i.e., vowels are not fused with the consonant to form the syllabic letter and they also have an independent graphemic form. So for a Malayalam reader it is easy to visualize both consonant and associated vowel in their secondary forms in an utterance. Having a visual model of speech makes it easier to treat language as an object and inspect its form in metalinguistic tasks.

A study on development of reading and mctaphonological skills in Malayalam speaking children by Roopa Iyer (2000) concluded that phonological awareness, which plays an important role in alphabetic literacy, seemed to be a significant factor in Malayalam reading also.

In view of the above the present study focusscd on comparing a sample of children with Down's syndrome and a sample of normally developing children (both having Malayalam as their mother tongue) matched for reading ability on their phonological awareness skills and thereby investigating the relation between reading ability and phonological awareness skills in Down's syndrome.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

Reading is not a biologically evolved skill like walking or talking. It is a product of cultural evolution and is dependent on cultural transmission for its continued existence.

Reading is essentially a meaning extracting process from print. It is a complex process involving perceptual, cognitive and motivational components. It involves decoding the graphcmic symbols and integrating them to a word and then to prepositional form that can be compared with the mental representation to comprehend the message contained in print. Primary linguistic skills arc speaking and listening and they are universal. Reading is termed as a secondary linguistic skill. Reading involves " interpretation of signs.... arbitrary symbols deliberately created and used for the purpose of communication" (Downing, 1984). He defined reading as a skill like any other verbal or motor skill, which requires a period of deliberate training and practice to be performed adequately.

Learning to read has been compared to learning other skills like driving or cycling (Boder, 1973). It involves a complex integration of many behaviors-cognitive, attitudinal and manipulative. And it is essentially a process of extracting meaning from print.

Models of reading

Divergent views exist among the reading researchers regarding the manner in which children acquire the complete skill of reading. Chall (1967) presented an

analysis of various issues on the effectiveness of early reading acquisition in her book "learning to read-the great debate". Chall explains that most of the approaches to reading acquisition can be considered to fall roughly into either of the two groups, referred to as the code emphasis and 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. The meaning emphasis group would argue that children learn to read best when the meaning of the printed matter is emphasized from the beginning.

Marsh's model

Marsh, Friedman, Welsh and Desberg (1981) have presented cognitive developmental theory. They postulated four stages in the development of reading in terms of four learning strategies with specific prediction for reading unknown words and reading known words in isolation and in context. They provided empirical evidence for the existence of the four stages and their successive emergence over the school years.

Rote learning is the first strategy for learning new words. This is contemplated by the so called linguistic guessing i.e., a child often tries to produce a word for context. At stage 2, for the first time guesses arc based on visual letter cues as well as linguistic context. At stage 3, sequential decoding in letter-by-lcttcr and phoneme-by-phoneme fashion is introduced. At stage 4, hierarchical decoding appears i.e., the interpretation of each phoneme becomes dependent on its letter context. Lastly at this stage, the analogy strategy first appears, which from then on is used more and more for the successful reading of new words (sec Ellis, 1985; Frith, 1985).

Friths model

Frith (1985) used Marsh's framework in developing her own model. The development of literacy acquisition is divided into three phases identified with three strategies called logographic, alphabetic and orthographic. Logographic skills refer to the instant recognition of familiar words. Salient graphic features may act as important cues in the process. Letter order is largely ignored. And phonological factors arc entirely secondary, in other words, the child pronounces the word after he or she recognizes it. However the child will often be prepared to guess on the basis of contextual or pragmatic cues.

Alphabetic skill refers to knowledge and use of individual phonemes and graphemes and their correspondences. It is an analytic skill involving a systematic approach, namely decoding grapheme by grapheme. Letter order and phonological factors play a crucial role. This strategy enables the reader to pronounce (not necessarily correctly) novel and nonsense words.

Orthographic skills refer to the instant analysis of words into orthographic units without phonological conversion. The orthographic units ideally coincide with morphemes. They are internally represented by abstract letter-by-letter strings. The orthographic strategy is distinguished from the logographic one being analytic in a systematic way and by being non-visual. It is a distinguished one by operating in bigger units and by being non-phonological.

Information processing theories

Information processing is the prominent theoretical framework on which current models of skilled reading arc based. In these structural models, the skilled reading is viewed as consisting of many separate but interacting components such as letter identification unit, visual word recognition unit, grapheme-phoneme conversion unit, semantic unit etc., which are called modules (Ellis, 1985). Another characteristic feature of the current model is that, the lower decoding as well as the higher comprehension operations involved in reading arc treated at the lexical level. Therefore, essentially word recognition models like Logogcn model and studies on the nature of lexical access and lexical code such as lexical decision tasks, word/non-word reading have had an immense bearing on the present day understanding of reading. For instance two such important findings are:

- Reading a word does not prime subsequent auditory word recognition and hearing a word docs not prime subsequent visual word recognition system. These are separate and independent systems.
- A word containing a particular root morpheme primes later visual words containing the same root morpheme. This finding implies that morpheme constitutes units of word recognition/reading (Ellis, 1985). A parallel development to the first finding can be seen in conceptualization of lexical or non-lexical (or "reading by eye & reading by car") routes in skilled reading (Coltheart 1980). The second is analogous to the idea that skilled readers employ morphemic strategy while reading. (Frith 1985, Harris & Coltheart 1986). According to Ellis (1985), a skilled reader has mainly two routes from print to lexicon-a direct visual route and 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 and non-words (see Ellis, 1985 for details). 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 (Coltheart 1980).

Since late seventies attempts have been made to integrate the structural models of skilled reading with new developmental models of literacy acquisition. These models try to trace how a child in course of his becoming a competent reader acquires the different component systems or strategies of skilled reading.

Factors affecting reading

There are several verbal and non verbal factors that affect reading performance. A large body of research has demonstrated that reading skill is linked to an incredibly wide range of verbal abilities. Vocabulary, syntactic knowledge, metalinguistic awareness, verbal short-term memory and verbal fluency form only a partial list of verbal abilities that have been linked to reading (Ball, 1993; Byrne, 1981; Carrillo, 1994; Chall, 1983; Cheung, 1999; Defior & Tudela, 1994; Durgunoglu & Oney, 1999; Evans & Carr, 1985; Kamhi & Catts, 1989; Stanovich, Cunningham & Ferman, 1984).

In contrast, the non-verbal abilities linked to reading are much more circumscribed (Hulme, 1988; Vellutino, 1979). The non-verbal abilities associated with reading are more likely to be distinct and domain-specific for e.g., orthographic storage, processing of certain spatial frequencies. Verbal abilities related to reading arc more likely to have global influence. For e.g., inferential comprehension, verbal short-term memory and vocabulary, thereby affecting general verbal IQ (Stanovich, 1991).

Some of the common factors, which affect reading acquisition, that are relevant to the present study are teaching method, IQ, memory, orthography and print awareness.

Phonological awareness and reading

The role of phonological awareness in reading is one of the most widely studied aspects. More than a quarter century of research into one or another aspect of phonological awareness has occurred since the early work of Bruce (1964).

Phonological awareness is 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. Research (Tunmer, Herriman & Nesdale, 1988) has suggested that phonological awareness is one of the four general types of mcta linguistic abilities, which may be described as a developmentaily distinct kind of linguistic functioning that develops separately from, and later than, basic speaking and listening skills. Trieman's (1991) theme is that phonological awareness refers to the awareness of any of the phonological unit, of the spoken language. Languages

contain several kinds of phonological units including syllables, intrasyllabic units and phonemes. A major difference between phonemes and syllables, is that syllables are marked acoustically. Unlike phonemes, which have no physical analogue in the spectrographic representation of speech, syllables do have a physical correlate in relative amplilude. Syllables arc the smallest independent articulable segments of speech (Wagner & Torgensen, 1987) whereas most phonemes cannot be pronounced in isolation. Consistent with this suggestion arc the results of several studies showing that children achieve an awareness of syllables much earlier in development than they achieve an awareness of phonemes (Fox & Routh, 1975; Liberman, Shankweiler, Fisher & Carter, 1974). Trieman (1987) argues that an additional level of awareness intermediating between syllables and phonemes needs to be distinguished. Triemen claims that the ability to segment phonemes is preceded by the ability to segment syllables into the intrasyllabic units of onset and rime, where onset is the (optional) initial consonant or consonant cluster and rime is the (obligatory) vowel and any following (optional) consonants.

There arc many conflicting views about the relationships between phonological awareness and learning to read an alphabetic orthography.

Four views can be distinguished:

- Bradley and Bryant (1983) claimed that phonological awareness is a causal factor in reading acquisition.
- Morais, Cary, Algeria and Bertelson (1979) regarded phonological awareness as an effect of learning to read.
- Morais, Algeria and Content (1987) adopted an interactionist position.

- Liberman, Shankweiler, Liberman, Fowler and Fisher (1977) hinted that there might not be any direct causal relationship. Rather the association "might be a manifestation of some kind of intellectual maturation".

Continuing to investigate the link between phonological abilities and early reading achievements, Bryant, Maclean and Bradley (1990) reported evidence from a longitudinal study showing that the relation between children's sensitivity to rhyme and alliteration and their success in reading is highly specific and cannot be accounted for in terms of general language ability. They argued that awareness of rhyme makes a distinctive contribution to reading by helping children to form spelling categories. On the basis of such results, Goswami and Bryant (1990) suggested that a connection between awareness of rime and alliteration and later progress in reading and spelling was an important causal factor in reading development in English. Similar findings have been obtained by Bryant, Bradley, Maclean and Crossland (1989). They stated that in the pathway to reading the contribution of rhyme detection may be mediated by phoneme detection.

Muter, Valeric, Snowling and Margaret (1999) examined the relationship between phonological awareness, short term memory, grammatical awareness and reading accuracy in a follow up study of 34 nine year old originally studied as pre schoolers. The best concurrent predictor set for reading accuracy at age 9 were grammatical knowledge, phoneme awareness and speech rate which together explained nearly 90% of the variance in reading skill. Phoneme deletion, non word repetition and letter knowledge measures taken at ages 5 and 6 predicted reading skills at age 9, while rhyme recognition proved a poor long term predictor.

Among the Indian studies, Prema (1997) found that the correlational analysis indicated rhyming skills as having negative relationship with reading ability which is suggestive of minimal role of rhymes in the process of learning to read Kannada.

Libcrman el al., (1977) found syllabic awareness as the significant predictor of reading ability in kindergarten whereas Blachman (1984) found that syllabic segmentation was not a significant predictor at the first grade for alphabetic reader. Prema (1997) found that syllabic segmentation tasks like syllabic stripping tasks could be a more sensitive indicator of learning to read Kannada.

The reciprocal causation interpretation fits with the longitudinal study by Perfetti, Beck, Bell and Hughes (1987) of first graders' development of phonemic awareness and reading. They found that phoneme blending was a cause of early reading proficiency while ability to delete phonemes was better described as a result of early reading.

A more recent longitudinal study by Frost and Jorgen (2002) explored the relation between pre school phoneme awareness and initial reading development among Danish beginning readers. Distinctions were made between formal and functional letter knowledge and between foundation and subsequent phases of reading development.

The children were divided into two groups: one group of 21 children with high phonemic awareness and the other with 23 children with low phonemic awareness. On entering grade one, the results showed persistent group differences in favour of

children with high phoneme awareness, regarding letter knowledge and word reading. They stated that phonemic awareness is an indispensable catalyst in the development of initial word processing ability.

Numerous intervention studies have shown that heightening the pre-school, K.G. and 1st grade child's awareness of the phonological structure of speech facilitates early reading and spelling acquisition (e.g., Ball & Blachman, 1991; Bradley & Bryant, 1983; Byrne & Fielding-Barnsley, 1993).

Bruck et al., (1998) conducted a study with the help of two groups of grade three children, one who had received whole language instruction since they began to learn to read and the other who attended a phonics programme. The results proved that the children attending phonics programme produced more accurate word spelling than whole language group.

Difficulties that children sometimes encounter in acquiring phonological awareness skills

The results of training studies indicate that children exhibit individual differences in the benefits they receive from training in phonological awareness skills. On a large scale training study of phonological awareness in pre school children, Lundberg, Frost and Peterson, (1988) found that 6% of the children in the training troop showed virtually no gains in phonemic segmentation ability, despite having received daily lessons in phonological awareness skills over an eight months period. Similarly, Bryant and Bradley, (1985) found that phonological awareness training was helpful for some beginning readers who were not phonologically aware, but not for

others (sec Bryant & Goswami, 1987). There arc two views as to why some children encounter difficulty in acquiring phonological awareness skills. The first view proposes that the different phonological awareness skills observed in some children may be related to a more basic deficit in a highly specialized, or modular, language-processing system (Shankweilcr & Crain, 1986; Stanovich, 1987; Kafz, 1985).

Another view of inability of some prclitcralc children and beginning readers to segment phonemically proposes deficient metalinguistic ability as a result of a developmental delay in the control-processing component of working memory. (Lundberg, 1987; MacLean, Bryant & Bradley, 1987).

Is phonemic awareness limited to alphabetically transcribed languages

Much of the work on phonemic awareness in relation to reading is confined to alphabetically transcribed languages such as English (the Oxford group; the Pittsburgh group; the Austin group, Texas, group, the Brussles group), Russian (the early Elkonis work; Vygolsky, Luria) French (Alcgria, Pignot, and Morais, 1982) and Italian (Cossu, Shankweilcr, Liberman, Katz and Tola, 1988). One intriguing question arising from these cumulative findings and from the often quoted studies of segmental analysis involving consonant addition and deletion with Portuguese adult illiterate and ex-illiterate by the Brussels group of Morais, Cary, Alegria,and Bertelson, (1979) and Morais, Bertelson, Cary, and Alegria (1986) and from the replication with adult Chinese Pinyin (alphabet) transliteration system by Read, Zhang, Nie, and Ding (1986) is, whether or not the facilitation of phonemic awareness is mainly limited to alphabetic language systems. This is still an unresolved issue (Sec Lundbcrg, Frost & Petersen, 1988; Mann, 1985; 1986 for details).

From her cross-linguistic studies with young Japanese children Mann (1985, 1986) found that experience with the Japanese syllabary could facilitate the awareness of Morac (syllables with approximately equal duration). Read et al (1986) from the performance of Chinese people (alphabetic script Vs ideograms) in his study found that knowledge of alphabetic script was strongly related to the ability to perform phonological segmentation tasks; adults who read and wrote in a logographic orthography for many years were poor at tasks involving phonemic manipulation.

A study by Cossu et al (1988) compared the segmentation abilities of Italian children with those of English-speaking (American) children using the same method of assessment and the same subject selection criteria. At the preschool level, though the Italian children manifested a higher level of performance overall, syllable segmentation ability was stronger than phoneme segmentation in both the groups. After school entrance, this pattern remained unchanged in American children but was reversed in Italian beginning readers. This was attributed to the greater consistency of the alphabetic representation in Italian than English. This disparity in languages, thus can expect to have differential effects on the degree of importance of phonemic awareness to the listeners/readers.

A few studies were conducted in India. The Indian writing system is a semi syllabic system where in a graphemic character that represents a syllable can be systematically analyzed into consonantal and vocalic components. The features of interest in relation to phonemic awareness, arc its semi syllabic principle of dietric markers to denote phoneme changes, and the presence of some distinct graphemes that represent single phonemes.

Studies by Chandrika, (1990); Patel and Soper, (1987); Prakash, (1987); Prakash, Rekha, Nigam and Karanth, (1993); and Rekha (1987) revealed that phonemic awareness was not a crucial factor in learning to read Indian languages. However the study by Roopa Iyer (2000) concluded that phonological awareness, which played an important role in alphabetic literacy seemed to be a significant factor in Malayalam reading also.

Assessment of phonological awareness

Catts and his colleagues (Catts, Wilcox, Wood-Jackson, Larrivee & Scott, 1997) found over twenty different tasks that have been used by researchers to measure phonological awareness. In their analysis, they grouped these measures into three broad categories: phoneme segmentation, phoneme synthesis, and sound comparison. Phoneme segmentation tasks require a relatively explicit level of awareness of phonemes because they involve counting, pronouncing, deleting, adding, or reversing the individual phonemes in words.

The sound blending task is used to measure phoneme synthesis. In this task, the tester attempts to pronounce a series of phonemes in isolation and asks the child to blend them together to form a word.

The sound comparison tasks use a number of different formats that have a common requirement to make comparisons between the sounds in different words like rhyme recognition and alliteration judgement tasks.

Reading skills of children with Down's syndrome (DS)

Buckley, Bird and Byrne (1996) claims that the majority of children with DS can learn lo read and that progress in reading can also develop speech and language skills, auditory perceptual skills and working memory function - all areas where children with DS usually display difficulties (Fowler 1990; Hulme & Mackenzie, 1992). These children with DS have a superior visual perceptual ability, stronger visual vocal channels, belter visual sequencing ability (Bilovsky & Share, 1965; Schcffclin, 1968; Marcell & Armstrong, 1982; Pucschcl, Gallagher, Zartler, & Pezzullo, 1987) than their auditory perception and processing ability (Marcell, Harvey & Cothran 1988; Lincoln, Courechesne, Kilman & Galambos, 1985; Glenn, Cunningham & Joyce, 1981; Varnhagcn, Das & Varnhagen, 1987).

Individual case studies have shown that many young people with Down's syndrome can achieve functionally useful levels of literacy skills and also indicated that reading can considerably improve the speech and language of children.

It was the progress of Sarah Duffen as described by her father Leslie that first drew attention to the possibility that children with DS could achieve functional levels of literacy (Duffen, 1976). Daniel, another child with DS was introduced to reading at 2 years 4 months when he had a production vocabulary of about 50 single words. At 3 years 8 months he read 116 words and spoke in six-word sentences. Daniel's rapid progress continued and at 8 years of age, his reading age was 12 years, 4 months on school assessment (Norris 1989).

Casey, Jones, Kugler and Watkins (1988) followed the progress of 36 children with DS, 18 in mainstream placements and 18 in schools for children with moderate learning difficulties. After two years, 90% of the girls and 67% of the boys in the mainstream classroom could achieve scores on both the accuracy and the comprehension components of the Neale Reading Test. The children in the special school were lagging behind. As the children were equally able at the start of the study, Casey et al suggested that the difference in reading progress two years later was due to differences in the teaching of reading.

The first large longitudinal study by Buckley and Bird (1993) compared the progress of 24 children with Down's syndrome, with average and reading age matched peers in their mainstream classrooms. The findings indicated that many children with Down's syndrome were reading within the same range of achievement as other non-disabled children in the mainstream schools.

For two years the reading progress of children with Down's syndrome kept up with that of the reading matched group. For most children reading was a definite strength, with reading ages consistently ahead of language and number ages as measured on standard tests confirming the view that the children are visual learners. Those with the reading ages of seven or eight years showed the ability to use the letter-sound (phonic) knowledge to decode new words in texts and to spell.

In 1994, Buckley and Bird established a new pre school longitudinal study of 20 children with Down's syndrome and then compared their progress with that of pre school deaf children and non-disabled peers. The children with Down's syndrome as a

group made exactly the same progress on the reading programme in the first year as the typically developing children. In both the groups some children only learned a few words and some learned zero or more, with the largest number learned by a child with Downs syndrome.

After three years, 11 of the children with Down's syndrome could score on standard tests for reading and reading comprehension compared with 16 of the typically developing children and there were no significant differences on the scores of the two groups on these tests.

According to Buckley, Bird and Byrne (1996), the children with Down's syndrome move from the logographic stage (sight words) to the alphabetic stage (words sounded out) at a much slower rate. As their vocabulary and knowledge of grammar grows, they are increasingly able to use context to identify new words.

Morton and Frith (1993) stated that Down's syndrome children may lack some process that underlies metalinguistic ability and as a result acquire their grapheme-phoneme representation system in a different way.

Phonological awareness in Downs syndrome

The discovery of a relationship between phonological awareness and alphabetic literacy acquisition has been referred to in the literature as " one of the greatest successes of modern psychology" (Bryant & Goswami 1987:439). Accordingly, a disability in the area of phonological awareness has been widely

believed to be the primary cause of children's reading difficulties (e.g., Bryant & Bradley 1985; Pennington, Van Orden, Smith, Green & Haith 1990).

In terms of theoretical approaches to reading development, the association between phonological awareness and early oral reading was consistent with a dual route model, whereby children acquired two qualitatively different mechanisms for reading single words aloud (e.g., Harris & Colthcart, 1986). One mechanism depended on converting graphemes into phonemes and then blending those phonemes to form a word (the GPC route), whereas the other route involved recognizing a sequence of graphemes as a familiar word and accessing the corresponding lexical entry (the lexical route).

The situation with regard to connectionist models of reading was markedly different. In these models, there was no defined level of phonological representation that it was necessary (or even desirable) to access during the course of reading (or learning to read) (e.g., Hinton & Shallice, 1991; Patterson, Scidcnbcrg & McClelland, 1989). In apparent support of such models, Cossu and Marshall (1990) and Cossu, Rossini, and Marshall (1993a, 1993b) argued against the existence of a necessary association between phonological awareness and oral reading on the basis of data from individuals with intellectual disability.

Cossu, Rossini and Marshall (1993a) questioned the hypothesis of a connection between phoneme awareness and reading acquisition. These authors reported the results of a study investigating the development of phonemic awareness among children with Down's syndrome who had already started to read. Ten children

with DS (mean age = 11.4 years) and ten normally developing children (mean =7.3 years), matched for reading ability, participated in the study.

Four tasks were used to assess the children's phoneme awareness: the phoneme segmentation task required the children to count the number of phonemes in words presented orally by the experimenter; in the phoneme deletion task, the children were asked to subtract the first two phonemes of orally presented words; the oral spelling task required the children to pronounce the sounds of the words enunciated by the experimenter; and finally, in the "phonemic synthesis" task, the children were asked to blend sequences of phonemes into the appropriate words. According to Cossu ct al., (1993a) the children with DS performed significantly worse than the controls on the phoneme awareness tasks. They, hence claimed that the poor performance of the children with DS on the phoneme awareness tasks must therefore imply that alphabetic reading acquisition could proceed in the absence of phoneme awareness.

This result was subjected to multiple interpretations. It was compatible with the distinction that Morton and Frith (1993) drew between competence and performance *vis-a-vis* phonological awareness tasks. Byrne (1993) argued that factors extraneous to the phonological awareness tasks, such as attention and working memory were masking the true level of phonological awareness. Likewise, Bertelson (1993) raised the suspicion that the cognitive deficits of children with Down's syndrome made it impossible to decide the issue by application of traditional tests.

A study by Cupples and lacono (2000), questioned the existence of a necessary association between phonological awareness and oral reading development. In this study, 22 children with Down's syndrome (between the ages of 6.7 and 10.3 years) initially completed tests of receptive language, cognitive function, oral reading, and phonological awareness. The tasks determining phonological awareness were rhyme judgments, alliteration judgments, phoneme blending (real words and non words), phoneme segmentation and counting (real words and non words), nonlinguistic counting.

Reading and phonological awareness were reassessed approximately 9 months later. Better oral reading was associated with superior phoneme segmentation skills on reassessment. Furthermore there was some evidence that early segmentation ability predicted later non word reading, but not the reverse. The results indicated an association between phonological awareness and early oral reading ability in children with Down's syndrome and were interpreted within a theoretical view of reading development in which phonological awareness played a central role.

Cossu et al., (1993a) admitted that the children with DS might have failed to understand the requirements of their phonological awareness tasks. According to them, the children with Down's syndrome could not understand the tasks because they could not consciously manipulate phonemes. They also recognized that a wide range of attentional, memorial, arithmetic, and analytic processes have sheltered under the label of phonological awareness. Yet what impressed them was that, whatever impairments the children with Down's syndrome undoubtedly showed in

these areas, those deficits had not precluded the children from acquiring the transcoding skills involved in reading.

Cardoso-Marlins and Frith (2001) also agreed that individuals with DS might not know how to consciously manipulate phones. However according to them, lack of that ability should not be equated with absence of the ability to pay conscious attention to the phonemic constituents of speech and, instead that inability may result from the lack of cognitive processes that are also necessary to explicitly operate on phonological representations. They also claimed that individuals with DS who could read by phonological recoding should be able to demonstrate awareness of the phonemic constituents of speech if assessed by tasks that did not require the ability to manipulate or operate on phones. One such task was the alliteration detection task. This task was more accessible than tasks that required the ability to explicitly manipulate or segment phonemes (Stanovich, Cunningham & Cramer 1984; Yopp 1988).

Two studies were conducted by Cardoso-Martins and Frith (2001) to test the above hypothesis. They chose to conduct the studies with Brazilian-Portuguese speaking subjects in order to make their findings more comparable to Cossu et al's. Like Italian, and in contrast to English, Portuguese had a relatively transparent orthography.

Their first study assessed the ability of 33 individuals with Down's syndrome (age range from 10 to 49 years) who had already started to read and who had showed clear signs of phonological rccoding skills to detect phonemes, and compared their

performance to the performance of a group of 33 normal children (age range 6 to 9 years) of equivalent reading levels. They also assessed the two groups' performance on a phoneme deletion task, similar to the one used by Cossu et al (1993a). The other task given was the phoneme detection task which was cognitively less demanding. The children with Downs syndrome performed quite well on the phoneme detection task, although they performed relatively poorly on the phoneme deletion task.

The second study included 93 individuals with Down's syndrome, some of whom who had already participated in the first study. They were divided into two groups on the basis of their performance on a reading task. Participants who read 5 or more words on the reading task were assigned to the reading group, while participants who read 4 or fewer words were assigned to the non-reading group. The reading group consisted of 46 individuals, ranging in age from 9 to 50 years. The group of non-readers consisted of 47 individuals, ranging in age from 6 to 50 years. Both groups were subjected to reading task and phoneme detection task.

The individuals with Down's syndrome who participated in their first study showed clear signs of phonological recoding skills. Their relatively poor performance on the phoneme deletion task made Cardoso-Martins and Frith (2001) support Cossu ct al.'s (1993a) claim that the ability to explicitly manipulate the phonemic constituents of speech was not necessary for discovering the alphabetic principle and using it to learn to read words.

However the individuals with Down's syndrome performed quite well on the phoneme detection task. The same was true for the group of readers with Down's

syndrome who participated in the second study. They explained that the difficulty experienced by the individuals with Down's syndrome in tasks that required the ability to explicitly manipulate phonemes resulted from impairments in their general processing ability. Phoneme manipulation tasks are cognitively demanding, and a certain level of intellectual maturity may be necessary before children (and adults, for that matter) are able to perform them successfully (Patel & Patterson 1982; cited in Scoles 1991). Hence the phoneme detection task was included.

According to them the individuals with Down's syndrome who had already learned to read should perform well on phoneme detection task, despite their intellectual limitations. In contrast to phoneme segmentation and manipulation tasks, the ability to detect phonemes did not require the execution of a new cognitive operation.

The results of this study pointed out to the importance of distinguishing between ability and performance in discussing about the relationship between reading and phonological awareness (e.g., Byrne 1993;Morton & Frith 1993). According to Cardoso-Marlins and Frith (2001) their study revealed that individuals with Down's syndrome who had already started to read could consciously attend to phonemes but found it difficult to operate on them.

They supported the view of many others regarding the reciprocal relationship that existed between metalinguistic ability and literacy acquisition (e.g., Morais, Algeria & Content 1987; Perfetti, Beck, Bell & Hughes 1987; Goswami & Bryant 1990).

METHOD

METHOD

The aim of this study is to compare a sample of children with Down's syndrome and a sample of typically developing children (both having Malayalam as mother tongue) matched for reading ability on phonological awareness skills and thereby investigate the relation between phonological awareness and reading ability in Down's syndrome.

Participants

The experimental group included seven subjects with Down's syndrome (DS) who had Malayalam as their mother tongue, ranged in chronological age from 12.2 to 15 years (mean=I3.2 yrs). Their mental age ranged from 6 to 8 years (mean = 6.8 yrs). All the participants with DS were attending schools for individuals with developmental disorders in a major city of Kerala. It followed a 'whole-word' approach in teaching reading. All the participants with DS had been receiving intensive reading training for a period of 3 to 3.6 years. All children with medical problems, sensory impairments including hearing deficits and decreased visual acuity were excluded. Informal language screening was done based on conversation with the subjects with DS and report from parents in order to rule out effects of language inadequacy.

The children with DS were matched for reading ability with a group of seven chronologically younger normally developing children (age range = 6 to 7.6 year, mean = 7.2 years) who formed the control group. Both the groups were matched on the basis of their ability to read words and letters of Malayalam script.

PHASE-1

READING ABILITY MATCHING

Material

- **Letters of Malayalam script**

51 letters of Malayalam script were given which included 11 vowels and 40 consonants [Appendix -1].

- Word reading

Oral word reading test given in the test material developed by Roopa Iyer (unpublished dissertation, 2000) was used. It consisted of 150 Malayalam words arranged in simple to difficult order [Appendix - II].

The participants were instructed to read the letters / words clearly.

Mode of presentation of stimuli

Each stimulus letter / word was presented on a separate card.

Scoring

A score of one was given for each correctly read letter / word. The articulatory errors were checked against the findings obtained from administering Malayalam Articulation Test (Maya, 1990) [Appendix - III]. The consistent articulatory errors were ignored and a score of one was given [Appendix - IX].

Maximum possible score for the letter and word reading tasks were 51 and 150 respectively

Results

Table 1 : Showing the comparison of performance of the experimental and control groups on oral word reading task

Groups	N	Mean	SD	Range	t-values
E	7	146.14	1.22	145-148	1.915 NS
C	7	147.71	1.80	145-150	

NS : Not significant

Tabic 1 shows the mean, SD, range and t-values of oral word reading for the experimental (E) group and control (C) group. The graphical representation of the same is shown in figure la. It is evident from the table that there was no significant difference between the two groups on the oral word reading task.

All the participants in both the groups recognised all the letters of the Malayalam script and obtained a score of 51. The graphical representation of the above measure is shown in figure lb. Hence, the two groups were matched for reading ability.

Figure 1a : Showing the comparison of performance by the experimental and control groups on oral word reading task

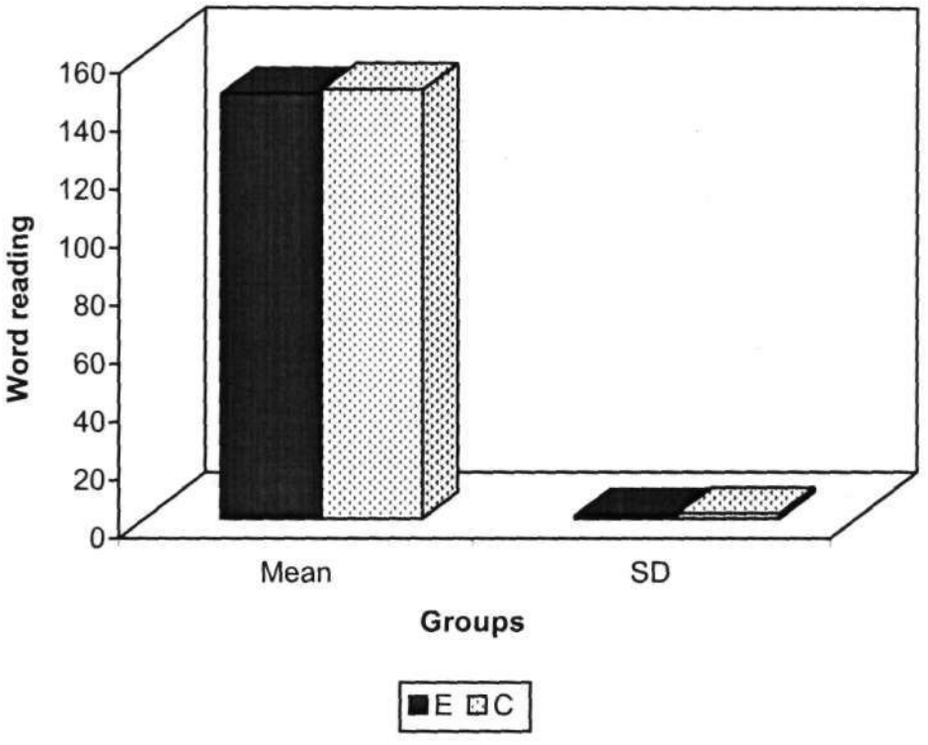
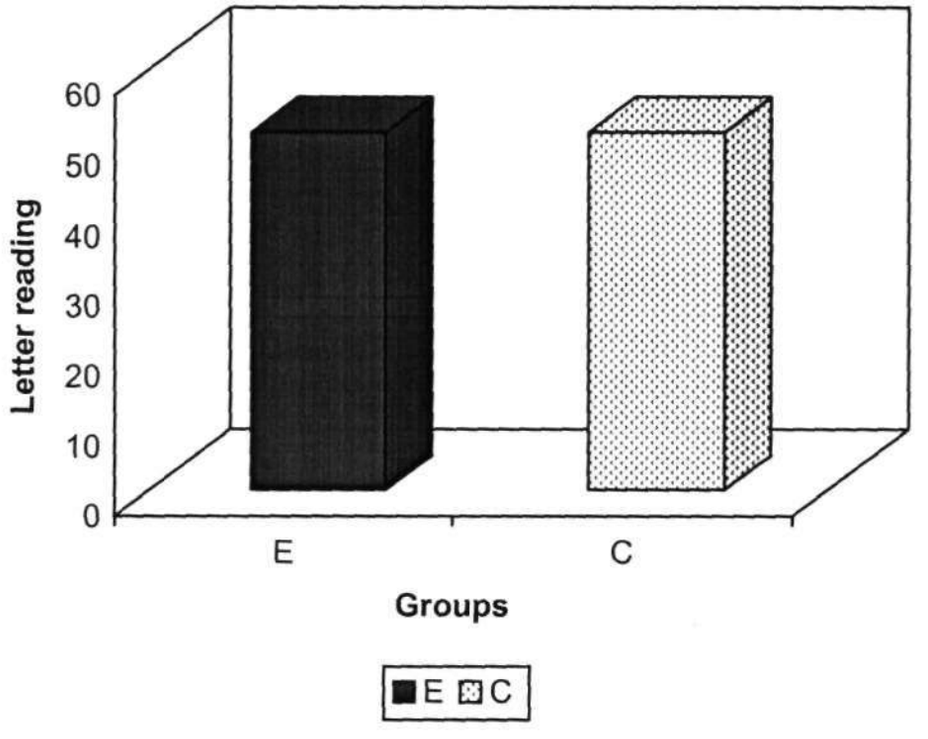


Figure 1b : Showing the comparison of performance of the experimental and control groups on the letter reading task



PHASE-2

- **Testing Phonological awareness**

A set of metaphonological tasks given in the test material developed by Roopa Iyer (unpublished dissertation, 2000) was used.

The tasks administered were the following:

I. Rhyme recognition

It consisted of five pairs of practice words and twelve pairs of stimuli words - six rhyming and six non rhyming [Appendix - IV]. A number of practice trials and demonstrations were given to ensure that the subject understood the nature of the task. During the practice trials, incorrect responses were corrected and correct responses were praised. No such feedback was given during the experimental trials.

Instruction

"I will say two words aloud. Listen to them carefully. If they sound similar, point to the flash card that shows (✓). If they sound different point to the card that shows (x). "With this instruction the test material was orally presented to the subject and the responses were recorded in a separate recording sheet.

Scoring

A score of one was given for each correct response. Maximum possible score was 12 [Appendix - IX].

2. Syllabic stripping

It consisted of five practice words and fifteen bisyllabic or trisyllabic stimuli words [Appendix - V]. The task was to tell the remaining of a word after deletion of the first / second / third syllable. The order of the missing syllable was varied across trials. A number of demonstration trials were given in order to make the child understand the task. This was done initially by means of colored pins which stood for each syllabic of a word. Incorrect responses were corrected and correct responses were praised. No such feedback was given during the experimental trials.

Instruction

"I will present a word to you twice. Listen to it carefully. Then, I will tell you to remove a part of it and say aloud what remains afterwards". With this instruction the test was orally presented to the subjects and the responses were recorded in a separate recording sheet.

Scoring

A score of one was given for every correct response. Maximum possible score was 15 [Appendix - IX].

3. Syllable reversal

It consisted of five practice words and twelve stimuli words [Appendix - VI]. The task was to reproduce the word in the reverse order, at the syllable level. The child was given a number of practice trials and demonstrations to ensure that the child understood the nature of the task. To make the concept of syllable splitting and reversal easier, colored pins were made use of during the demonstration. Incorrect

responses were corrected and correct responses were praised during the practice trials. No such feedback was given during the experimental trials.

Instruction

"I will present a word to you twice. Listen to it carefully. You should reproduce the same word in the reverse order". With this instruction the test material was orally presented to the subject and the responses were recorded in a separate recording sheet.

Scoring

A score of one was given for each correct response. Maximum possible score was 12 [Appendix - IX].

4. Phoneme detection

This was a test item that was not included in the test material developed by Roopa Iyer (unpublished dissertation, 2000). This task was considered as it was a cognitively less demanding one. Individuals with Down's syndrome who could read by phonological recoding should be able to demonstrate awareness of the phonemic constituents of speech if assessed by tasks that did not require the ability to manipulate or operate on phones. It was thus possible that individuals with Down's syndrome who had already begun to read, perform successfully on phoneme detection tasks (Cardoso-Martins & Frith, 2001).

The ability to detect phonemes was assessed through a categorization task, consisting of three training trials and ten experimental trials [Appendix - VII]. The participant's task was to identify the word beginning with a target sound from a group

of three words. In order to minimize the working memory load, the words in each trial were presented pictorially as well as verbally [Appendix - VIII]. The order of the target word (and picture) was varied across the trials.

During the training trials the incorrect responses were corrected and the correct responses were praised. No such feedback was given during the experimental trials

Instruction

"You must pay attention to the sound in the beginning of the word. Your name begins with the sound .... (the first phoneme in the participant's name was pronounced), doesn't it?" The drawings corresponding to each trial were showed and after naming each drawing and asking the participant to name them aloud, he or she was asked: " Which name begins with the phoneme ….?" The same procedure was used for all trials.

Scoring

A score of one was given for each correct answer. Maximum possible score was 10 [Appendix - IX].

RESULTS AND DISCUSSION

RESULTS AND DISCUSSION

This study has been take up with the aim of comparing a sample of typically developing children and a sample of children with Down's syndrome (both having Malayalam as their mother tongue) matched for reading ability on phonological awareness skills and thereby investigating the relation between phonological awareness (PA) and reading ability in Down's syndrome (DS).

The results of the study are evaluated in the following sections :

• Comparison of PA scores of experimental and control groups

Table 2 : Showing the comparison of performance of the experimental(E) and control(C) **groups on the PA tasks.**

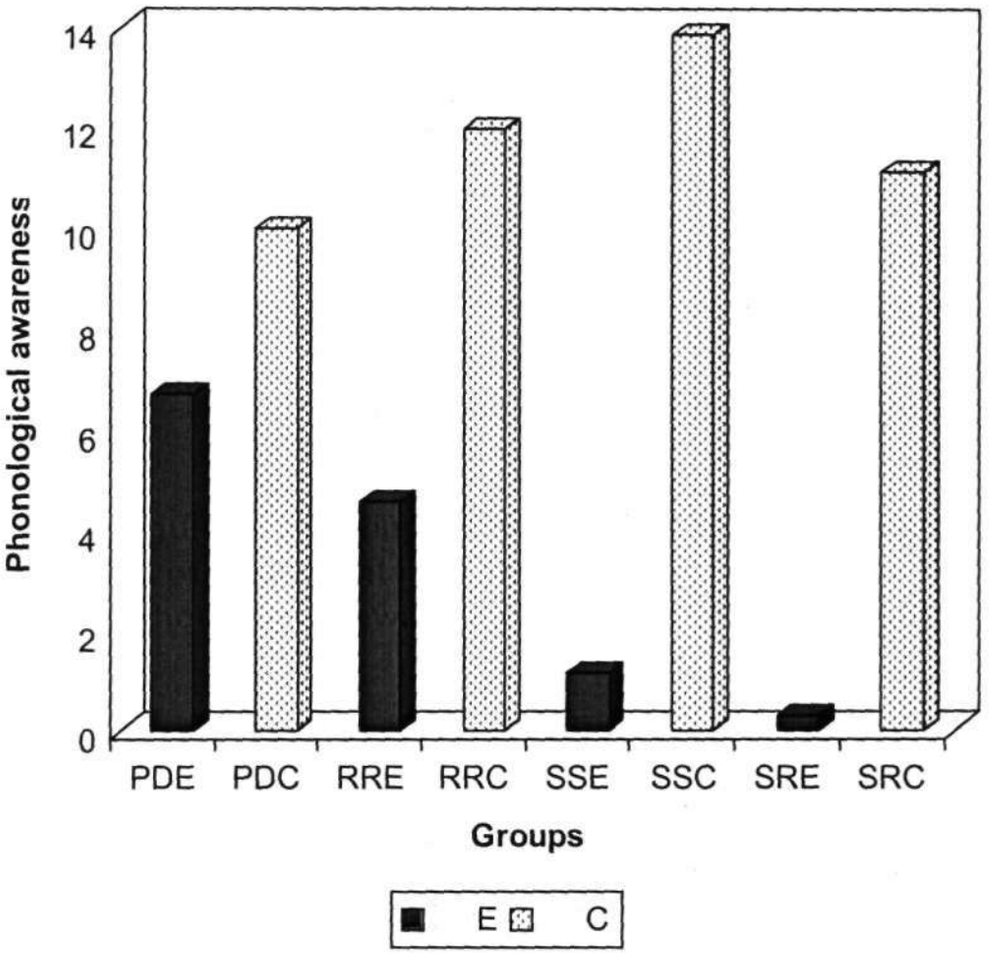
	PD		RR		SS		SR	
	E	C	E	C	E	C	E	C
Mean	6.714	10.00	4.571	12.00	1.143	13.857	0.296	11.143
S.D.	0.756	0.00	1.134	0.00	1.070	1.215	0.488	0.900
Range	6-8	-	3-6	-	0-3	13-15	0-1	10-12
t-value	11.500**		17.333**		20.786**		28.065**	

****:** $p < 0.01$

Table 2 shows the mean, SD, range and t-values obtained on each PA task like phoneme detection (PD), rhyme recognition (RR), syllable stripping (SS) and syllable reversal (SR) by the experimental and control groups. The graphical representation of the same is given in fig. 2.

The t-values given in the table 2 indicates statistically significant difference beyond 0.01 level between the experimental and control groups on all the four PA tasks.

Figure 2 : Showing the comparison of performance of experimental (E) and control (C) groups on phonological awareness tasks (PO, RR, SS & SR)



The hierarchy of task performance in the increasing order of difficulty in the case of children with DS was phoneme detection, rhyme recognition, syllable stripping and syllabic reversal. As is evident from the table 2, phoneme detection was the easiest task and syllable reversal was the most difficult task for the children with Down's syndrome with syllable stripping and syllable reversal placed in between. These results arc quite unlike the performance of normally developing children who had obtained high scores on all the phonological tasks. This is in accordance with the findings of Catts and his colleagues (Catts, Wilcox, Wood-Jackson, Larrivee & Scott, 1997) who claimed that segmentation tasks are more difficult than sound comparison tasks. Segmentation tasks in their study included counting, pronouncing, deleting, reversing or adding phonemes / syllables, while the present study included segmentation tasks such as syllable stripping and syllabic reversal tasks. The sound comparison tasks administered were rhyme recognition and phoneme detection tasks.

- **Performance on individual subtests of PA**

Phoneme detection

Mean of the phoneme detection scores of the experimental and control groups are 6.714 and 10 respectively as shown in table 2. The graphical representation of the same is shown in fig.2.

The children with DS obtained maximum scores in phoneme detection task among all the four PA tasks given. This may be because of the fact that this task was cognitively less demanding as it made use of visual cues in the form of picture cards and thereby made the task more accessible for these children as it did not require taxing of their limited cognitive resources.

In contrast to phoneme segmentation tasks, the ability to detect phonemes does not require the execution of a new cognitive operation (Cardoso-Martins & Frith, 2001). This task required the children only to consciously attend to the phonemes and did not require them to operate on them. Hence the task requirements were much easier.

Rhyme recognition

Mean of the rhyme recognition scores of the experimental and control groups are 4.571 and 12 respectively as shown in table 2. The graphical representation of the same is given in fig.2.

Rhyme recognition task was also performed poorly by the children with DS. However they performed belter on rhyme recognition tasks than the segmentation tasks like syllable reversal and syllable segmentation. This task was however hierarchically more difficult than the phoneme detection task.

Children experience rhymes in the form of songs and nursery rhymes from a very young age (Bryant, Maclean & Bradley, 1990); they can make reliable judgements about rhyme at least from the age of 3 (Bradley & Bryant, 1985). Moreover, in the pathway to reading the contribution of rhyme detection may be mediated by phoneme detection (Bryant, Bradley, Maclean & Crossland, 1989). Phoneme detection was the task that obtained maximum scores by the children with DS as mentioned earlier while rhyme recognition followed. Hence the relatively better scores obtained in rhyme recognition task when compared to the segmentation tasks

like syllable reversal and syllable stripping tasks may be attributed to the above reasons.

Syllable stripping task

Mean of the syllable stripping task scores of the experimental and control groups arc 1.143 and 13.857 respectively as shown in table 2. These measures are also depicted graphically in fig.2.

As mentioned earlier this segmentation task was hierarchically more difficult for the children with DS than the above two tasks namely phoneme detection and rhyme recognition task.

The stripping of the medial syllable was the most difficult in the case of children with Down's syndrome. This finding is in agreement with Goswami's (1994) observation that the onset (initial syllabic) and the rime (final syllable) are relatively easier to delete than the coda (medial syllable). Among the Indian studies, Prema (1997) also found similar results with a study of reading profiling in Kannada, another Dravidian language like Malayalam, largely spoken in the state of Karnataka. Medial syllable processing may be even more complex for the children with DS, given their cognitive deficiency.

A few correct responses were given by these children on bisyllabic stimuli than trisyllabic, i.e., they found it relatively easier to operate on shorter length words than longer words probably because they have a limited short-term storage capacity for processing of auditory information (Varnhagen et al., 19870).

Syllable reversal task

Mean of the syllable reversal task scores of the experimental and control groups arc 0.296 and 11.143 respectively as shown in table 2. The graphical representation of the same is presented in flg.2.

This task was hierarchically the most difficult. The poor performance on syllabic reversal task which requires splitting of words into its constituent syllables and then reversing its order, necessitates the prerequisites of good cognitive skills such as sequential and simultaneous processing. As identified by Pueschel et al., (1987) the children with DS lack these skills.

The apparent deficits of the children with DS on all the PA tasks can be attributed to different factors like :

Bilovsky and Share	1965	Input - Output circuiting is delayed in auditory vocal channels
Marcell and Armstrong	1982	Auditory sequential memory is weak
Lincoln et al.,	1985	Slow auditory information processing
Marcell et al.,	1988	Auditory distraction and off-task glancing during lab tasks

Other factors

- **Nature of reading training**

Even though the children with DS had been receiving intensive reading training, the approach used was a 'whole word' approach and not phonological awareness training. This may not have helped in developing phonological awareness as such, probably because, PA is a verbal task, elicited by auditory cues only. As mentioned earlier, their auditory-vocal channels are weaker than visual-vocal channels. The better performance in reading task may be attributed to the

strengthening of their already superior visual-vocal condition (Scheffelin, 1968) through intensive training.

- **Maturation**

It has been observed that the participant with DS with the highest mental age acquired maximum scores in most of the PA tasks. One interpretation of this pattern supported the Libcrman et al's (1977) position that both reading skills and phonological awareness skills reflect maturational processes.

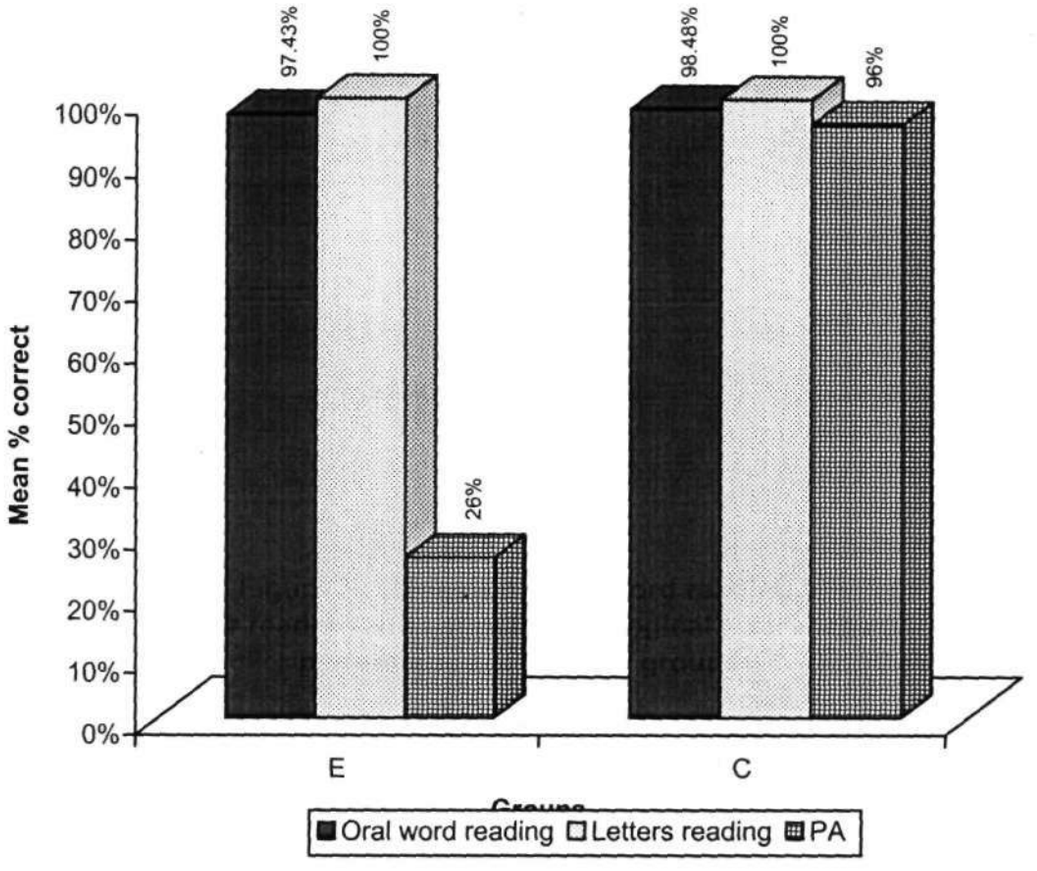
- **Reading and phonological awareness in Down's syndrome**

The mean percentages obtained by the children with Down's syndrome for oral word reading test and letter reading are 97.4% and 100% respectively, whereas, the overall mean percentage obtained for phonological awareness task is 26%. There is a wide discrepancy between the scores of PA and reading in the case of children with DS unlike that of the typically developing children as evident in Table 3. The graphical representation of the same is given in Fig. 3.

Table 3 : Showing the mean percentage obtained by experimental (E) and control (C) groups on oral word reading, letter reading and phonological awareness tasks

	Oral word reading	Letter reading	PA
E	97.43%	100%	26%
C	98.48%	100%	96%

Figure 3 : Comparing oral word reading,
letter reading and overall phonological awareness
performance of E and C groups



Hence, the results reveal that the gross failure on PA tasks when compared to the performance of normally developing children have not prevented the children with DS from acquiring reading at the level of 6 to 7 year old normally developing children.

This observation is in contrast with the findings by Bryant ct al (1990) who reported evidence from a longitudinal study showing that the awareness of rhyme makes a distinctive contribution to reading. Similar findings were given by Goswami and Bryant (1990). Muter, Valerie, Snowling and Margeret (1999) concluded that rhyme recognition was a poor long time predictor of reading whereas phoneme deletion task was a better predictor of the same. Prema (1997) found that rhyming skills have a negative relationship with learning to read Kannada. She found that syllabic segmentation task like syllable stripping task could be a more sensitive indicator of reading ability. The reciprocal causation interpretation fits with Perfetti et al's (1987) longitudinal study of 1st graders in which he found that phoneme blending was a cause of early reading proficiency while ability to delete phonemes was better described as a result of early reading. A study by Cupples and Iacano (2000) on 22 children with DS indicated an association between phonological awareness and early oral reading ability in these children and the results were interpreted within a theoretical view of reading development in which phonological awareness played a central role. They also gave some evidence that early segmentation ability predicted later non word reading but not the reverse.

No such trend in terms of any of the individual subtest of PA playing a causative or consequential role in reading acquisition can be observed in the present

study, as is evident in table 4. The graphical representation of the same is given in Fig. 4.

Table 4 : Showing the mean percentage obtained by the experimental (E) and control (C) groups on reading tasks (WR and LR) and phonological awareness tasks (PD, RR, SS and SR)

	WR (%)	LR (%)	PD (%)	RR (%)	SS (%)	SR (%)
E	97.43	100	67.14	38.10	7.62	2.38
C	98.48	100	100	100	92	92.86

WR : Word reading

LR : Letter reading

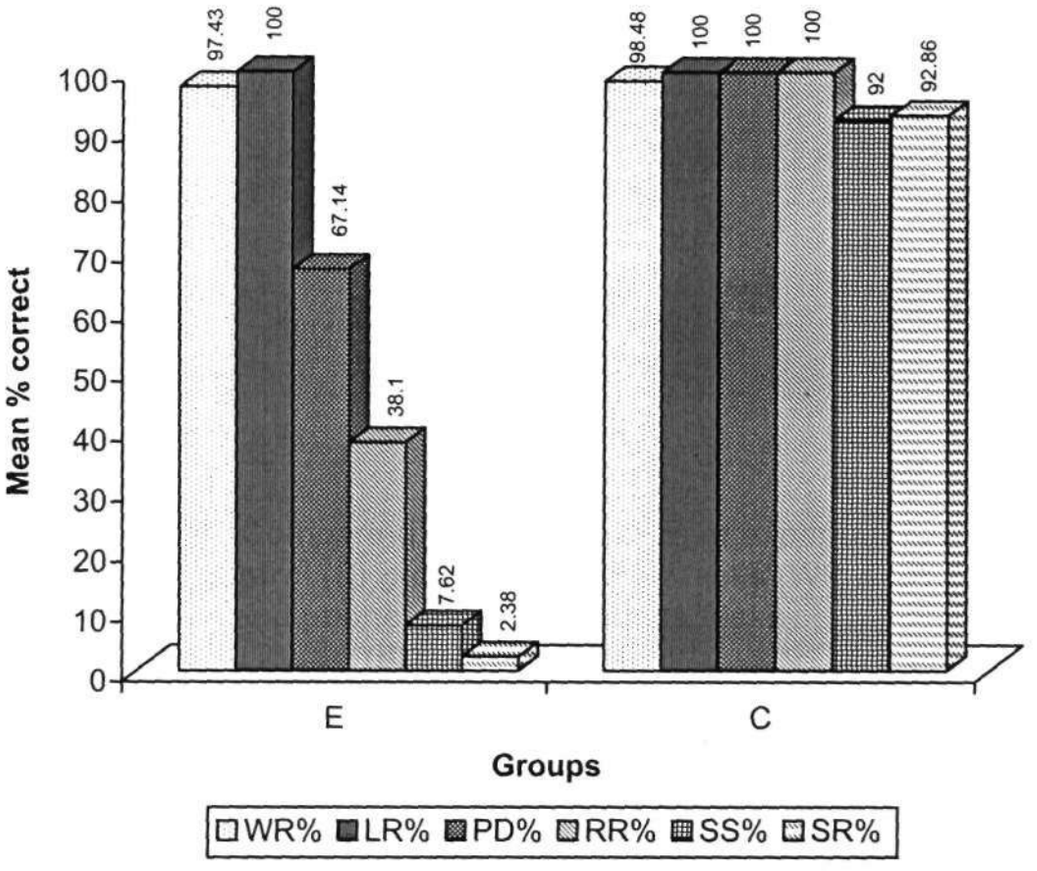
PD : Phoneme detection

RR : Rhyme recognition

SS : Syllable stripping

SR : Syllable reversal

Figure 4 : Comparing the performance of experimental (E) and control (C) groups on reading tasks (WR & LR) and phonological awareness tasks (PD, RR, SS & SR)



However, it cannot be implied that there was a total lack of PA in these children with DS. The presence of non-zero scores in all PA tasks (though very few in the segmentation task) indicates a non-zero PA in the case of children with DS. Since the Down's syndrome children have measurable levels of PA, the fact that they scored lower than the controls can be attributed to factors extraneous to the PA tasks, such as attention or working memory, which are masking the true level of PA.

Moreover, the better results obtained by the children with DS on phoneme detection task paralleled with the findings of Cardoso- Martins and Frith (2001). They explained in their first study that the ability to pay conscious attention to the phonemic constituents of speech as measured by phoneme detection task may indeed have been what enabled the individuals with DS in their study to learn to read inspite of their pronounced intellectual difficulties. The results of their second study suggested that the ability to detect phonemes distinguished between readers and non-readers with DS.

The results of this study point to the importance of distinguishing between ability and performance in discussion about the relationship between reading and phonological awareness (e.g., Byrne, 1993; Morton & Frith, 1993). This is to say that the actual PA of the children with DS may not be tapped completely using the conventional phonological awareness tasks like the ones used in the present study. As many authors have argued, the relationship between metalinguistic ability like phonological awareness and literacy acquisition is probably reciprocal, with increases in one supporting the development of the other (e.g., Morais, Algeria & Content 1987; Goswami & Bryant 1990).

SUMMARY AND CONCLUSION

SUMMARY AND CONCLUSION

Different views are existing regarding the relation between reading and phonological awareness. As the review of literature revealed, phonological awareness which plays an important role in alphabetic literacy, seemed to be a significant factor in Malayalam reading also because of its orthographic features.

The main purpose of this study was to compare a sample of children with Down's syndrome (DS) and a sample of typically developing children (both having Malayalam as their mother tongue) matched for their reading ability on phonological awareness (PA) skills and to investigate the relationship between phonological awareness and reading ability in the children with DS.

Seven children with DS (experimental group) were matched with seven chronologically younger typically developing children (control group) on reading ability. Oral word reading test and letter reading were the tasks used for testing reading ability. Four phonological awareness tasks were then given to both the groups namely rhyme recognition, syllable stripping, syllable reversal and phoneme detection.

The following conclusions can be drawn from the present study :

1. The children with DS obtained significantly lower scores on all the 4 phonological awareness tasks as compared to the typically developing children who obtained high scores on the same. The apparent failure of these children

with DS on PA tasks may be attributed to their limited cognitive capacity such as poor auditory perceptual ability, deficient auditory memory.

2. The hierarchy of task performance in the increasing order of difficulty in the case of children with DS was phoneme detection, rhyme recognition, syllable stripping, syllable reversal. Hence, it was noted that segmentation tasks (syllable stripping and syllable reversal) which required a relatively explicit level of syllable awareness, were more difficult than sound comparison tasks like rhyme recognition and phoneme detection tasks. Therefore, it is possible that the children with DS were able to consciously attend to the phonemes but were not able to operate on them.
3. No apparent relation was observed between reading and phonological awareness in the case of children with DS i.e., their gross failure on phonological awareness tasks did not prevent them from acquiring reading ability matched with that of normally developing children. This may be because :
    - > The children with DS had been receiving intensive reading instruction by means of 'whole word' approach and not through phonological awareness training.
    - > The actual level of their PA was not tapped completely using the conventional PA tests.
4. The existence of a few non-zero scores in all the PA tasks was indicative of a minimum PA present in the children with DS. Hence the relationship between phonological awareness and reading may be reciprocal, with increases in one supporting the development of the other.

Limitations

- The study was conducted on a small number of subjects.
- Tasks used for assessing phonological awareness were limited.
- Follow-up data on the children with DS in separate time frames would have made the research design stronger.

Suggestions for future research

- Similar studies may be carried out in children with Down's Syndrome by making use of a different set of phonological awareness tests.
- Effects of early phonological awareness training may be studied in normal children as well as learning disabled (Malayalam) determining the efficacy of the same.
- Similar studies may be carried out in (Malayalam speaking) illiterates, to determine the effect of literacy on phonological awareness skills.

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APPENDIX

APPENDIX - I

MALAYALAM SCRIPT

VOWEL SYMBOLS [svaram]

അ	/a/	അം	/am/
ആ	/a:/	അഃ	/aha/
ഇ	/i/		
ഈ	/i:/		
ഉ	/u/		
ഊ	/u:/		
ഋ	/ṛ/		
എ	/e/		
ഏ	/e:/		
ഐ	/aị/		
ഒ	/o/		
ഓ	/o:/		
ഔ	_/aụ/		

CONSONANTS [vyanjanam]	VOICELESS PLOSIVES				VOICED PLOSIVES				NASALS	
	UNASPIRATED		ASPIRATED		UNASPIRATED		ASPIRATED			
VELAR	ക	/k/	ഖ	/kʰ/	ഗ	/g/	ഘ	/gʰ/	ങ	/ŋ/
PALATAL	ച	/tʃ/	ഛ	/tʃʰ/	ജ	/dʒ/	ഝ	/dʒʰ/	ഞ	/ɲ/
RETROFLEX	ട	/ʈ/	ഠ	/ʈʰ/	ഡ	/ɖ/	ഢ	/ɖʰ/	ണ	/ɳ/
DENTAL	ത	/t̪/	ഥ	/t̪ʰ/	ദ	/d̪/	ധ	/d̪ʰ/	ന	/n/
LABIAL	പ	/p/	ഫ	/pʰ/	ബ	/b/	ഭ	/bʰ/	മ	/m/
SONORANTS	യ	/j/	ര	/ɾ/	ല	/l/	വ	/ʋ/		
FRICATIVES	ശ	/ʃ/	ഷ	/ʂ/	സ	/s/	ഹ	/h/		
MISCELLANEOUS	ള	/ɭ/	ഴ	/ɻ/	റ	/ɾ̪/				

APPENDIX - II

ORAL WORD READING TEST

ആറ	/aṟa/	പാവ	/pa:va/
ആല	/ala/	മാനം	/ma:nam/
ആന	/a:na/	ചില	/ʧila/
ഇല	/ila/	പിടി	/piḍa/
ഇര	/i ra/	കീരി	/ki:ri/
ഈര	/i:ra/	പീലി	/pi:li/
ഉരി	/uri/	കുട	/kuḍa/
ഊണ്	/u:ṇə/	ചൂട്	/ʧu:ḍə/
എലി	/eli/	കൂട്	/ku:ḍə/
ഏണി	/e:ṇi/	വെടി	/veḍi/
ഒന്ന്	/oṉṉə/	കൈണി	/keṇi/
ഓണം	/o:ṇam/	നേരം	/ṉe:ram/
ഓല	/o:la/	പേടി	/pe:ḍi/
ഋഷി	/ṛʃi/	കൈ	/kaɨ/

ദൈവം	/ɖaɪ̯vam/	നഖം	/ɳakʰam/
കൃമി	/kr̥imi/	ഗളം	/gaɭam/
കൊടി	/koɖi/	ഘനം	/gʰanam/
പൊടി	/poɖi/	മൂങ്ങ	/mu:ŋ/
ലോകം	/lo:kam/	ഛായ	/tʃʰa:ja/
തോട്	/t̪o:ɖə/	ജലം	/ʤalam/
രോഗി	/ro:gi/	ഞാൻ	/ɲa:n/
കസേര	/kase:ra/	പാഠം	/pa:ʈʰam/
മൗനം	/maʊ̯nam/	മണം	/maɳam/
ദുഃഖം	/ɖukʰam/	രഥം	/raʈʰam/
കട	/kaɖa/	ദിനം	/ɖinam/
പാടി	/pa:ɖi/	ധനം	/ɖʰanam/
തല	/t̪ala/	നരി	/ɳari/
പണി	/paɳi/	ഫലം	/pʰalam/

ഭയം	/bʰajam/	പറവ	/paṟava/
ബലം	/balam/	താലം	/t̪a:lam/
മരം	/maram/	കടല	/kaɖala/
വല	/vala/	ശ്രവണ	/ʧravaṇa/
ശരം	/ʃaram/	മകുടം	/makuɖam/
മഷി	/maʂi/	ഭരണി	/bʰaraṇi/
സദ	/saɖa/	ചക്കിരി	/ʧakiri/
ഹരി	/hari/	ചാമരം	/ʧa:maram/
മകൾ	/makaɭ/	ഭാരതം	/bʰaraṭ̪am/
അവൻ	/avan/	മാരകം	/ma:rakam/
പകൽ	/pakal/	കരടി	/karaɖi/
ആണ്	/a:ɳ/	നവര	/n̪avaɻa/
കയർ	/kajaṟ/	നായകി	/n̪a:jaki/
വള	/vaɻa/	പാടം	/pa:ɖam/
മഴ	/maɻa/	കടലാസ്	/kaɖala:s/

ലളിതം	/laɭiṯ̪am/	വട്ടം	/vaṭṭam/
വിഭാഗം	/vibʰa:gam/	അണ്ണാ	/aṇṇa:/
മധുരം	/madʰuram/	അപ്പം	/appam/
അകലം	/akalam/	അമ്മ	/amma/
അദയം	/abʰajam/	ഉള്ളി	/uɭɭi/
മരണം	/maranam/	കുട്ട	/kuṭṭa/
ദിവസം	/d̪ivasam/	മണ്ണ്	/maṇṇa/
ശാലിമ	/ʃa:lima/	ഉണ്ണി	/uṇṇi/
കാശ്	/ka:ʃə/	വള്ളി	/vaɭɭi/
ആകാശം	/a:ka:ʃam/	നെറ്റി	/n̪etti/
പാനീയം	/pa:ni:jam/	തടസ്സം	/ṯ̪aḍassam/
നാരങ്ങ	/n̪a:raŋa/	തണ്ണു	/ṯ̪aṇṇu/
കായൽ	/ka:jal/	ശയ്യ	/ʃajja/
കാക്ക	/ka:kka/	വച്ചാൽ	/vatʃa:l/
പച്ച	/patʃa/	പട്ടണം	/paṭṭanam/

ടീച്ചർ /ʈi:tʃaṛ/

ഉറവിടം /uṛaviḍam/

അഭിമാനം /abʰima:nam/

സമുദായം /samuda:jam/

കമനീയം /kamani:jam/

കൃഷി /kṛiʂi/

സ്വയം /svajam/

ചന്ദനം /tʃanḍanam/

കുന്തം /kunḍam/

ശക്തി /ʃakʈi/

പക്ഷി /pakʂi/

ഗ്രാമം /gṛa:mam/

പത്രം /paʈram/

അമ്പലം /ambalam/

പ്രാവ് /pra:va/

പമ്പരം /pambaram/

ചെമ്മീൻ /tʃemmi:n/

സന്ധ്യ /saṉḍʰja/

ചെമ്പ് /tʃemba/

ബുദ്ധി /budʰi/

നക്ഷത്രം /ṉakʂaʈram/

സിംഹം /simham/

ചിന്നം /tʃinnam/

ചന്ദനം /tʃanḍanam/

സ്വന്തം /svanḍam/

സൂര്യൻ /su:rjan/

സ്വപ്നം	/svapnam/
സമർത്ഥൻ	/samarṯʰan/
കർത്തവ്യം	/karṯṯavjam/
അദ്ധ്യാപകൻ	/adʰja:pakan/
സ്വാതന്ത്ര്യം	/sva:ṯandrjam/

APPENDIX - III

MALAYALAM ARTICULATION TEST

AGE	PHONEME	CHECK WORD		RESPONSE
3.0-3.6	/a/	/aɳɳa:n/	അണ്ണാൻ	
	/a:/	/a:na/	ആന	
	/i/	/ila/	ഇല	
	/i:/	/i:tʃa/	ഈച്ച	
	/u/	/uɾi/	ഉറി	
	/u:/	/u:ppa:l/	ഊഞ്ഞാൽ	
	/e/	/eli/	എലി	
	/e:/	/e:ɳi/	ഏണി	
	/o/	/oɳɳə/	ഒന്ന്	
	/o:/	/o:la/	ഓല	
	/k/	/kuda/	കുട	
		/ʈa:kko:l/	താക്കോൽ	
	/g/	/gaɖa/	ഗദ	
		/ba:gə/	ബാഗ്	
	/ŋ/	/ma:ŋa/	മാങ്ങ	
	/tʃ/	/tʃi:ppə/	ചീപ്പ്	
		/pu:tʃa/	പൂച്ച	
	/dʒ/	/dʒanal/	ജനൽ	
		/gadʒam/	ഗജം	
	/ɲ/	/ɲanɖə/	ഞണ്ട്	
		/ɲappu:l/	ഞാഞ്ഞൂൽ	
	/ʈ/	/ʈa:ppə/	ടാപ്പ്	
	/ɖ/	/ɖo:kʈaɾ/	ഡോക്ടർ	
		/ɾo:ɖə/	റോഡ്	
	/ɳ/	/kiɳaɾ/	കിണർ	
		/ʈu:ɳə/	തൂണ്	
	/ʈ/	/ʈaʈʈa/	തത്ത	
		/mo:ʈiram/	മോതിരം	
	/ɖ/	/ɖi:pam/	ദീപം	
		/maɖɖaḷam/	മദ്ദളം	
	/ɳ/	/ɳakʃaʈram/	നക്ഷത്രം	
	/p/	/pu:və/	പൂവ്	
		/uḍuppə/	ഉടുപ്പ്	
	/b/	/bassə/	ബസ്സ്	
		/ɾibbaɳ/	റിബ്ബൺ	

AGE	PHONEME	CHECK WORD		RESPONSE
	/m/	/ma:la/	മാല	
		/a:mal/	ആമ	
		/maram/	മരം	
	/j/	/je:ʃu/	യേശു	
		/mujal/	മുയൽ	
	/l/	/lo:ɾi/	ലോറി	
		/alama:ri/	അലമാരി	
		/viral/	വിരൽ	
		/vaḷa/	വള	
	/v/	/va:l/	വാൾ	
		/vi:ḍə/	വീട്	
	/ʧ/	/ʧevi/	ചെവി	
	/h/	/simham/	സിംഹം	
	/nd/	/pa:ndə/	പാന്റ്	
	/t/	/pu:mba:tta/	പൂമ്പാറ്റ	
	/nɖ/	/panɖə/	പന്ത്	
		/sandʒi/	സന്ധി	
		/ʈi:vandi/	തീവണ്ടി	
	/nk/	/panka/	പങ്ക	
3.7-4.0	/s/	/su:rjan/	സൂര്യൻ	
		/kase:ra/	കസേര	
	/pʰ/	/pʰalam/	ഫലം	
	/ɾ/	/ra:dʒa:və/	രാജാവ്	
		/ʧeruppə/	ചെരുപ്പ്	
	/ɲʤ/	/indʒa/	ഇഞ്ച	
4.0-4.6	/ʃ/	/ʃanka/	ശങ്ക	
		/me:ʃa/	മേശ	
	/ɻ/	/ko:ɻi/	കോഴി	
4.7-5.0	/ɾ/	/re:ḍijo/	റേഡിയോ	
		/uɾumbə/	ഉറുമ്പ്	
		/ka:ɾ/	കാർ	
	/nɖr/	/ʧandran/	ചന്ദ്രൻ	
	/pr/	/pra:və/	പ്രാവ്	
	/kr/	/ʧakram/	ചക്രം	
	/ʈr/	/pa:ʈram/	പാത്രം	
5.0-5.6	/ʂ/	/ʃarʈʈə/	ഷർട്ട്	
		/braʃə/	ബ്രഷ്	
	/st/	/pusʈakam/	പുസ്തകം	
5.7-6.0	/sk/	/sku:ʈʈaɾ/	സ്കൂട്ടർ	
		/biskkattə/	ബിസ്ക്കറ്റ്	
6.0-6.6	/ʧ/	/ʧa:jə/	ചായ	
	/ʈʰ/	/kaʈʰakaḷi/	കഥകളി	

AGE	PHONEME	CHECK WORD		RESPONSE
	/ʈʰ/	/miʈʰa:ji/	മിഠായി	
	/str/	/vastram/	വസ്ത്രം	
6·7-7.0	/kʰ/	/kakʰam/	കക്ഷം	
		/mukʰam/	മുഖം	
	/kʂ/	/nakʂatram/	നക്ഷത്രം	

APPENDIX - IV

RHYME RECOGNITION

DEMONSTRATION

അല്ലി /alli/	പല്ലി /palli/
പടി /paḍi/	മടി /maḍi/
കരം /karam/	മരം /maram/
പറ /paṟa/	വട /vaḍa/
കട /kaḍa/	ടറ /ṭara/

TEST ITEMS

ടാറാവ് /ṭa:ṟa:va/	പാറാവ് /pa:ra:va/
ചരണം /tʃaraṇam/	മരണം /maraṇam/
ടെറ്റി /ṭetti/	മറപ്പു /maṟappu/

കാട്
/kaːɖə/

നാട്
/ɳaːɖə/

മണ്ട
/mɳɳɖə/

പല്ല
/pallə/

കേരം
/keːram/

നേരം
/ɳeːram/

പറമ്പു
/parampu/

ജോടി
/ʤoːɖi/

കോടി
/koːɖi/

നെറ്റി
/ɳetti/

എവിടെ
/eviɖe/

അവിടെ
/aviɖe/

മണം
/maṇam/

പണം
/paṇam/

നടി
/ʈaɖi/

വണ്ട
/vanɖə/

കല്ല
/kallə/

വടി
/vaɖi/

APPENDIX -V

SYLLABLE STRIPPING

DEMONSTRATION

പുടവ /puḍava/	പു /pu/	ടവ /ḍava/
കരുണ /karuṇa/	രു /ru/	കണ /kaṇa/
ചതുരം /tʃaṭuram/	രം /ram/	ചതു /tʃaṭu/
മനസാക്ഷി /manasa:kʂi/	ക്ഷി /kʂi/	മനസാ /manasa:/

TEST ITEMS

മരണം /maraṇam/	മ /ma/	രണം /raṇam/
അച്ചലം /atʃalam/	ച്ച /tʃa/	അലം /alam/
ചവണ /tʃavaṇa/	ണ /ṇ/	ചവ /tʃava/
പരിജ്ഞ /paridʒa/	പ /pa/	രിജ്ഞ /ridʒa/
ആയുനികം /a:d̪ʰunikam/	കം /kam/	ആയുനി /a:d̪ʰuni/

വാൽ /va:ɭ/	ൽ /ɭ/	വാ /va:/
മകുടം /makuḍam/	കു /ku/	മടം /maḍam/
ചക്കിരി /ʧakiri/	ച്ച /ʧa/	ക്കിരി /kiri/
കമനീയം /kamani:jam/	യം /jam/	കമനീ /kamani:/
കരടി /karaḍi/	ര /ra/	കടി /kaḍi/
മരിച്ചു /mariʧu/	ച്ചു /ʧu/	മരി /mari/
കുടിൽ /kuḍil/	ടിൽ /ḍil/	കു /ku/
സമുദായം /samuḍa:jam/	യം /jam/	സമുദാ /samuḍa:/
പൊലിമ /polima/	മ /ma/	പൊലി /poli/
ഗരുഡൻ /garuḍan/	ഡൻ /ḍan/	ഗരു /garu/

APPENDIX - VI

SYLLABLE REVERSAL

DEMONSTRATION

പരവ
/paṟava/

വറപ
/vaṟapa/

കടല
/kaḍala/

ലടക
/laḍaka/

ഠവള
/ṭavaḷa/

ളവട
/ḷavaṭa/

TEST ITEMS

പടല
/paḍala/

ലടപ
/laḍapa/

കറവ
/kaṟava/

വറക
/vaṟaka/

ച്ചവണ
/tʃavaṇa/

ണവച്ച
/ṇavatʃa/

പലക
/palaka/

കലപ
/kalapa/

പുടവ
/puḍava/

വടപു
/vadapu/

മണ്ഡാടി
/mandʒa:ḍi/

ടിണ്ഡാമ
/ḍindʒa:ma/

ഭവനം
/bʰavanam/

നംവഭ
/namvabʰa/

ചിരവ
/tʃirava/

വരച്ചി
/varatʃi/

കരടി
/karaḍi/

ടിരക
/ḍiraka/

കടുവ
/kaḍuva/

വടുക
/vaduka/

ചെമ്പകം
/tʃembakam/

കംബച്ചെ
/kambatʃe/

ചങ്ങാതി
/tʃaŋga:ṯi/

തിങ്ങാച്ച
/ṯiŋa:tʃa/

APPENDIX - VII

PHONEME DETECTION

DEMONSTRATION

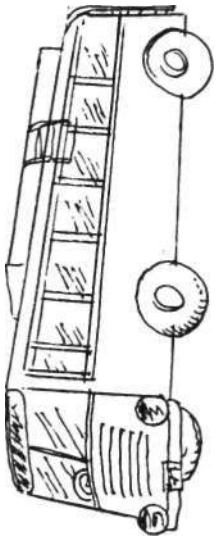
കസേര	തേങ്ങ	മുക്ക്
/kase:ra/	/te:ŋa/	/mu:kka/
തവള	പശു	ആട്
/t̪avaḷa/	/paʃu/	/a:ḍə/
മഷി	നുള്	വള
/maʂi/	/ɳu:lə/	/vaḷa/

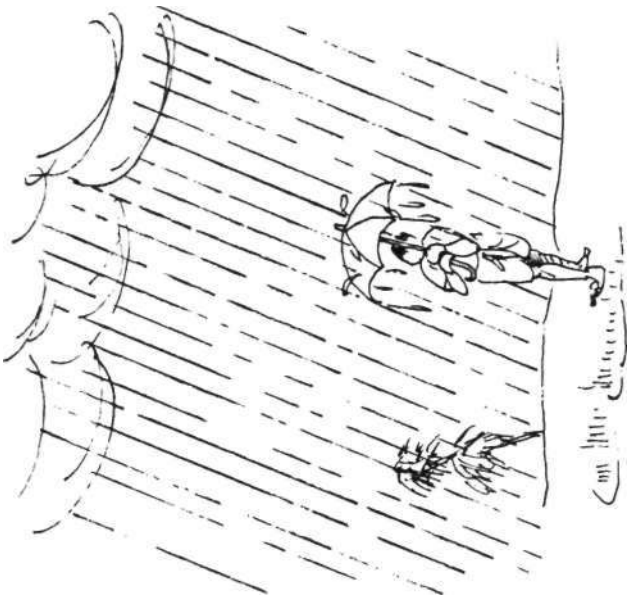
TEST ITEMS

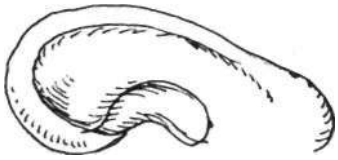
മല	ബസ്സ്	കാക്ക
/maḻa/	/bassə/	/ka:kka/
കുപ്പി	മണി	ചെവി
/kuppi/	/maṇi/	/ʧevi/
വെള്ളം	സൂര്യൻ	പേന
/veḷḷam/	/su:rjan/	/pe:na/
ചെവി	ഉടുപ്പ്	തല
/ʧevi/	/uḍuppə/	/t̪ala/
ഇല	പൂവ്	മരം
/ila/	/pu:və/	/maram/

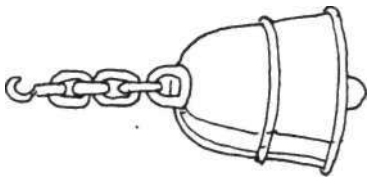
ഗാനം /gaːnam/	കിണർ /kiɳaɾ/	തറ /t̪aɾa/
ടാപ്പ് /ʈaːppə/	പണം /paɳam/	വിളക്ക് /viɭakkə/
ആന /aːna/	കമ്മൽ /kammal/	മേശ /meːʃa/
താക്കോൽ /t̪aːkkoːl/	രാത്രി /raṯ̪ri/	വാതിൽ /vaːʈil/
ലോറി /loːɾi/	കാർ /kaːɾ/	സിംഹം /simham/

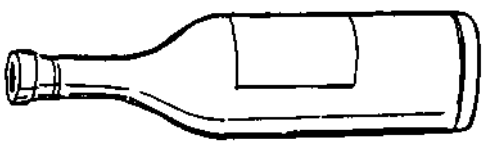
APPENDIX - VIII

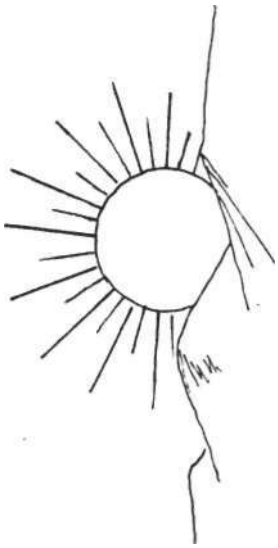


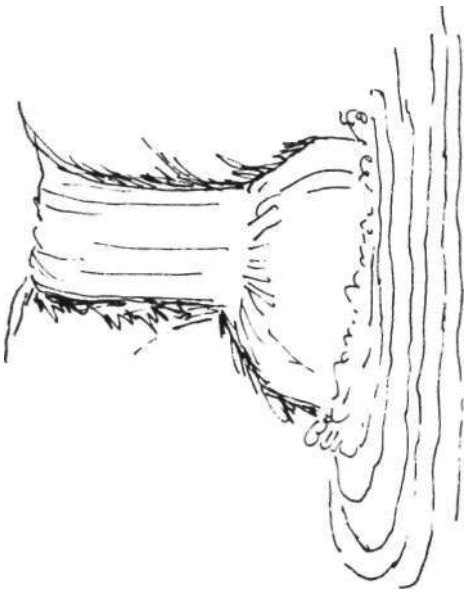


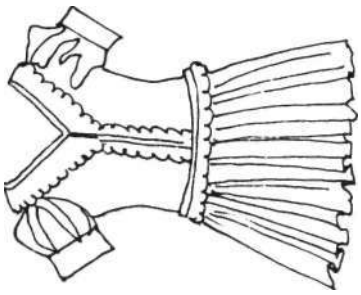


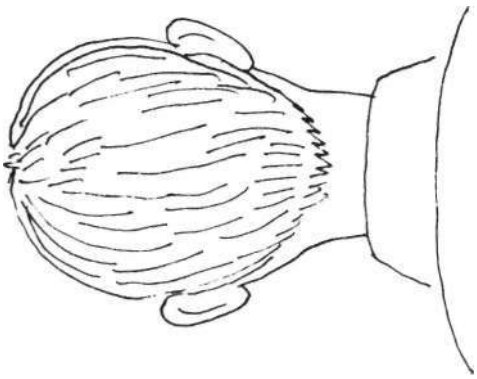


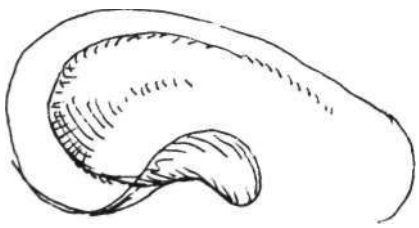


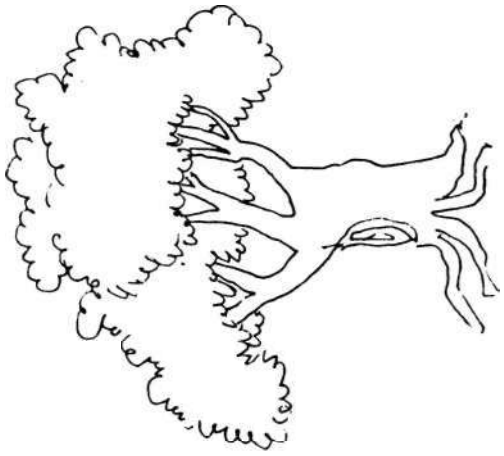


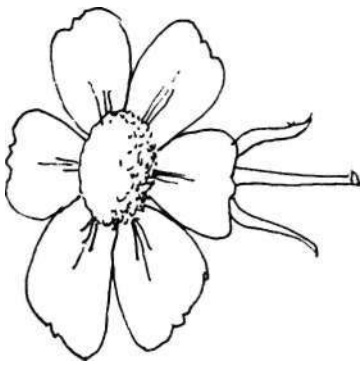


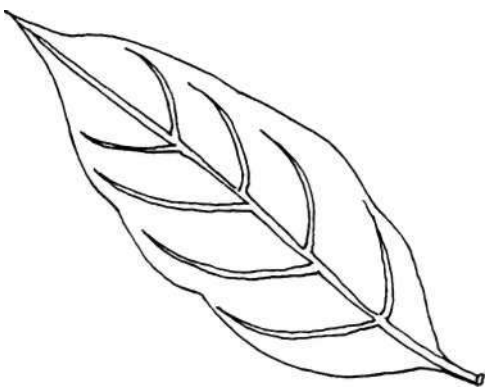


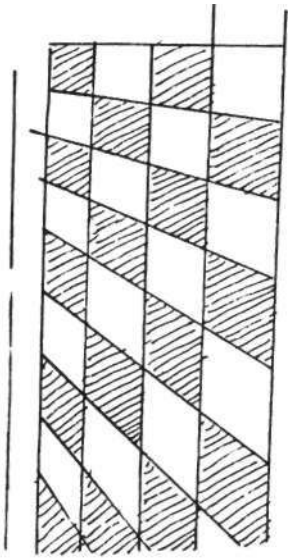


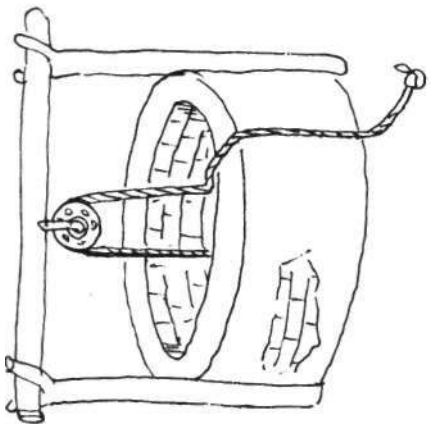


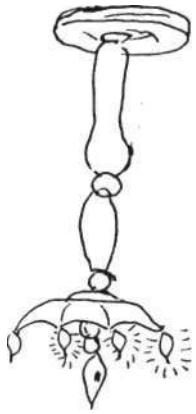


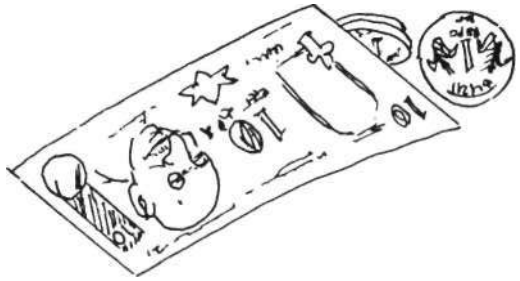


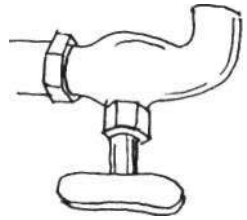


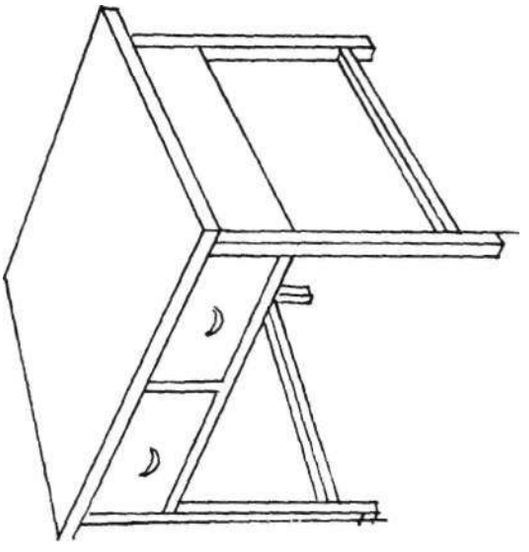


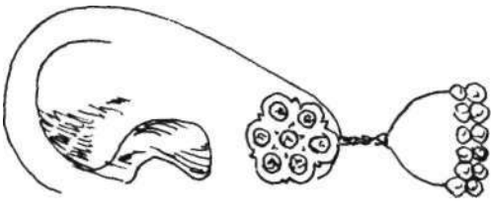


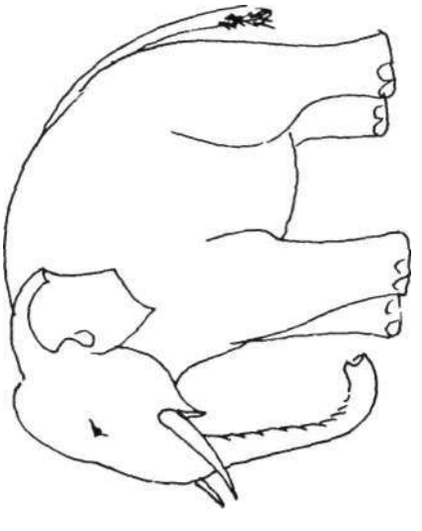


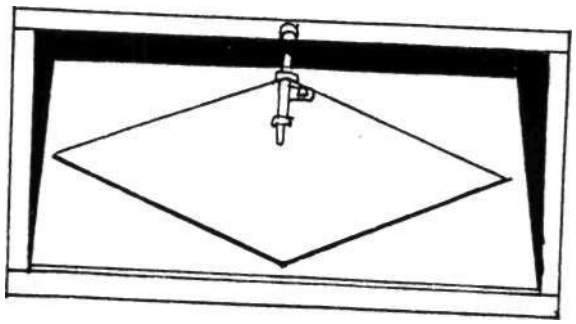


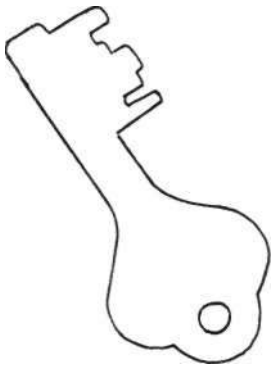


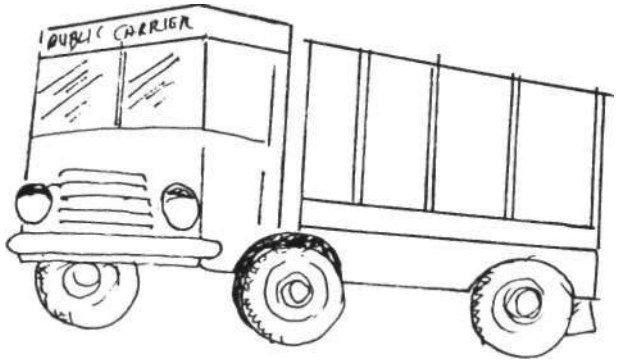


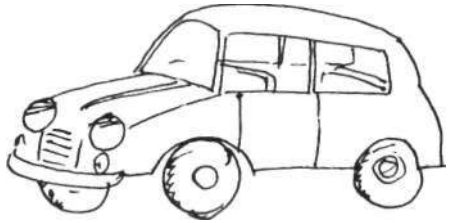









PUBLIC CARRIER



APPENDIX - IX

Score sheets for reading tests

Sl. No.	Test word	Child's response	Score 1/0	Articulatory errors
1.				
2.				
3.				
Total			/150	

Sl. No.	Test letter	Child's response	Score 1/0	Articulatory errors
1.				
2.				
3.				
Total			/51	

Score sheet for Phonological awareness tests

Sl. No.	Test word	Correct response	Child's response	Score 1/0	Remarks
1.					
2.					
3.					