

CHAPTER I

INTRODUCTION

Reading is an essential component of academic learning that builds the foundation for the broader community. Reading is formally introduced when the child starts kindergarten and extends as long as the studies go on. Reading is a complex process brought about by the interaction of many cognitive processes. It involves decoding of visual symbols (or grapheme) into corresponding spoken units (or phoneme) particular to the language. Therefore the reading strategies as well as cognitive resources are expected to vary depending upon the characteristics of the script involved.

Children take their first critical steps toward learning to read and write very early in life. Long before they learn to read they acquire some basic understanding of the concepts about literacy and its functions. Children learn to use symbols, combining their oral language, pictures, print and play into a coherent mixed medium and creating and communicating meanings in a variety of ways. From their initial experiences and interactions with adults, children begin to read words, processing letter-sound relations and acquiring substantial knowledge of the writing system. Unlike the general communication abilities and other developmental skills, reading is a conscious learning process that requires careful planning and instruction.

Reading acquisition progresses through many stages. Stages of reading are discussed at length in the past by few researchers including Ehri (1999) beginning with pre-alphabetic reading stage where they use visual cues for word identification followed by partial alphabetic reading stage where children develop the sensitivity for letters and start associating them with sounds. Third stage is full alphabetic reading stage where children have attained most of the letter sound knowledge and also start sight word reading. In the final consolidated alphabetic reading stage the child is able to chunk or re-chunk words and then read them using appropriate decoding. Frith's model (1985) also was similar to this consisting of three stages namely, logographic, alphabetic and orthographic stage. The process of reading consists of two components namely word decoding and reading comprehension (Perfetti, 1985). Literature enumerate many factors influencing reading which can be categorized into cognitive and linguistic related factors and those pertaining to the child and the socio-cultural setting (Burgess, Hecht & Lonigan, 2002; Purcell-Gates, 1996). Cognitive and linguistic related factors include vocabulary, syntactic knowledge, meta-linguistic awareness, memory (Adams & Snowling, 2001; Purvis & Tannock, 2000; Nation, Adams, Bowyer-Crane, & Snowling, 1999; Gathercole, Willis, Baddeley, & Emslie, 1994), phonological awareness and verbal fluency (Muter, Hulme, Snowling & Stevenson, 2004; Oakhill, Cain & Bryant, 2003; Goff, Pratt & Ong, 2005; deJong & van der Leji, 2002; Verhoeven & Van Leeuwe, 2008; Gillam &

Van Kleeck, 1996; Snow, Burns, & Griffin, 1998). In particular, phonological awareness is a precursor in determining the success rate of reading (Badian, 1995; Mann, 1986, Storch & Whitehurst, 2002). Phonological awareness and its relationship to reading is a debated issue since decades. Another set of processes vital to reading success in addition to socio-cultural factors include the educational status of parents, the amount of exposure to a second language outside the school setting (Cheung & Ng, 2003), socio-economic status (SES), exposure to books apart from the texts at school (Anderson, 1996; Elley, 1991; Stanovich, 1993), etc.

Reading process in children learning to read in two languages (biliteracy) is an interesting area of research owing to the nature of complexity involved. It is also an upcoming area of research as a result of global increase in bilingualism. At present bilingualism and biliteracy is almost inevitable especially in culturally diverse countries like India. Biliteracy places readers at cognitive demands of decoding script to meaning that takes place at different levels. These cognitive demands are even challenging if distinct writing systems are involved.

English language learning is increasingly becoming an integral part of the community in every domain of the society and hence its incorporation in school settings is inevitable. This in turn necessitates effective teaching methods to be employed at school level to facilitate better placements in higher educational and work settings.

Most of the reading acquisition research till date has been alphabet centric (Share, 2008). Alphabetic languages have been explored immensely to understand the development of reading in children. Alphabetic languages are characterized by the basic components namely alphabets which are combined in various permutations and combinations pertaining to that particular language in forming meaningful words. Once the child understands the phonemic nature of the language the reading acquisition is considered to have reached a plateau. Research on the learning of alphabet writing systems shows that children tend to spell better when they have been explicitly taught the correspondences between letters and phonemes than when teaching has focused on larger units (Ehri, Nunes, Stahl, & Willows, 2001; Rayner, Foorman, Perfetti, Perfetti, Pesetsky, & Seidenberg, 2001).

Although much research has been done on the acquisition of alphabetic writing systems, especially English, less is known about the acquisition of other systems. Alphasyllabaries possess the characteristics of both alphabets as well as syllables (Bright, 1996; Daniels, 1996; Sproat, 2006). These writing systems are characterized by graphic complexes that correspond to syllables which may still be capable of being decomposed into phonemes within them. The basic units in most of the writing forms comprise of symbols which have vowels embedded within them. For example in Malayalam the

consonant /kʌ/ is represented by the symbol /K/. the syllable /kʌ/ is therefore a combination of two phonemes namely /k/ and /ʌ/. Alphasyllabary possess characteristics of both alphabetic and syllabic writing systems. One can spell a word one chunk at a time, eliminating the need for analysis into phonemes, but one can alternatively build up graphic complexes from their phonemic components. In comparison to the alphabetic systems, like English, the acquisition of individual units of alphasyllabary may extend over several years (Nag, 2007; Nag & Sircar, 2008; Tiwari, Nair & Krishnan, 2011). It is possible to teach spelling in alphasyllabary, either at the akshara level or at the level of individual phonemes, though the strategy followed across many schools relies largely on rote memorization of whole akshara rather than a phoneme based approach (Nag, Trieman & Snowling, 2010).

Children require certain underlying abilities to be able to develop reading in any language. In English learning the concept of alphabetic principle needs to be acquired which is fundamental in English reading. Alphabetic principle includes the knowledge of the names various letter existing in the language and their sounds and also the systematic relationship between the letters and sounds (Adams, 1990). However reading in alphasyllabic writing involves the acquisition of visuo-spatially complex and extensive orthography which extends over years unlike English letter acquisition (Nag, Treiman & Snowling, 2010).

With the advent of multicultural society and English becoming a globally accepted language in most of the official settings, biliteracy is currently becoming a standard in most of the academic setting. However, research on acquisition patterns of children learning two different languages is scanty. Therefore cross-linguistic research is needed for developing the data on biliteracy acquisition. Few cross-language comparisons have been reported primarily in alphabetic languages, like English and German (Frith, Wimmer, & Landerl, 1998) and English and Greek (Treiman, Mullenix, Bijeljac-Babic & Raymond- Welty, 1995). As, alphasyllabary shares features of alphabetic writing as well as of syllabic writing, such a comparison is necessary to infer strategies which children use when exposed to two different set of orthographies.

In a country like India where diverse culture co-exists biliteracy is found to be very common. With the increasing significance of English in mainstreaming it becomes vital for us to understand the processing taking place in children when exposed to two languages simultaneously in a formal setting. The differences in processing is also important in understanding the problems posed by the languages in children who have difficulty acquiring the rules governing the reading and writing acquisition. Hence, there is a pressing need for research on literacy acquisition in biliterates in our country.

Given the differences in reading acquisition in the English and Indian scripts, it is of interest to study reading acquisition in children learning to read in two different writing systems. While English follows alphabetic writing system, Indian scripts (e.g., Malayalam) follow alphasyllabic writing. Malayalam is the official language spoken in the state of Kerala of southern India with a script of its own. Malayalam script has a rich traditional history dating back to thirteenth century, though has not received adequate research attention. The present study thus aimed at investigating reading acquisition in children learning to read two distinct writing systems, Malayalam and English simultaneously.

CHAPTER 2

REVIEW OF LITERATURE

Reading is often considered as a complex task brought about by the combined influence of language, cognition and metaphonological skills. Early reading is often considered as a precursor for determining the later scholastic performance of the child. As the community is increasingly turning bi/multilingual so is the literacy development in children learning to read.

Phonological awareness and Reading

Phonological awareness is considered as the ability to manipulate the phonological units existing within a word. Trieman (1991) calls phonological awareness to the awareness of the phonological unit of the spoken language. Such units may range from syllables, intra-syllabic units to phonemes which are often marked acoustically. However, depending upon the nature of language, these smallest units would vary and hence the awareness in children. Learning to speak children naturally becomes acquainted to the elementary phonological units of the language. Syllables are often considered the smallest independent units of speech which are capable of being produced whereas phonemes are difficult to be produced in isolation (Wagner & Torgesen, 1987). These phonological awareness skills are acquired in a progressive manner beginning with the initial simple skills of rhyme recognition, alliteration etc. and then moving on to the ability to detect and isolate components and then onto manipulating them. Manipulation would involve *blending*, *segmenting* and *substituting alternate sounds* for specific syllable or phoneme units. Thus these tasks can be placed hierarchically with the ability to recognize rhymes being the easiest for children across languages. *Blending phonemes* and *syllable splitting* (e.g., segmenting the beginning sound of back, /b/, from the remainder, -ack) are intermediate-level tasks. The most difficult phonemic awareness tasks are those that involve completely *segmenting* the phonemes in spoken words and manipulating phonemes to form different words (Adams, 1990). Consistent with this suggestion are 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, Fischer & Carter, 1974) thereby following the hierarchical pattern of progression.

Phonological awareness and its relation to reading is well investigated in the past by various researchers, however still conflicting views exist in this respect. Phonological awareness however is often

most commonly correlated with alphabetic languages like English, Russian, French and Italian. Even when considering alphabetic languages the claims are equivocal. The relationship between phonological awareness and reading is not, however unidirectional. Views range from considering phonological awareness as a causal factor (Bradley and Bryant, 1983), an effect of learning to read (Morais, Cary, Algeria & Bertelson, 1979; Wagner, Torgesen, & Rashotte, 1994), or to have a bidirectional relationship with learning to read (Morais, Algeria & Content, 1987). Letter knowledge and early reading have shown considerable influence on the development of phonological awareness (Ehri, 1998). Several studies have suggested that, in the absence of reading instruction, the ability to isolate and manipulate single phonemes in co-articulated syllables is obstructed (Bertelson & deGelder, 1990). Contradictory research studies have also reported the effectiveness of phonemic awareness in the development of children's reading and spelling abilities in normal school setting (Lundberg, Frost & Peterson, 1988) as well as in immersed situations (Ramirez, Yuen, & Ramey, 1991). Bryant, McLean 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 & 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.

Numerous studies have reported the effectiveness of phonemic awareness training on the developments of children's reading and spelling abilities. Lundberg, Frost, and Petersen (1988) taught pre-school children to attend to the phonological structure of language prior to any explicit instruction about the alphabetic writing system. The phonemic awareness training showed a facilitative effect on the acquisition of spelling ability in Grade 1 and word recognition and spelling ability in Grade 2. A few studies have also suggested that phonological awareness skills are better predictors of reading performance in children learning English language than are oral proficiency skills (Durgunoglu et al., 1993; Geva & Seigel, 2000; Limbos & Geva, 2001; Moll & Diaz, 1985).

Phonological awareness skills are investigated in non-alphabetical languages, though the issue still remains unresolved. A study by Ying (2009) on Chinese children in Grades 3, 4 and 5 assessed their phonological awareness skills, especially the effect of medial vowel in phoneme deletion task revealed interesting findings. Chinese children of third Grade when given the task of initial consonant deletion tended to delete medial vowel along with the initial consonant. The responses of children from fourth and fifth grade however differed showing correct deletion of the initial consonant. This developmental trend observed was consistent with the phonological features present in Chinese language. Similar findings

were reported in studies assessing the phonological awareness in English. The children of lower Grades were able to effectively separate the onset from the rime when given simple words such as /sit/ whereas it was the later Grades which were capable of isolating the initial consonant from a CCVC cluster. This was because the onset/rime concept appears earlier than the concept of phonemes. Separating the initial phoneme from onset rime is thus simpler and earlier to emerge in children compared to the isolation of phoneme from a cluster, which requires the true understanding of a phoneme. The performances of these children in these tasks thus paralleled their developmental patterns.

In Indian languages, research report phonological awareness as important though not a crucial factor for reading acquisition in normally developing children (Patel & Soper, 1987; Prakash, 1987; Prakash, Rekha, Nigam and Karanth, 1993; Prema, 1997, Seetha, 2002). However, alphabetic principles require the ability to isolate and manipulate phonemes in a coarticulated speech. Prema (1997) posited that syllable awareness is the earliest to develop in a non alphabetic language and phoneme awareness was the last to develop where it could be owing to the alphabetic nature of the Kannada script or due to exposure to alphabetic language in school setting. The major factor that triggers this ability is the exposure to alphabet. However, phonemic awareness cannot be triggered by the alphabet unless the early form of phonological awareness is well developed. Liberman et al. (1974) conducted a study on American children of the age range 4 to 6 years. In their study syllabic awareness and phoneme awareness tasks were included. The results of the study reveal that syllabic awareness was present in pre-readers and phonemic awareness did not develop until they received formal education in school setting. Cossu, Shankweiler, Liberman, Katz & Tola (1988) found a similar finding in Italian children where phoneme awareness was shown by 13% of 4 year olds, 27% of five year olds and 97% by the school going children. Thus the results suggested that syllable awareness was independent of the orthographic exposure whereas phoneme awareness purely depends on the exposure to alphabetic orthography. Children who do not meet this prerequisite must be explicitly trained for phonemic segmentation. With younger children, however, or with children who are language-delayed the training program should probably begin with the establishment or improvement of sensitivity to rhymes and the ability to detect the onset and rime of the syllables.

Orthography and Reading

Acquisition of orthographic skills is essential for successful reading achievement. The orthographic skill in itself is often considered as a strong predictor of reading acquisition and performance. Orthographic knowledge or skill is also known to influence the phonological awareness

skills of a child and this relationship is reported as bidirectional (Brady & Shankweiler, 1991). Word reading performances are often correlated with the degree of mapping consistency between the orthographic units to the phonologic codes. Contradictory findings have also been reported failing to arrive at any such correlation which in turn suggests that though these skills on phonological awareness and orthographic knowledge are necessary, they are not uniquely sufficient for the development of skilled reading in children. A study by Baron and Trieman (1980) reported weaker correlation between nonword reading and irregular word compared to relationship between non word reading and regular word reading which indicated the role of additional factors in modulating the performance.

Across all languages and writing systems the task of the reader is to learn how to obtain meaning from printed words and larger units of text. The orthographic depth hypothesis (Frost, Katz, & Bentin, 1987; Katz & Feldman, 1983; Katz & Frost, 1992) suggests that the continuum of orthographic transparency influences the strategies adopted by the readers. For instance alphabetic systems are based on correspondences between phonemes and graphemes, basically with graphemes representing the phonetic segments. Syllabaries such as Korean on the other hand establish correspondences between consonant vowel groups and graphemes. Character languages such as Chinese on the other hand select morphemes as the basic unit and associate those units with characters indicating both semantic and some phonological properties.

Reading acquisition models till date have most commonly focused on deep orthographic languages such as English. Very less work has been done in understanding the mechanism of reading in shallow orthographies or relatively less transparent orthographies. Initially the mechanisms involved in reading was considered to be the same irrespective of the type of orthography however recent findings on the performance of children across languages as well as differences in the pattern of acquisition of reading across languages has gained attention suggesting the level of orthographic transparency a crucial factor in determining the reading acquisition. Cross linguistic comparison of reading performance across languages differing in the degree of transparency such as Italian, German, English, French, Greek, & Brazilian have evidenced a difference in the reading strategy adapted by these children (Cossu, 1999; Frith, Wimmer, & Landerl, 1998; Harris & Giannouli, 1999; Porpodas, 1991; Sprenger-Charolles & Bonnet, 1996; Wimmer & Goswami, 1994). The traditional models of reading suggest the stage to begin with logographic reading however contradictory findings have been reported in languages like German (Wimmer & Hummer, 1990) and French (Sprenger-Charolles & Bonnet, 1996), where beginning readers were observed to use sublexical routes involving GPC (Grapheme to Phoneme Correspondence) unit. This was contradictory to the strategies used by English children who were initially observed to use logographic strategy (Seymour & Elder, 1986; Stuart & Coltheart, 1988). English language has been compared to many shallow

orthographies such as German, Italian & Spanish suggesting differences in reading strategies across different orthographies, with more complex orthographies involving a different strategy and pattern of acquisition.

Letter-sound knowledge and reading

Studies exist in literature suggesting an association with the delay in letter knowledge acquisition to the delay in literacy acquisition (Hecht, Burgess, Torgesen, Wagner & Rashotte, 2000). These studies suggest the importance of assessing letter knowledge as a major predictor of reading acquisition. Letter knowledge is generally assessed by letter sound recognition (pointing to the letters when the letter sound is given), letter sound recall (saying the letter sound) or letter reproduction (writing the letters when the sound is given) (Bowey, 1995; Duncan & Seymour, 2000; Treiman & Broderick, 1998). Letter sound knowledge is very important for the development of alphabetic principle. This helps children associate the letters to their respective sounds and also in constructing spellings of the words in their spoken vocabulary. Though letter sound knowledge is considered important for reading development it is nevertheless considered the only factor sufficient for developing adequate decoding skills required for efficient reading.

Letter sound recognition may be measured by making the child scan a letter grid and find out a grapheme matching the spoken form. The demands on memory are minimal because visual stimuli enhance access of stored letter knowledge. Hence this may be the first skill to develop. Letter sound recall on the other hand demonstrates an emerging understanding of the alphabetic principle (Berko-Gleason, 1997). This skill depends on both letter recognition and phoneme awareness which results in the accurate retrieval of phoneme sounds. Letter reproduction is brought about by the interaction of letter sound knowledge with a printing response. To perform this task, children need to process the auditory stimuli of spoken phoneme, discriminate it from the others and retrieve the corresponding letter shape from memory followed by initiation of a motor response to the hand to manipulate a pencil to write the respective grapheme on paper.

Reading acquisition across orthographies

Cross linguistic studies have reported that children learning to read consistent orthographies such as Italian, Spanish, Turkish, Greek and German appear to acquire reading at a faster rate than children

learning to read inconsistent orthographies such as English. Reading accuracy and reading speed for words and nonwords appear to be greater in more consistent writing systems. When word and non word reading is studied in individual languages, children who are learning to read consistent orthographies typically show very good levels of decoding, even in first year of learning to read. Porpodas, Pantelis and Hantziou (1990) compared the reading abilities of Grade 1 children in Greek languages across the tasks of word reading and nonword reading. The results of the study revealed a similar performance with children showing 90% accuracy for word reading and 89% accuracy for nonword reading. Greek is a regular language and similar performances in regular languages have been reported in other studies (Cossu, Gugliotta & Marshall, 1995). However the studies on inconsistent orthographies yielded different results with poorer scores on tasks of word reading and non word reading by children of lower grades on both true words and non words with the performance being better on real words (Frith, Wimmer & Landerl, 1998; Goswami, Gombert & de Barrera, 1998; Wimmer & Goswami, 1994).

These differences in patterns of scores based on the differences in the orthographies clearly support the hypothesis that reading and phonological recoding strategies at the grapheme-phoneme level are acquired at a faster rate in consistent orthographies. However comparison of these studies on monolinguals needs to be treated with caution as the item characteristics and participants characteristics may vary widely from one study to the other. The ideal way of testing this hypothesis of faster acquisition of reading accuracy in consistent writing systems is by matching participants across languages for key characteristics and also matching word and non word items as well.

Frith, Wimmer, and Landerl (1998) compared English learning children with German learning children. The task required word and non word reading. This study had a stronger methodology because it was successful at using an ideal manipulation for studying grapheme phoneme decoding strategies across languages. The non words and words used were same across German and English participants. However there was a significant difference in their orthographic consistency. Results of the study revealed that German children reached a ceiling by the end of their first grade. However the reading performance of English children did not reach that accuracy level unless they received three years of formal reading instruction at school. This was suggestive of different psycholinguistic grains operating for different languages.

Such difference in the pattern of acquisition has been explained by psycholinguistic grain size theory (Ziegler & Goswami, 2005), which focuses on the grain size processing taking place in each language. According to this theory, although the sequence of phonological development may be language universal, the ways in which sounds are mapped to letters (or other orthographic symbols) may be

language specific. The units of processing may be large (analogy) or smaller units (phoneme based) depending upon the features of a given language. Children exposed to orthographically consistent languages like Greek, German, Spanish etc are considered to rely heavily on phoneme grapheme correspondence during the course of their reading acquisition owing to the regularity in the language and hence are considered to rely on much smaller grain size units for processing the text. Children who learn much inconsistent language such as English cannot completely rely on these small units owing to the inconsistencies of these in comparison to larger units like rimes-bodies (Treiman, Mullenix, Bijeljac-Babic & Raymond- Welty, 1995). As a consequence, English speaking children supplement grapheme phoneme recoding strategies with larger unit strategies such as the use of spelling patterns for rhymes (reading by analogy) and the recognition of whole words. Thus, these inconsistent languages such as English may result in the child developing both small unit and large unit decoding strategies in parallel.

Developmental progression of phonological awareness has also been explained by psycholinguistic grain size theory. Most of the cross linguistic studies on phonological awareness have succeeded in showing a general pattern of development of phonological awareness with awareness of syllables, onsets, and rimes preceding the development of phonological awareness for phonemes (Liberman, Shankweiler, Fischer & Carter, 1974; Cossu, Shankweiler, Liberman, Katz & Tola, 1988; Bradley & Bryant, 1983; Wimmer, Landerl & Schneider, 1994). Syllable awareness is reported to be relatively good prior to literacy, whereas phoneme awareness is relatively poor. Hioen, Lundberg, Stanovich and Bjaalid (1995) investigated phonological awareness using syllable and phoneme counting tasks in Norwegian preschoolers. Results showed significantly better performance i.e., 83% correct response in syllable task in comparison to 56% correct response in phoneme task. Similar findings were reported by Wimmer, Landerl, Linortner and Hummer (1991) on a study conducted on German children. Durgunoglu and Oney (1999) gave syllable and phoneme tapping tasks to Turkish kindergartners and first graders. These children performed 94% response for syllable task and 67% for response for phoneme detection task. Harris and Giannoulis (1999) also reported similar findings in Greek kindergartners and first grade children. Thus, for all languages, researchers arrived at a similar finding that phonological awareness of syllables was markedly superior to the awareness of phonemes before literacy. However rapid progress in phonemic awareness followed the onset of literacy instruction.

Reading acquisition thus differs considerably depending upon the nature of orthography. Consistent orthographies show relatively rapid reading acquisition in comparison to inconsistent orthographies like English. In consistent languages phoneme to grapheme correspondence is regular hence acquisition basically relies on how well children acquire those basic set of principles. In inconsistent languages however such reliance on grapheme phoneme recoding alone will not be

successful instead larger sublexical units like rimes and whole word processing also is needed (Berndt, Reggia & Mitchum, 1987; Ziegler, Stone & Jacobs, 1997).

Reading acquisition in Bilingual children

Biliteracy is defined as children's competency in two written languages developed to varying degrees either simultaneously or successively (Dworin, 2003). Children's acquisition of literacy skills is guided by the writing system of the language in use, as each writing system is based on a different set of symbolic relations and thus requires different cognitive skills (Coulmas, 1989). Alphabetic writing exploits the phoneme to grapheme link; even with varying scripts for example Roman or Semitic share the essential feature of grapheme representing the phonetic segments. Syllabic writing, for example Korean, makes use of the syllable (consonant-vowel groups) to grapheme correspondence. And the logographic writing as in Chinese, it is the character maps at the level of morpheme in the oral language. As the process of reading varies across writing systems, learning to read in bilinguals is expected to be determined by the writing system in use for each language.

Research on reading acquisition in biliterates is of particular interest because of two reasons. First, bilingual children develop the prerequisite skills for literacy development differently than monolingual children (Bialystok, Luk & Kwan, 2005). Three important skills for literacy acquisition are oral proficiency, metalinguistic awareness, and general cognitive development. Oral vocabulary skills have been shown to influence children's acquisition of literacy (Adams, 1990; Dale, Crain-Thoreson, & Robinson, 1995; McBride-Chang & Chang, 1995; Stahl & Fairbanks, 1986; Stanovich, 1986). However, preschool bilingual children are documented to have smaller vocabulary than comparable monolingual children of each language (Ben-Zeev, 1984; Bialystok, 1988; Merriman & Kutlesic, 1993; Rosenblum & Pinker, 1983). Similar findings were provided by Cobo-Lewis, Pearson, Eilers and Umbel (2002) in a large-scale study on Spanish-English bilingual children until fifth grade. Research has well established the significance of phonological awareness for reading in alphabetic languages (Bryant & Goswami, 1987; Liberman, Shankweiler, Liberman, Fowler, & Fischer, 1977; Morais, 1987; Perfetti, Beck, Bell, & Hughes, 1988; Wagner, Torgesen, & Rashotte, 1994). Recently phonological awareness relation was also established in learning to read in nonalphabetic languages as Chinese (Hanley, Tzeng, & Huang, 1999; Ho & Brynat, 1997; Shu, Anderson, & Wu, 2000). Phonological awareness acquisition in bilingual children is seldom reported, yet a few studies report bilingual advantage for 5-year-old children that disappears by 6 years of age, at start of reading instruction (Bruck & Genesee, 1995; Campbell & Sais, 1995; Yelland, Pollard & Mercuri, 1993). Certain other studies however report only limited evidence for

bilingual advantage on some tasks (Bialystok, Majumder, & Martin, 2003). An important factor to consider in cross-linguistic studies on phonological awareness is the relation between the two languages, which might influence children's access to phonological awareness (Bruck & Genesee, 1995). Literacy achievement in children is related to levels of cognitive development, and is reported to differ between monolinguals and bilinguals. Geva and Siegel (2000) reported an interaction of cognitive factors like working memory, and orthography in written Hebrew, thus reflecting the limits on cognitive development generalization on reading outcomes by demonstrating contribution of the written language i.e., orthography.

Second reason to assume that bilingualism could alter the course of literacy acquisition is the possibility that skills can transfer to a similar domain in the other language. Many studies have shown positive transfer of literacy skills across languages (Geva & Seigel, 2000; Geva, Wada-Woolley & Shany, 1997; Oller & Eilers, 2002). Phonological awareness skills, for example transfers and even relates to reading in the other language, though the extent of transfer depends on the similarity between the two languages and writing system. Majority of the evidences come from alphabetic writing system, which shows positive transfer of phonological skills in bilinguals across languages (Geva & Siegel, 2000; Gholamain & Geva, 1999; Wada-Woolley & Geva, 2000). Studies report phonological awareness correlations between English and Spanish (Durgunoğlu, 1988; Durgunoğlu, Nagy, & Hancin-Bhatt, 1993; Lindsey, Manis, & Bailey, 2003) or French (Comeau, Cormier, Grandmaison, & Lacroix, 1999) for bilingual children and significant influences between phonological awareness in one of these languages and word recognition in the other.

Few biliteracy studies have also demonstrated transfer of skills across language and writing system, especially when one of the languages is not based on phonological representations. For example, Huang and Hanley (1994) found significant correlations between phonological awareness skills in the two languages for Chinese-English bilinguals from Taiwan and Hong Kong, even though phonics instruction for reading was available only to children in Taiwan. However, phonological awareness skills did not correlate with reading between two languages. Similar findings were reported by Luk (2003) in a group of Chinese-English bilingual children. In a study on Cantonese-English bilingual children though, reported significant correlation between Chinese rhyme detection and English phonological and reading measures (Gottardo, Yan, Seigel, & Wade-Woolley, 2001). However, only rhyme awareness was used a measure of phonological awareness in this study thus limiting the scope of findings from the study. Another cross-linguistic study carried out in English-Hebrew bilingual children from Grade 1 to Grade 5, showed that age predicted performance for real and nonword reading in English but not in Hebrew (Geva, & Seigel, 2000). With improvement in basic reading skills, only little improvement was seen in Hebrew language in

contrast to steady increase in English reading. Similar findings were reported in a group of Persian-English bilinguals (Gholamain & Geva, 1999). These observations therefore reflect that differences in orthographic transparency influence the reading progress in two languages. A recent study by Bialystok, Luk and Kwan (2005) compared four groups of children in first grade on early literacy tasks. Three of the groups were bilingual with languages and writing systems of different similarity relation, for example Spanish-English (similar in structure and uses alphabetic writing in a Roman script), Hebrew-English (different languages but written alphabetically using different scripts), and Chinese-English (both languages and writing systems being distinct) bilinguals. Fourth group of children were monolingual English speakers. All subjects performed on decoding and phonological awareness tasks, bilingual subjects completed the task in two languages. Results showed a general increment for reading abilities in all bilingual children but a larger advantage for children learning two alphabetic systems. Thus, the transfer of literacy skills was observed for languages that shared the writing system.

Predictors of literacy development in monolingual and bilingual children: Following are a few predictors of reading acquisition in children across different orthographies

- *Letter knowledge:* refers to the ability of an individual to correctly identify the letters or syllabaries in a given orthography. These skills have been highly predictive of reading acquisition in children exposed to single or two languages (Muter & Diethelm, 2001).
- *Phonological awareness:* an important predictor of reading acquisition is the ability of the child to manipulate the sounds of a given language. Phonological awareness correlates with literacy skills and predicts the reading performance. Cross-linguistic comparison of phonological awareness is studied using different tasks like tapping (Liberman, Shankweiler, Fischer, & Carter (1974) and oddity tasks (Bradley & Bryant, 1983; Wimmer, Landerl, & Schneider, 1994).
- *Word and non-word reading:* the task requires the subject to decode or read aloud given text or word and/or nonword. The recognition is thus purely based on the decoding process. Decoding/reading correlates well with the reading abilities of individuals across different orthographies. However its predictive strengths have been weaker with bilingual population as reported by few studies in literature (Frederickson & Frith, 1998).
- *Oral language proficiency:* it is yet another aspect which correlates well with the reading achievement in children (Chard, 2006).

Alphasyllabary as a distinct script was identified only recently (Daniels, 2000; Salomon, 2000). Salomon (2000) enumerated the defining characteristics of the alphasyllabic script as follows: (1) the

syllable – the physical graphic unit – is usually of V, CV, CCV, etc. (2) The consonantal grapheme in its unmarked form is understood to have an automatic or inherent vowel, (3) Vowels other than the inherent one are indicated by the addition of an extra marker, and (4) Vowels that do not follow a consonant (e.g., in the word initial position) are represented by independent graphemes. The term ‘alphasyllabary’, therefore, represents the shared features of both alphabetic as well as syllabic scripts. South Asian scripts as Brahmi and its descendants belong to this particular writing system. Thus, alphasyllabaries present a special case owing to their adherence with alphabetic and syllabic principles. Additionally, as evident from a mere review of the literature, this has been one of the least explored orthographies of the world. These factors, therefore, call for adequate research attention to the reading processes in alphasyllabaries.

Indian Context

Being a multilingual country, India has a great many languages. A recent survey has identified a total of 325 languages and dialects in India. Of all these languages, 22 are at present scheduled in the Indian constitution, together spoken by the great majority of the population (Vijayanunni, 1999). Even though most Indian states have a major language, none of them are monolingual. There are about 25 scripts. India’s education policy follows a ‘*Three Language Formula*’ wherein all school-going children learn first, second and third languages by the time they complete secondary school. The first language or medium of instruction is the mother tongue/regional standard language, which must be used at the primary school stage (Grades 1-5). The second and third languages are introduced in secondary school (Grades 6-10) and include Modern Indian Language or Sanskrit for Hindi speaking children, Hindi for non-Hindi speaking children and English. Thus, biliteracy, although being a prevailing issue in India, has not received adequate research attention.

Literacy instructions in alphasyllabary follow akshara (Bright, 2000) learning using akshara recitation and simultaneous copy-writing. Traditionally akshara recitation given in a singsong manner coupled with writing practice has been an indigenous teaching method for beginning readers (Dharampal, 1983). Therefore, akshara learning is first completed before moving into reading.

Malayalam is one among the four Dravidian languages spoken in southern India. Malayalam language is spoken by more than thirty million people in Kerala, the south-western state of India. Malayalam writing system is derived from Brahmi script containing sixteen vowels and thirty-six consonants. Malayalam script primarily consists of two types of characters, svaram (both independent vowels and vowel diacritic characters) and vyanjanam (consonant characters). The svaram characters are used only when the vowel occurs initially in a syllable, as in the initial syllables in the words ‘Ak’ /ara/ (room) and ‘Bd’ /a:na/ (elephant), otherwise when the syllable begins with a consonant, the vyanjanam

character indicates the consonant-vowel sequence. The vyanjanam character by itself has the value of a syllable onset followed by the vowel *a*. When a syllable is followed by a vowel other than *a*, the vowel is indicated by a diacritic on the letter, rather than the full svaram character (for example, ‘പ’ /pa/, ‘പി’ /pi/ and ‘പു’ /pu/). Thus vyanjanam could be followed either by a vowel (as shown above), or by another consonant forming a cluster. Like vowels, certain consonants could be represented with diacritic markers (e.g. റ് [v] + യ് [y] + അ [a] = റ്യ [vya]). Further, the position of the consonantal diacritic marker could be either before (e.g., ത് [t] + ര് [r] + അ [a] = ത്ര [tra]) or after the consonantal symbol (e.g., as in റ്യ [vya]). The consonant-consonant cluster could also be represented using either vertical conjuncts (e.g., സ് [s] + ത് [t] + അ [a] = സ്ത [sta]) or horizontal conjuncts (e.g., ജ് [j] + ന് [n] + അ [a] = ജ്ഞ [jna]).

Though many crosslinguistic comparisons of languages are currently being taken up comparing many alphabetic languages with non alphabetic languages, concurrent development of two languages in children exposed to two formal languages in school setting has not been explored to lesser extent. There is a dearth of such studies in Indian languages. Comparison of Indian languages like Malayalam which are alphasyllabary with alphabetic language like English would provide essential information on the development of reading across two different orthographies. These two languages differ from each other on their phonological and orthographic characteristics.

The present study thus aimed at comparing the reading acquisition pattern of two distinct orthographies namely English and Malayalam in school setting by Malayalam speaking children.

CHAPTER III

METHOD

Present study aimed at investigating reading acquisition in children learning to read Malayalam and English scripts in parallel, with specific objectives of exploring and comparing the development of reading, phonological awareness and orthographic knowledge skills in the two languages of children from Grades I to VII.

The participants taken for this study were students of Grade I to Grade VII from schools where medium of instruction was English. The method followed for teaching English in the initial Grades was mostly a wholistic approach in some respect. The children were initially taught rhymes and the sounds represented by various alphabets along with teaching alphabet reading and writing. Say for example the letter /b/ was taught to represent sound /b/ rather than only focusing on the letter name. Teaching of Malayalam on the other hand followed traditional syllabic approach (letter type teaching) wherein children begin to trace primary vowels and consonants along with naming and memorizing them.

Subjects

A total of 210 children participated in the study (30 children in each Grade from Grade 1 to Grade 7). All the children were enrolled in English medium schools from grade 1 and there was no change in the medium of instruction. Subjects for the study were taken from two leading schools in Calicut district in Kerala. Both the schools strictly insisted on using English as a medium of communication in the school ambience. Equal weightage was given for English and Malayalam in the academic curriculum. The participants ranged in age from 6 years to 14 years. The demographic details of the participants are provided in table 1 below.

Table 1: Demographic data of the participants across grades

Grades	Mean Age (in years)	Number of males	Number of females
1	7	14	16
2	8	14	16
3	9	14	16

4	10	14	16
5	11	15	15
6	12	16	14
7	13	12	18

All subjects were initially screened for possible history of neurological and academic problems from an interview with teachers as well as parents. The subjects were also matched for socio economic status and parents' educational qualification using NIMH socioeconomic status scale (Venkatesan, 2009).

Participants were recruited based on following given criteria

1. Students should not have changed the school since beginning of their schooling.
2. Their medium of instruction should be English.
2. Students should have had formal exposure to only English and Malayalam orthographies.
3. Students should not have any significant medical/family history suggestive of any communication disorder.
4. Students should not have any complaints of physical, sensory or psychological problems.
5. All children who have earned a pass in all their previous Grades were only taken up for the study.

Study Phases

Current study was carried out in three phases namely,

Phase I: Stimulus preparation

Phase II: Data collection

Phase III: Data Analysis

Phase I: *Stimulus preparation*

Stimulus preparation for examination of reading, phonological awareness and orthographic knowledge skills was carried out using students' school books and reading materials and by compiling several tests and subsections from various standardized tests.

The stimulus set was divided into three main sections namely, Phonological awareness, Reading skills and Letter/Akshara knowledge.

Stimulus was prepared upon referring several available resources. The stimulus for phonological awareness section in Malayalam was adopted from Seetha (2002) and Ponnunani's (2002) material with necessary modifications to match the objectives of the study. For the section on reading stimuli was prepared by enlisting words from text books of grades I till VII followed by a familiarity rating carried out by the class teachers on a five point rating scale. The words rated 3 and above for familiarity by two teachers from each grade were taken up as the stimulus of word reading section in English and Malayalam languages for the respective grades. The English non words for the Grades were taken from sources as "Graded non word reading test (Snowling, Stothard & McLean, 1996)" and "Children's Test of Nonword Repetition (Gathercole, Willis, Baddeley & Emslie, 1994) and prepared from words (by transposing vowels and consonants without violating the phonotactic rules of the language) and were subsequently checked for pronunciation. English word list generated was checked by a linguist for the regularity and irregularity feature. Word list in Malayalam also was prepared using respective text books of each grade and the non words were prepared by transposing syllables, substituting syllables and omitting syllables in words. All non words followed the phonotactic rules in Malayalam language. The orthographic knowledge section comprised of letter knowledge in English and akshara knowledge in Malayalam. In the section of Letter Knowledge, stimuli for English letter recognition and recall were adopted from Test of Early Reading Skill (Loomba, 1995). For Malayalam akshara knowledge section, stimuli were prepared for akshara recognition by selecting and compiling different akshara types in Malayalam including Consonants, Vowels, Consonant with Inherent Vowel, CC cluster with consonant ligature, C with vowel ligature and CCC with inherent vowel and akshara recall by hierarchically arranging the letter combinations in the order as given in their text books from Grade I to Grade III which comprised of Vowels, Consonants with Inherent Vowel (CwIV), CV akshara with Ligature (CVwL), Chillaksharam, Consonant Ligatures (CCwIV), Consonant Conjuncts (Vertical), Consonant Conjuncts (Horizontal) and Consonant Clusters (CCCV).

Recognition task required the participants to identify a minimum of one combination under the various variants of akshara combinations listed above. In recall task all the combinations under the above mentioned variants were evaluated. For each task section, five practice trials were provided to familiarize the participants with the task on which the investigator gave them assistance if needed to perform the task followed by the test stimulus. Given below is the overview of the test stimuli and tasks used in the study:

I. Phonological awareness: Phonological awareness refers to the individual's ability to manipulate the sounds of a language and also his/her basic understanding of the phonological structure of the language (Trieman, 1991). It comprises of numerous tasks from simple to complex level. Simple tasks include rhyme recognition, alliteration and blending syllables. It is known that phonological awareness skills prepare children well for learning orthographic link between words, once they begin formal construction of linking phonemes to graphemes (Maclean, Bryant & Bradley, 1987). Phonological awareness tasks namely rhyme recognition, syllable deletion, phoneme deletion and phoneme oddity were included in English and Malayalam languages.

Rhyme recognition: This task checks the ability of the participant to recognize a pair of words as rhyming or not. The task required the participant to give a "Yes" or "No" response for a pair of words given based upon whether they rhyme. The children were instructed about the pairs of words to be given and to carefully say 'yes' if the child felt the word pairs to be rhyming and a 'no' if they were not rhyming. The stimulus set contained 12 pairs of words both in English and Malayalam. Each correct response was scored '1' and incorrect response scored '0' with a total score of 12.

Syllable deletion: This task checks the ability of the participant to delete a target phoneme from a given word. The child was instructed that he/she would be given a word and that he/she needs to delete a target syllable as mentioned by the examiner and say the rest loudly. The items were balanced wherein four required initial syllable deletion, four medial and remaining four required final syllable deletion. The stimulus was prepared in similar manner for both English and Malayalam. The stimulus set consisted of 12 words. Each correct response was scored '1' and incorrect response was scored '0' having a total score of 12.

Phoneme deletion: This task checks the ability of the participant to delete a target phoneme from a given word. The child was instructed that he/she would be given a word and that he/she needs to delete a target phoneme as mentioned by the examiner and say the rest part loudly. The stimuli were matched for initial medial and final target phonemes. Stimulus in both Malayalam and English was prepared in the similar manner. The task consisted of 12 items preceded by five practice trials. Each correct response was scored '1' and incorrect response was scored '0' having a total score of 12.

Phoneme oddity: This task checks the participant's ability to identify oddity in a set of words given based upon difference in a single phoneme. The child was instructed that he/she would be given a set of five words and that he/she needs to identify the odd word from the set based on the difference in initial, medial or final phoneme and say the odd one loudly. The task contained 12 stimulus sets in addition to five

practice trials each in English and Malayalam. Each correct response was scored '1' and incorrect response was scored '0' having a total score of 12.

Reading: This task required reading of words and nonwords in Malayalam and English languages respectively. Reading task in English contained regular word reading, Irregular word reading and non word reading respectively. Regular words are words that follow regular phoneme grapheme correspondence in English language and irregular words consist of irregularly spelled letter combinations in English language. Malayalam reading task comprised of word and non word reading. Ten words were presented in each section in addition to five practice items in word and non word reading. The children were instructed to read the words aloud upon visual presentation through cards with each word written on it. If they were unable to read any of the words they were instructed to quit the word and move on to the next word. A score of '1' was awarded for every correctly read word and/or non word, and '0' was given for every incorrect response.

Orthographic Knowledge: This section assesses orthographic knowledge among students learning to read in Malayalam (akshara knowledge) and English (letter knowledge) scripts.

This section assessed recognition and recall of minimal orthographic units in English and Malayalam scripts. English letter recognition task consisted of twenty lower case and upper case letters requiring the participant to point out the letter on the card presented visually. The recall task comprised of recall of twenty upper case, lower case letters and clusters, requiring the participants to write down the letter or cluster presented verbally. Malayalam akshara knowledge task consisted of akshara recognition and recall. Akshara Recognition task was similar to English letter recognition with akshara types as vowel in primary form, chillaksharam, consonant ligatures making up a total of 20 akshara for recognition task. Akshara recall task was divided into 8 sections owing to the complex nature of the akshara in Malayalam language. The sub sections included Vowels, Consonants with Inherent Vowel (CwIV), CV akshara with Ligature (CVwL), Chillaksharam, Consonant Ligatures (CCwIV), Consonant Conjuncts (Vertical), Consonant Conjuncts (Horizontal) and Consonant Clusters (CCCV).

Phase II: Second phase of the study comprised data collection. As an initial step all schools in and around the districts of Calicut were shortlisted. These schools were then contacted through mails and also via telephones for permission to collect data from students in these schools. Only two schools permitted for the collection of data from their students and were thus selected for the study. Socio Economic Status and the parents' educational qualifications were matched for most of the students. Students who fulfilled the selection criteria participated in the study.

Prior to the commencement of data collection stimulus familiarity and complexity was tested on 2 children from each grade. Necessary changes were done in the stimulus set based on this preliminary evaluation (e.g., for phoneme oddity task in Malayalam the item /b^haji/ - /^hm/ was removed as none of the participants, even in higher Grades failed to give a correct response). The participants were presented with practice items to help them to get familiarized with the task. Data was collected individually where each participant requiring approximately 30-40 minutes for completion of the entire task set. Data collection was carried out in a relatively quiet room within the school premises. The participants were required to carefully listen to the instructions before performing the task. Appropriate reinforcements were provided after the completion of the given task. The samples were audio recorded on Dell Inspiron laptop. The scores were also documented online on a scoring sheet as the task was performed by the participant. Below given Table 2 provides the test measures with section scores used in the study.

Table 2: Test measures

Task	Malayalam	Maximum Score	English	Maximum Score
Phonological awareness	Rhyme Recognition	12	Rhyme Recognition	12
	Syllable Deletion	12	Syllable Deletion	12
	Phoneme Deletion	12	Phoneme Deletion	12
	Phoneme Oddity	12	Phoneme Oddity	12
Reading	Reading Word	10	Regular Word	10
			Irregular Word	10
	Reading non-Word	10	Non-Word	20
Orthographic Knowledge	Akshara Recognition	20	Letter Recognition	40
	Akshara Recall	68	Letter Recall	60

Phase III: Data analysis was performed

Statistical Analysis

Participants' grade wise raw and percentage scores were tabulated across all subtasks in Malayalam and English languages respectively. Statistical analysis of the data was performed using SPSS software

(Statistical Package for the Social Sciences package, version 16.0) for windows. Mean (M) and standard deviation (SD) was computed for individual tasks across grades in the two languages. Parametric statistics was used to achieve the comparisons.

Chapter IV

RESULTS

Primary aim of the study was to examine reading acquisition in children exposed to two distinct orthographies namely Malayalam and English in formal educational setting. A total of 210 participants from Grade I through VII participated in the study. The participants performed on three tasks namely Phonological Awareness, Reading words and nonwords, and orthographic knowledge (letter/*akshara* recognition and recall) in Malayalam and English languages. Statistical analysis was carried out using Software Program for Statistical Sciences (SPSS) version 16 for windows.

Table 3: Percent mean scores (and standard deviations) of various tasks across grades

Task	Language	Grades							
		I (N=30)	II (N=30)	III (N=30)	IV (N=30)	V (N=30)	VI (N=30)	VII (N=30)	Total
Phonological Awareness	<i>English</i>	46.18 (8.40)	76.59 (6.08)	89.09 (3.03)	95.14 (3.16)	97.71 (1.67)	98.54 (2.19)	99.37 (1.24)	86.09 (18.45)
	<i>Malayalam</i>	55.48 (3.61)	62.71 (3.64)	65.48 (3.36)	76.87 (3.52)	80.21 (3.13)	81.59 (3.24)	86.80 (2.64)	72.74 (11.21)
Word reading	<i>English</i>	89.33 (11.50)	89.17 (8.21)	87.17 (9.71)	91.33 (5.71)	92.83 (5.52)	98.00 (4.27)	98.00 (4.27)	92.26 (8.40)
	<i>Malayalam</i>	93.67 (16.71)	99.00 (3.05)	99.00 (3.05)	98.67 (4.34)	100	100	100	98.62 (6.95)
Nonword reading	<i>English</i>	87.83 (9.25)	89.33 (7.16)	94.50 (5.62)	87.33 (6.12)	92.67 (5.83)	98.33 (3.03)	97.67 (4.30)	92.52 (7.40)
	<i>Malayalam</i>	93.33 (8.02)	89.67 (10.33)	96.33 (6.15)	99.00 (3.05)	97.00 (5.95)	100	100	96.48 (6.91)
Letter/ <i>akshara</i> recognition	<i>English</i>	98.50 (2.90)	99.42 (1.93)	100	100	100	100	100	99.70 (1.41)
	<i>Malayalam</i>	99.67 (1.82)	100	100	100	100	100	100	99.95 (0.69)
Letter/ <i>akshara</i> recall	<i>English</i>	80.88 (3.63)	88.50 (3.62)	92.50 (1.13)	96.72 (2.03)	99.05 (1.62)	99.94 (0.30)	100	93.94 (7.00)
	<i>Malayalam</i>	53.77 (5.68)	83.48 (5.86)	97.45 (1.77)	99.51 (0.89)	99.90 (0.37)	100	100	90.58 (16.36)

Table 1 presents the mean scores of children from Grades I to VII on phonological awareness, reading words and nonwords, and orthographic knowledge tasks respectively in English and Malayalam languages. A series of repeated measures Analysis of Variance was performed on 210 children. Language (Malayalam, English) was taken as within-subject factor and grade (Grades I to VII) was taken as

between-subject factor with phonological awareness, reading words and nonwords and orthographic knowledge (orthographic recognition and orthographic recall) as dependent variables. The analysis revealed a significant main effect of language for phonological awareness, $F(1,203) = 146, p < .001$; for word reading, $F(1, 203) = 85.01, p < .001$; for nonword reading, $F(1, 203) = 51.24, p < .001$; for letter/*akshara* recognition, $F(1, 203) = 9.51, p < .05$ and for letter/*akshara* recall, $F(1, 203) = 181.30, p < .001$. Thus language showed a differential effect on various test measures. For example, participants scored higher for phonological awareness task in English language. For word and nonword reading task however, participants' scores were higher in Malayalam language. And for orthographic knowledge measure, participants scored higher on orthographic recognition in Malayalam language, but poorer on orthographic recall section. The analysis also revealed a main effect of grade for all tasks as phonological awareness, $F(1, 203) = 766.37, p < .001$; for word reading, $F(1, 203) = 9.58, p < .001$; for nonword reading, $F(1, 203) = 19.67, p < .001$; for letter/*akshara* recognition, $F(1, 203) = 4.69, p < .001$ and for letter/*akshara* recall, $F(1, 203) = 1.03, p < .001$, hence suggesting the maturational effect on task performance. There was also a significant interaction observed between language and grade for all measures: for phonological awareness, $F(6, 203) = 131.36, p < .001$; for word reading, $F(6, 203) = 4.29, p < .001$; for nonword reading, $F(6, 203) = 6.83, p < .001$; for letter/*akshara* recognition, $F(6, 203) = 4.58, p < .001$ and for letter/*akshara* recall $F(6, 203) = 273.83, p < .001$, which revealed that within each of the grades there were differences in the languages learnt Malayalam and English. Figures 1, 2, 3, 4 and 5 show the interaction effects.

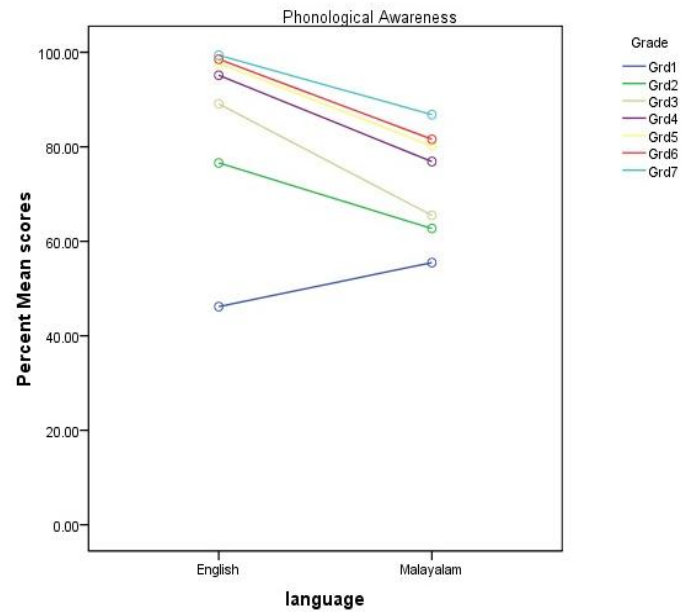


Figure 1: Interaction of language and grade on phonological awareness task

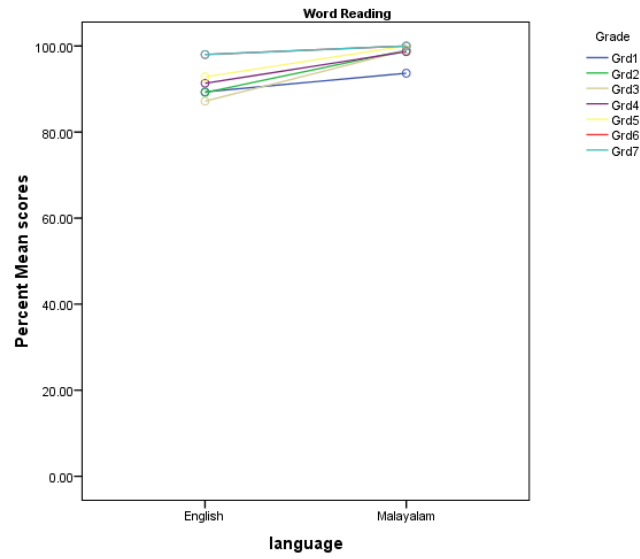


Figure 2: Interaction of language and grade on word reading task

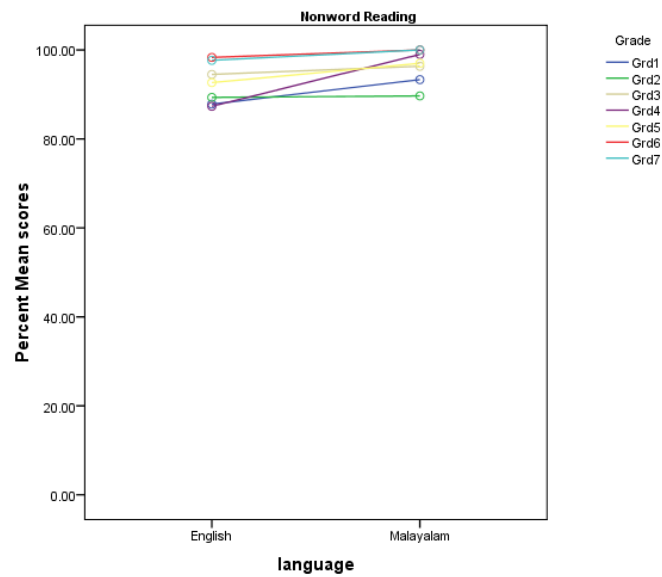


Figure 3: Interaction of language and grade on nonword reading task

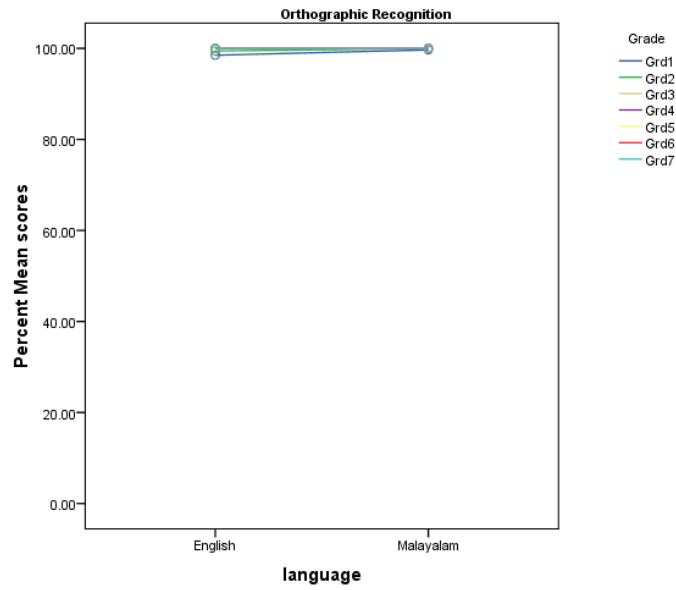


Figure 4: Interaction of language and grade on orthographic recognition task

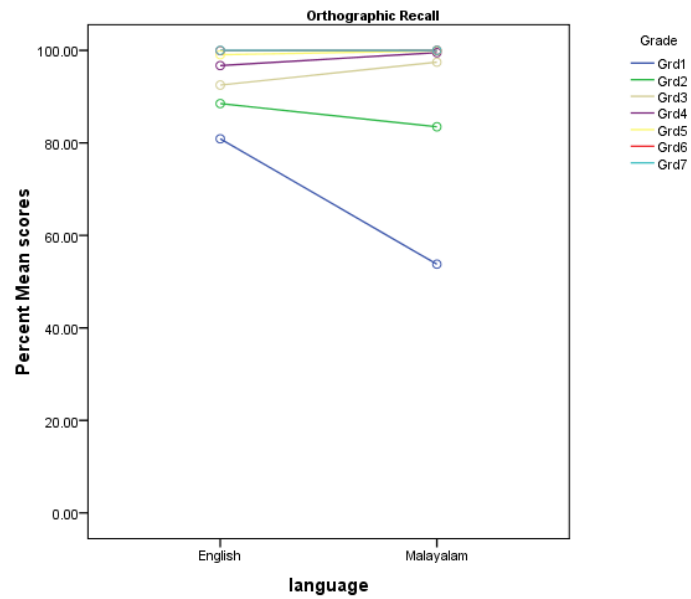


Figure 5: Interaction of language and grade on orthographic recall task

Phonological Awareness

Results from Table 1 indicate that phonological awareness skill acquisition continued till Grade VII. However, the participants' scores were found to be better in English than Malayalam language (except for students of grade I). Table 2 given below, provides split up of participants' scores on individual measures of phonological awareness. It was observed that, rhyme recognition skill was mastered by grade III and syllable deletion skill was mastered by grade IV in both English and Malayalam languages. However, phoneme deletion and phoneme oddity skills continued to progress till grades VI and VII. One way analysis of variance showed significant effect for all measures of phonological awareness suggesting maturation of phonological awareness skills as students moved to higher grades. Thus a significant effect of grade was observed on rhyme recognition in English language $F(6, 209) = 19.94, p < .001$, and in Malayalam language $F(6, 209) = 9.52, p < .001$; on syllable deletion in English $F(6, 209) = 172.21, p < .001$, and in Malayalam $F(6, 209) = 45.72, p < .001$; on phoneme deletion in English $F(6, 209) = 607.35, p < .001$, and in Malayalam $F(6, 209) = 211.13, p < .001$ and on phoneme oddity measure in English $F(6, 209) = 381.48, p < .001$ and in Malayalam language $F(6, 209) = 113.96, p < .001$. Figures 6 and 7 represent students' performance on phonological awareness subtasks in two languages across grades. Whereas students showed parallel maturation for rhyme recognition and syllable deletion in English and Malayalam languages, development of phoneme deletion and phoneme oddity tasks differed substantially with students scoring better in English than Malayalam language across grades.

Table 4: Percent Mean scores (and Standard Deviations) of phonological awareness across grades

Task	Language	Grades							
		I	II	III	IV	V	VI	VII	Total
<i>Rhyme Recognition</i>	English	90.81 (9.63)	96.65 (5.64)	99.72 (1.53)	100	100	100	100	98.17 (5.29)
	Malayalam	95.54 (7.51)	99.44 (2.13)	100	100	100	100	100	99.28 (3.29)
<i>Syllable Deletion</i>	English	60.27 (13.27)	94.15 (7.64)	96.93 (5.15)	100	100	100	100	93.05 (93.05)
	Malayalam	82.19 (10.18)	87.46 (9.96)	92.18 (6.91)	100	100	100	100	94.55 (94.55)
<i>Phoneme Deletion</i>	English	25.00 (7.23)	82.47 (11.22)	95.25 (5.24)	97.76 (4.36)	98.32 (3.42)	99.16 (3.36)	99.44 (3.05)	85.34 (25.99)

	Malayalam	41.95 (10.45)	58.88 (6.92)	61.94 (9.47)	93.03 (8.22)	93.04 (9.81)	95.83 (8.68)	97.20 (4.58)	77.41 (22.57)
<i>Phoneme Oddity</i>	English	16.11 (12.16)	33.03 (10.81)	64.72 (8.67)	82.21 (11.51)	91.63 (6.93)	95.25 (5.68)	97.48 (4.98)	68.63 (31.36)
	Malayalam	2.50 (6.24)	5.55 (6.32)	7.22 (8.40)	14.44 (9.52)	25.27 (8.88)	29.44 (6.83)	46.94 (10.37)	18.76 (16.94)

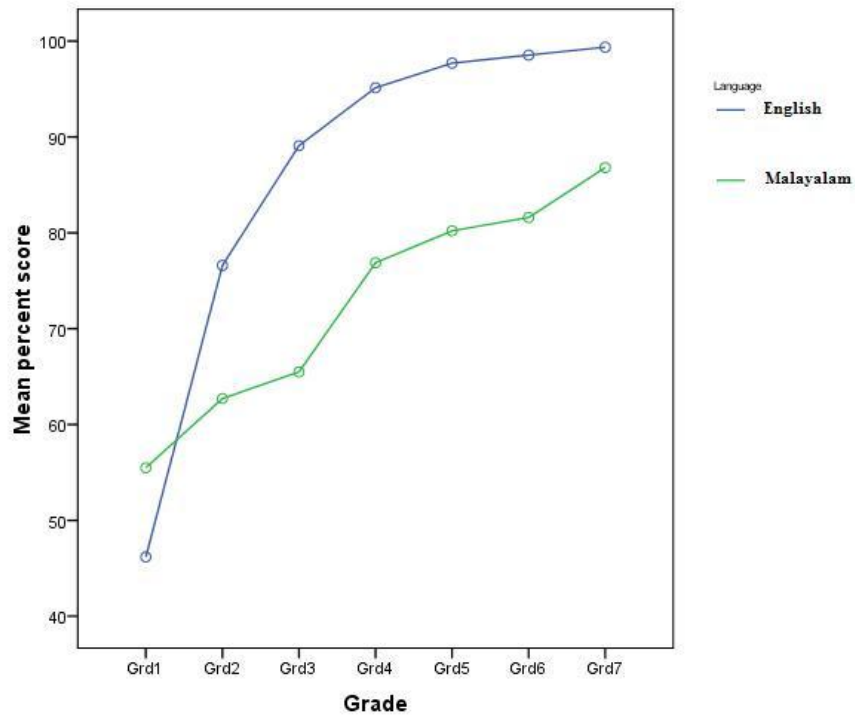


Figure 6: Development of phonological awareness across grades

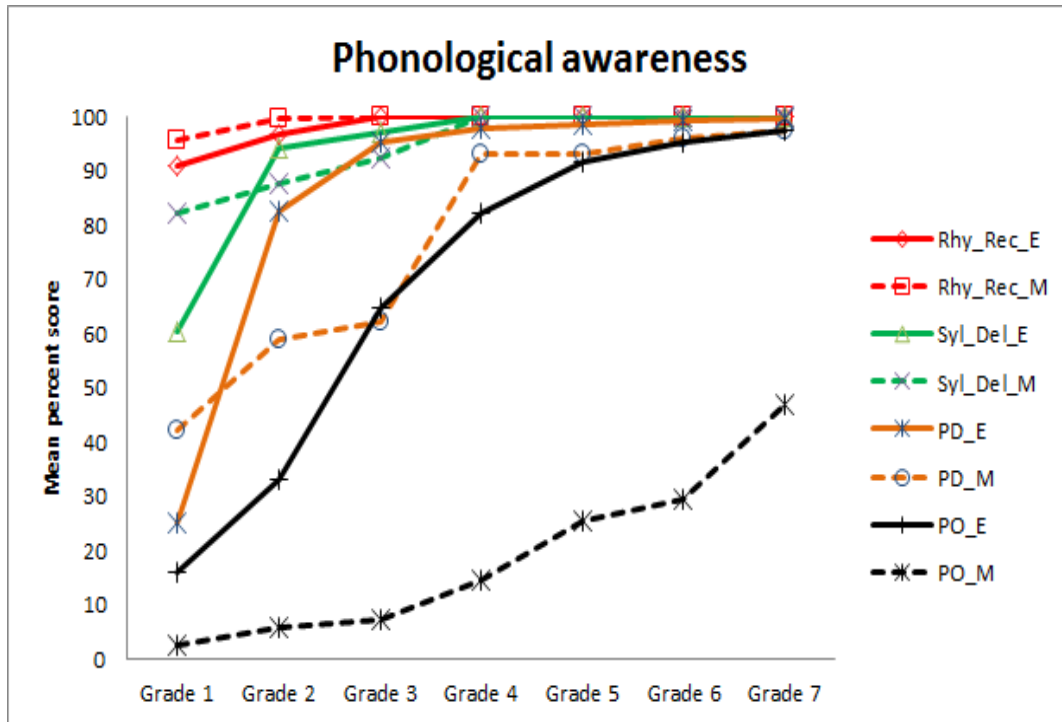


Figure 7: Maturation of phonological awareness subtests in English and Malayalam language

Word and nonword reading

Table 1 shows that students' performance on reading words and nonwords improved with grade. This progress in reading words and nonwords however was more obvious in Malayalam than in English, with students' scores reaching maturation by grades V and VI respectively. Table 3 given below, provides the mean scores (percent) on subtasks of word and nonword reading across grades. Word reading in English comprised of two sections, namely reading regular and irregular words. Participants' performance was comparable on regular and irregular word reading in English language. Paired t-test comparing mean percent scores on regular and irregular word reading in English showed that the difference was not significant ($t = -0.179$, $p = 0.86$). One way ANOVA results indicated significant effect of grade on regular word reading in English $F(6, 209) = 5.79$, $p < .001$; on irregular word reading in English $F(6, 209) = 10.09$, $p < .001$; on word reading in Malayalam $F(6, 209) = 3.37$, $p < .05$; on nonword reading in English $F(6, 209) = 16.11$, $p < .001$ and on nonword reading in Malayalam $F(6, 209) = 12.10$, $p < .001$. Paired t-tests were performed to compare the performance on word and nonword reading in both languages. Results showed significant difference in word and nonword performance scores for Malayalam ($t = 3.23$,

$p = .001$) but not for English language ($t = -.47$, $p = .640$). Figures 8 and 9, show development of word and nonword reading scores in the two languages.

Table 5: Percent mean scores (and Standard Deviations) of Reading words and nonwords across grades

Task	Sections	Grades							
		I	II	III	IV	V	VI	VII	Total
Word	<i>Regular English</i>	89.33 (12.57)	79.63 (32.71)	83.33 (13.22)	88.66 (8.99)	93.96 (22.96)	99.33 (3.65)	99.00 (3.05)	90.46 (18.17)
	<i>Irregular English</i>	89.33 (12.29)	75.60 (25.33)	91.00 (8.03)	94.00 (5.63)	90.66 (11.72)	97.00 (5.95)	97.00 (7.02)	90.65 (14.15)
	<i>Malayalam</i>	93.66 (16.71)	99.00 (3.05)	99.00 (3.05)	98.66 (4.34)	100	100	100	98.62 (6.95)
Nonword	<i>English</i>	87.83 (9.25)	89.33 (7.16)	94.50 (5.62)	87.33 (6.12)	92.66 (5.83)	98.33 (3.03)	97.66 (4.30)	92.52 (7.40)
	<i>Malayalam</i>	93.33 (8.02)	89.66 (10.33)	96.33 (6.15)	99.00 (3.05)	97.00 (5.95)	100	100	96.47 (6.91)

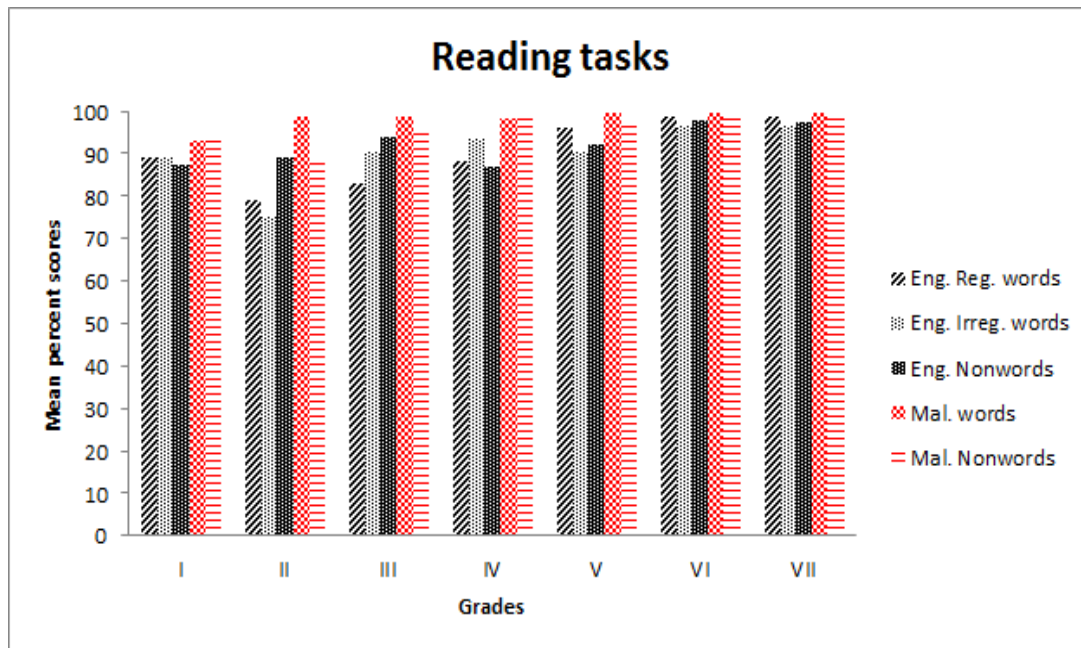


Figure 8: Maturation of word and nonword reading in English (regular and irregular) and Malayalam languages

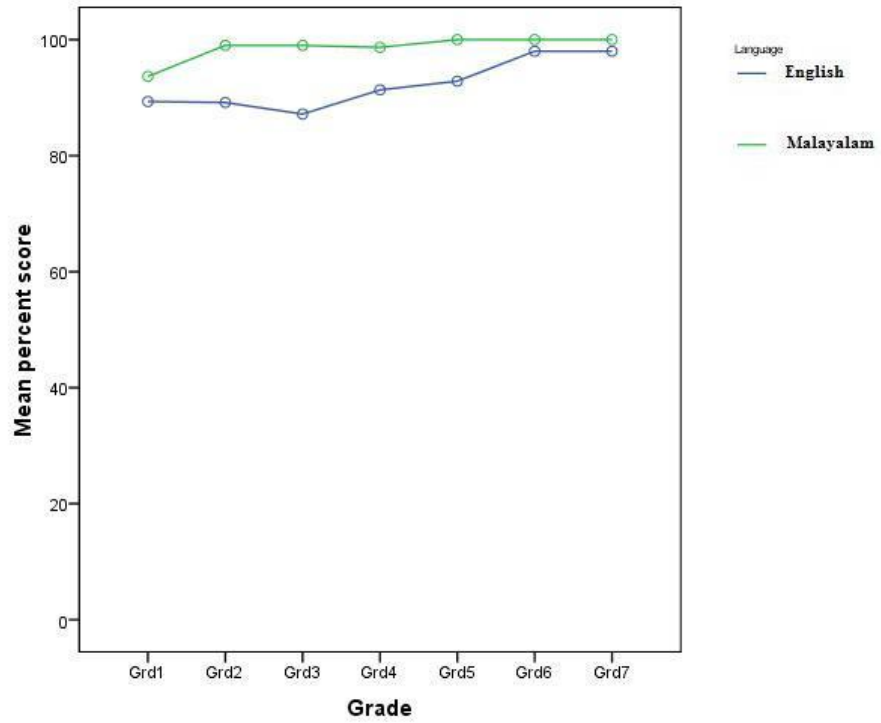


Figure 9: Interaction of grade and language on true word reading performance

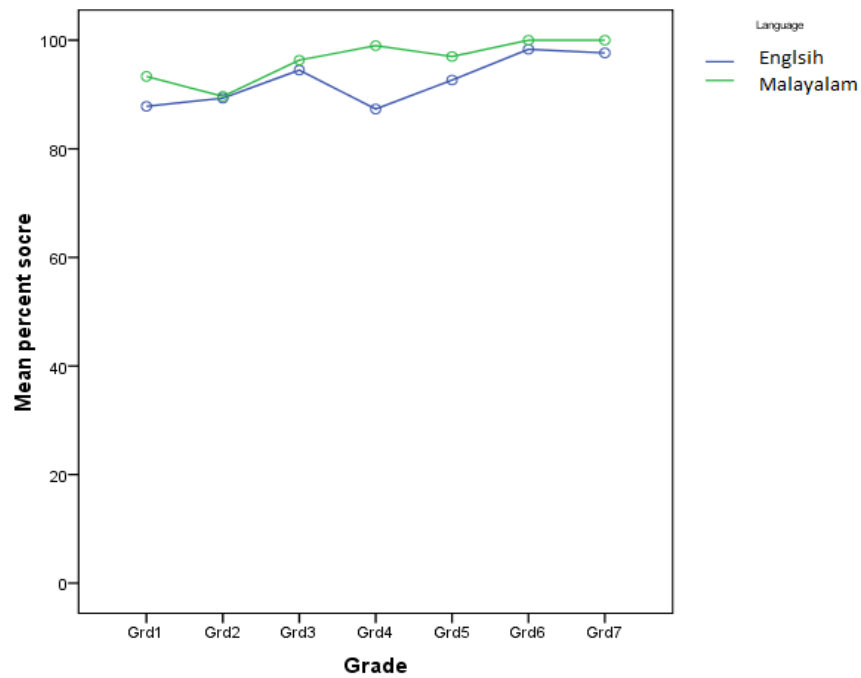


Figure 10: Interaction of grade and language on non-word reading performance

Orthographic Knowledge

Table 1 displays the orthographic knowledge development in the two languages across grades. As apparent from the table, letter/*akshara* recognition development preceded letter/*akshara* recall skills with the former reaching maturation by grade III and II respectively in English and Malayalam languages. Table 4 given below provides orthographic knowledge scores for every letter or *akshara* type. Thus, letter recognition (upper case, lower case and letter) in English was mastered by III grade. *Akshara* recognition too was mastered early, around grade II. Letter/*akshara* recall however showed varying points of maturation. While upper and lower case letters matured by III grade, clusters were matured only by grade VII. Further *akshara* recall in Malayalam too showed interesting trends. Vowel in primary form (V) matured by grade V, consonants with inherent vowel (CwIV) by grade VI, consonant with vowel diacritics or ligatures (CVwL) by grade III itself, chillaksharam i.e., consonant without inherent vowel (Ch) matured by grade IV, consonant cluster with inherent vowel (CCwIV) matured by grade VI, vertical consonant conjunct (Cconj-vertical) by grade IV, horizontal consonant conjunct (Cconj-horizontal) by grade VI and consonant clusters (CCCV) by grade V. Average of *akshara* recall showed maturation by grade VI. One way ANOVA findings showed significant effect of grade on orthographic recognition section like upper case recognition in English $F(6, 209) = 6.46, p < .001$; on lower case recognition in English $F(6, 209) = 3.14, p < .05$, and on letter recognition in English $F(6, 209) = 5.66, p < .001$. Effect of grade on *akshara* recognition in Malayalam, however was not found to be significant $F(6, 209) = 1.00, p = .43$. For orthographic recall section in English language, effect of grade was found to be significant on upper case recall $F(6, 209) = 7.89, p < .001$; lower case recall $F(6, 209) = 5.42, p < .001$; cluster recall $F(6, 209) = 424.59, p < .001$ and overall letter recall $F(6, 209) = 314.22, p < .001$. *Akshara* recall scores in Malayalam too showed significant effect of grade on recall of vowels in primary form $F(6, 209) = 6.76, p < .001$; on recall of consonant with inherent vowel $F(6, 209) = 95.71, p < .001$; on recall of consonant with vowel diacritics or ligatures $F(6, 209) = 8.53, p < .001$; on recall of chillaksharam i.e., consonants without inherent vowel, $F(6,209) = 7.13, p < .001$; on recall of consonant cluster with inherent vowel $F(6, 209) = 95.71, p < .001$; on recall of vertical consonant conjuncts $F(6, 209) = 575.16, p < .001$; on recall of horizontal consonant conjuncts $F(6, 209) = 1.06, p < .001$ and on recall of consonant cluster $F(6, 209) = 345.60, p < .001$. Figures, 10 and 11 display maturation of orthographic knowledge skills in the two languages. As apparent, orthographic recognition scores in English and Malayalam languages reached maturation in the early grades itself. Orthographic recall scores, in particular for difficult letters/*akshara* like clusters showed gradual maturation with age.

Table 6: Percent mean scores (and standard deviations) of orthographic knowledge across grades

Task	Sections	Grades							
		I	II	III	IV	V	VI	VII	Total
Letter Recognition English	<i>Upper Case-English</i>	97.50 (4.68)	99.16 (2.65)	100	100	100	100	100	99.52 (2.19)
	<i>Lower Case-English</i>	99.33 (1.72)	99.66 (1.26)	100	100	100	100	100	99.86 (0.83)
	<i>Letter English</i>	98.50 (2.90)	99.42 (1.93)	100	100	100	100	100	99.70 (1.40)
Akshara Recognition Malayalam	<i>Akshara Malayalam</i>	99.66 (1.82)	100	100	100	100	100	100	99.95 (0.69)
Letter Recall English	<i>Upper Case-English</i>	97.66 (4.30)	99.66 (1.26)	100	100	100	100	100	99.62 (1.85)
	<i>Lower Case-English</i>	98.17 (3.82)	98.17 (4.04)	100	100	100	100	100	99.48 (2.23)
	<i>Cluster English</i>	46.83 (6.23)	67.66 (9.26)	77.50 (3.41)	90.17 (6.08)	97.17 (4.85)	99.83 (0.91)	100	82.74 (19.27)
	<i>Letter recall (overall)</i>	80.88 (3.63)	88.50 (3.62)	92.50 (1.14)	96.72 (2.03)	99.05 (1.62)	99.94 (0.30)	100	93.94 (7.00)
Akshara Recall Malayalam	<i>V</i>	95.24 (10.16)	91.43 (14.82)	99.52 (2.61)	99.05 (3.62)	100	100	100	97.89 (7.55)
	<i>CwIV</i>	27.50 (20.07)	47.50 (34.33)	83.33 (16.52)	98.33 (6.34)	98.33 (6.34)	100	100	79.29 (32.06)
	<i>CVwL</i>	92.59 (12.83)	98.52 (4.82)	100	100	100	100	100	98.73 (5.71)
	<i>Ch</i>	90.66 (15.52)	94.00 (13.02)	99.31 (3.71)	100	100	100	100	97.70 (8.46)
	<i>CCwIV</i>	27.50 (20.07)	47.50 (34.33)	83.33 (16.52)	98.33 (6.34)	98.33 (6.34)	100	100	79.28 (32.06)
	<i>Cconj-vertical</i>	13.85 (13.46)	69.74 (13.84)	98.46 (3.72)	100	100	100	100	83.15 (31.07)
	<i>Cconj-horizontal</i>	24.31 (5.93)	78.82 (9.59)	96.66 (3.68)	98.23 (3.50)	99.61 (1.49)	100	100	85.38 (26.37)
	<i>CCCV</i>	3.33 (13.42)	87.77 (16.34)	90.00 (15.54)	97.77 (8.46)	100	100	100	82.69 (34.89)
	<i>Akshara recall (overall)</i>	53.77 (5.68)	83.48 (5.86)	97.45 (1.76)	99.51 (0.89)	99.90 (0.37)	100	100	90.59 (16.36)

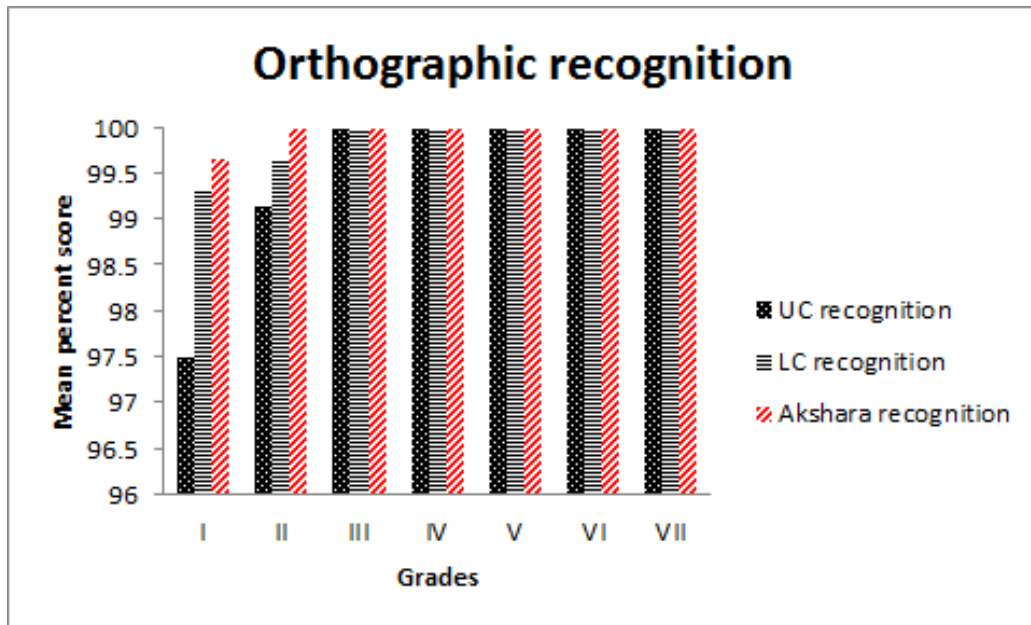


Figure 11: Maturation of orthographic recognition in English and Malayalam languages

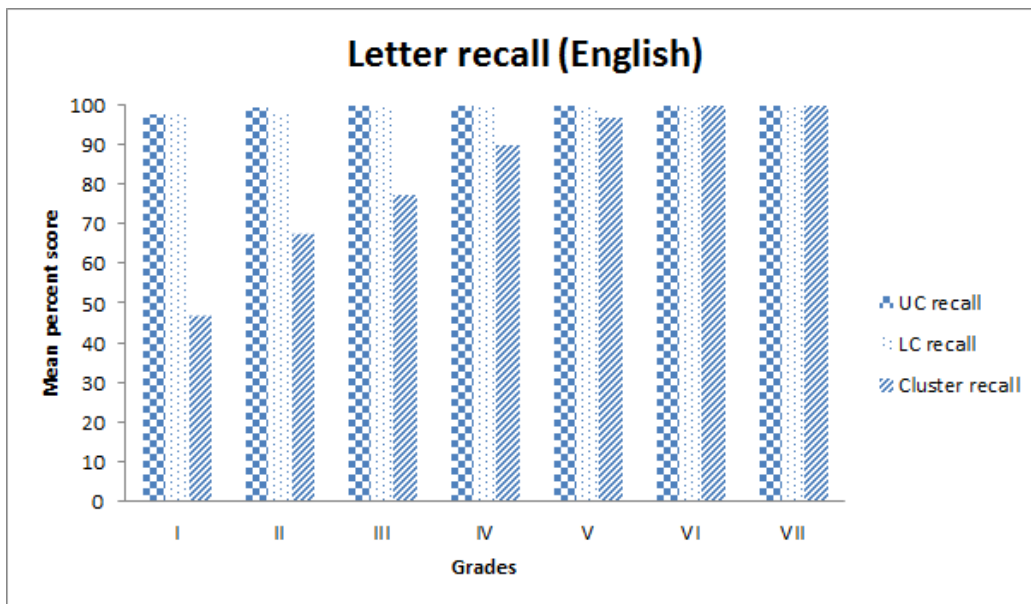


Figure 12: Maturation of letter recall in English language

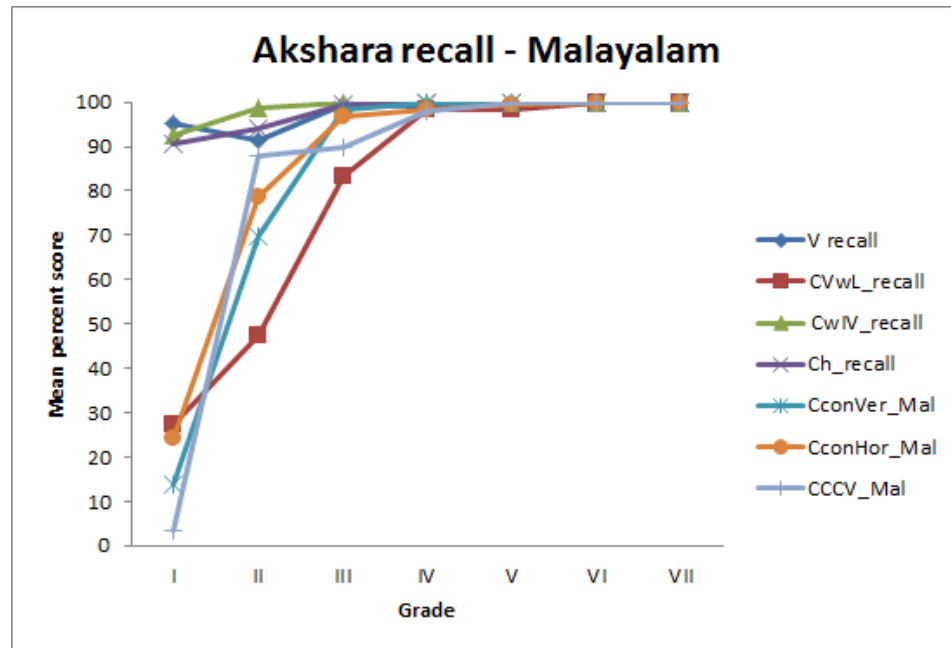


Figure 13: Maturation of akshara recall in Malayalam language

To summarize, the results of the study indicated significant main effects of language and grade across tasks. Also the interaction between language and grade was found to be significant for tasks of phonological awareness, word and nonword reading and orthographic awareness. While participants' performance on phonological awareness was better in English, performance on word and nonword reading measure was superior in Malayalam. Orthographic knowledge measure revealed superior performance in English. Syllable awareness development preceded phoneme awareness, with marked difference in phoneme awareness scores across languages. Reading words was superior to reading of nonwords. Further, reading for regular and irregular words was found to be comparable in English. Acquisition of orthographic recognition preceded recall in both languages. Interestingly, the pace of orthographic knowledge acquisition was determined by the letter/akshara complexity. For example, consonant clusters matured later compared to simple letters/akshara. Together these findings indicate that the acquisition of reading skills in Malayalam-English biliterates learning to read simultaneously in two distinct orthographies is not the same.

Chapter V

DISCUSSION

‘The writing system that a language uses affects children’s acquisition of literacy because each system is based on a different set of symbolic relations and requires different cognitive skills’ (Coulmas, 1989). While alphabetic writing employs the correspondences between phonemes and graphemes, syllabic writing like Korean uses correspondences between consonant-vowel groups (syllables) and graphemes, and character languages, such as Chinese makes use of the associations between morpheme and the character that signifies both semantic and phonological properties. As the mapping of spoken to written language units vary across writing systems, different writing systems place different demands on children learning to read. Thus, any effect of bilingualism or biliteracy on learning to read will depend on the type of writing system used in each language.

Present study therefore aimed to investigate reading acquisition in children learning to read in Malayalam and English scripts with distinct writing systems. A total of 210 children from grades I to VII (30 each) participated in the study. Participants were assessed on test measures like phonological awareness, reading words and nonwords and orthographic knowledge in each language. The obtained responses were scored and statistically analyzed to derive comparisons across grades and language. The findings of the study are discussed as follows:

Phonological awareness development

Phonological awareness skills form the basis for reading development. Although the salience of phonological awareness skills is well established in alphabetic languages (Bryant & Goswami, 1987; Liberman, Shankweiler, Liberman, Fowler, & Fischer, 1977; Morais, 1987; Perfetti, Beck, Bell, & Hughes, 1988; Wagner, Torgesen, & Rashotte, 1994), its significance in non-alphabetic languages is only beginning to be registered. Results of our study showed maturational effect on phonological awareness apparent in both languages. It’s a known fact that phonological awareness skills develop as a function of age (Bowey & Francis, 1991) and interaction with print (Bentin, Hammer & Cahan, 1991). The effect of maturation was observed for all aspects of phonological awareness like rhyme recognition, syllable deletion, phoneme deletion and phoneme oddity.

Phonological awareness tests require the ability to detect, isolate, or manipulate sub-word phonological segments. The ability to detect or make judgments on rhyme is reported to be present in children as young as three to four years of age (Chukovsky, 1963; Maclean, Bryant, & Bradley, 1987), even before they begin reading instructions. Present study results showed while rhyme recognition and syllable deletion skills reached maturation early (by grade IV), phoneme deletion and phoneme oddity skills continued to progress till grade VII. This in fact reflected difficulty at phoneme levels task. Rhyme recognition skills developed only by grade III (i.e., 7-8 yrs) in our participants in contrast to reports of Chukovsky (1963), and Maclean et al (1987). The reason for such disparate finding could be accounted for the nature of literacy training. Children trained on musical activities to improve phonological skills reportedly perform better in rhyme recognition task (Escalda, Lemos, Franca, 2011). Thus, poor performance on rhyme recognition in both Malayalam and English languages in our participant group is indicative of the nature of pre-literacy training provided in our set-up.

Phonological awareness development literature indicates that syllable awareness tasks are easier and acquired earlier than phoneme awareness tasks in young children (Dow, 1987; Fox & Routh, 1975; Liberman, Shankweiler, Fischer, & Carter, 1974). Our data showed a steep rise in phoneme deletion task scores in English language. Among the two phoneme level tasks, phoneme oddity task scores were the lowest in both languages. The difference in mean scores of participants on phoneme oddity task was quite marked (68.63 in English compared to only 18.76 in Malayalam language). Phoneme oddity task is one of the most frequently used measures of phonological awareness in young children (Bradley & Bryant, 1983; Felton & Brown, 1990; Mann, 1993; Torgesen & Bryant, 1994). This task requires the child to choose among three (or four) spoken words, the word that begins/ends with a different phoneme (i.e., odd word) than the other word (i.e., like words). This task requires skills in phonological perception in order to make phonological distinctions between the target sounds in the stimulus words. The task also appears to be a memory task. It requires participants to hold a series of words in memory and compare the initial or final segments in order to discern which one differs from the others (Catts, Wilcox, Wood-Jackson, Larrivee, & Scott, 1997). Stimulus used for phoneme oddity task in Malayalam and English languages was inconsistent however. Malayalam phoneme oddity task comprised of non-words [as the phonological awareness test in Malayalam was adopted from earlier work of Seetha (2002) and Ponnunmani (2003)] in contrast to English which used true words as stimuli. Therefore, performance discrepancy on phoneme oddity task across languages could be explained on the grounds of differences in the nature of stimuli used.

Results of our study showed significant effect of language on phonological awareness task performance with better scores in English language, effect being more evident for phoneme level tasks.

Phonological awareness skills predict and promote reading acquisition in children learning to read in English, better than age and IQ factors (Goswami & Bryant, 1990). Recent literature suggests that phonological processing is an important skill influencing learning to read in not only alphabetic languages, but also in non-alphabetic languages like Chinese (Hu & Catts, 1998) and Japanese kanji (Wydell, Patterson, & Humphreys, 1993). More recently, development of phonological awareness in Kannada, a semisyllabic language was documented to emerge slower compared to alphabetic languages (Nag, 2007). A greater sensitivity to syllable than phoneme for children in early grades was observed in Kannada alphasyllabary. Nag (2007) explained this delay in emergence of phonological sensitivity in Kannada as an influence of the orthographic domain on phonological domain, wherein syllable awareness gains importance for orthographic representation in Kannada language. Malayalam too belongs to semisyllabic writing, wherein akshara (the orthographic unit) maps to syllable in the spoken language. Hence, delay in phoneme awareness (compared to syllable awareness) acquisition in our data could be explained as a result of cognitive demands placed by orthographic to phonologic mapping.

Yet another factor possibly accounting for phonological awareness difference across languages is regarding the reading instruction methods followed in different schools. Phonics is the widely used method of teaching followed to read and decode words in English. Teaching English reading using phonics requires students to learn the connections between letter patterns and the sounds they represent. Instead, most of the Indian alphasyllabaries (including Malayalam) involve akshara learning using akshara recitation and simultaneous copywriting at a syllable level. These diverse teaching methods followed to teach reading in English and Malayalam thus entails the child to map orthography to phonology at different levels for the two languages.

Word and nonword reading

Learning to read involve deriving meaning from printed words and larger units of text. At fundamental level, reading reflects converting graphic input (letters, words, characters) to linguistic-conceptual objects (words, morphemes, and their associated concepts) (Perfetti & Dunlap, 2008). As each writing system presents its own distinctive mapping challenge, it is expected to influence the word reading performance in different languages. *Orthographic Depth Hypothesis* (ODH) is a related concept that explains the differences in cognitive demands when reading in different languages (Frost, 2005). Different orthographies could be explained on a continuum, varying in terms of degree of consistency between sound/letter, in turn affecting the pace of leaning to read. Cross-linguistic data from alphabetic writing

system reveal that, learning to read in opaque orthographies (having inconsistent sound/letter mappings) take longer than in transparent orthographies (Seymour, Aro & Erskine, 2003).

Our study finding showed a developmental effect on word and nonword reading across the grades. The word and nonword reading scores showed significant improvement with increase in age. Overall the development of word and nonword reading in Malayalam language was found to be ahead of that in English language. As reported in the reading literature, reading process necessitates the correspondence between the written and spoken units of the language. This mapping of units from written to spoken language however differs with the writing system. In alphabetic writing viz. English, letters map on to phonemes of the spoken language. In alphasyllabic writing (viz. Malayalam), the akshara map on to either a syllable or a phoneme. The pace of reading acquisition is therefore determined by the transparency of the script. This, in fact explains why reading maturation was observed to be faster in Malayalam than in English language, given the fact that Malayalam is a very transparent script and English an opaque script.

In our data, however, no difference was observed between the scores on regular and irregular word reading in English. Word reading performance was superior to nonword reading performance in both Malayalam and English languages, though the difference between word and nonword reading scores was not found to be statistically significant in English language. Studies on monolingual English readers have consistently shown *lexicality effect* (McCann & Besner, 1987; Rastle & Coltheart, 1999) wherein the word reading performance is superior to nonword reading performance; and *regularity effect* (Coltheart & Rastle, 1994) wherein the regular words are better read than the irregular words. Lexicality effect although observed in our data didn't reach statistically significant value. Regularity effect was not observed in our participant group for English reading tasks. The possible reason for such discrepancy would be that the word list prepared and used in our study was not adequately matched for length or frequency (as the selection of words was done from school grade books). Hence lexicality and regularity effects could not be explained in our data.

Orthographic knowledge development

Orthographic knowledge refers to the understanding that the sounds in a language are represented by written or printed symbols (<http://www.ldonline.org/glossary>). Orthographic knowledge forms the basic skill for learning to read in all languages. English and Malayalam writing differ not only with respect to orthographic depth aspect but also on the size of orthographic register and the complexity of written

script. Malayalam script contains 52 symbols including 16 vowels and 36 consonants that together form 576 syllabic combinations and additional diacritic characters. In contrast, English alphabets contain only 26 letters. Also the script used in Malayalam writing i.e., a descendent of the Brahmi script is visuo-spatially more complex than the linear alphabetic script English. These differences thus account for the processing demands operating at different levels while reading English and Malayalam scripts.

In alphabetic scripts, letter knowledge predicts reading success (Adams, 1990; Bowey, 2005; Seymour, 2005). Likewise in alphasyllabaries, akshara knowledge is reportedly related to reading performance and training (Nag-Arulmani, 2003). Provided the fact that alphabetic and alphasyllabic writing are essentially different in nature, it is expected that letter and akshara knowledge will differ. Letter knowledge has been explained as knowledge of name and /or sound (Seymour et al., 2003). In Malayalam (and most of the Indian alphasyllabaries) akshara name and akshara sound is same; hence akshara knowledge requires the mastery of a single akshara name-sound (except for *anuswara* and *visarga*). Akshara containing post-consonantal vowels like (ക /ka/ കാ /ka:/കി /ki/ കീ /ki:/ കു /ku/ കൂ /ku:/ കൈ /kai/ കെ /ke/ കൊ /ko/ കോ /kO/ കൗ /kou/ കം /kam/) and consonant clusters like (ക്ര [kṛ] /strə/ are represented using vowel diacritics placed to right, left, bottom and/or either sides of initial consonant. Hence the ligaturing rule inherent in the akshara system provides a complex visuo-spatial organization different from the letter system. Akshara knowledge therefore requires the rules of ligaturing (in addition to the akshara name) which govern the large set of symbols in an akshara system (Nag, 2007).

Results of our study showed that orthographic recognition preceded recall for participants in both languages i.e., English and Malayalam. Overall orthographic knowledge of participants improved with increasing grade or exposure to print. Though maturation effect was apparent in both languages, akshara knowledge took relatively more time to mature than letter knowledge. Letter recognition (Grade II) preceded akshara recognition (Grade III) development. This difference in development of orthographic recognition could be attributed to letter-to-sound mapping in English. Orthographic recall development also differed across language. In particular, the akshara type showed a differential pace on acquisition. For example, the akshara maturation showed following order: consonants with vowel diacritics - consonant without inherent vowel - vowels in primary form - consonants with inherent vowel - consonant clusters. Letter knowledge in alphabetic languages like English, French and Italian, is reported to develop by Grade I (Seymour, Aro & Erskine, 2003). Conversely, the orthographic knowledge in logographic languages, for example Chinese develops only by Grade VI (Shu, Chen, Anderson, Wu & Xaun, 2003). Thus, orthographic knowledge in alphasyllabaries (i.e., akshara knowledge) is drawn out as it requires the mastery of a large orthographic register in addition to the ligaturing rules (Nag, 2007). Development of akshara knowledge in Indian languages like Kannada, Bengali and Malayalam is reported to depend on

the akshara type (Nag, 2007; Nag & Sircar, 2008; Tiwari, Nair, & Krishnan, 2011), wherein complex akshara viz. consonant clusters and consonant with vowel diacritic or ligaturing rule, are slower to mature than akshara like consonant with inherent vowel etc. Therefore the difference in orthographic knowledge acquisition across Malayalam and English is attributed to the nature of orthography.

Chapter VI

SUMMARY AND CONCLUSIONS

Reading is often considered as a complex task brought about by the combined influence of language, cognition and metaphonological skills. Early reading is often considered as a precursor for determining the later scholastic performance of the child.

Present study aimed at exploring the reading acquisition in children learning to read in two distinct orthographies Malayalam and English. Children from Grades I to VII (30 each) participated in the study and were given tasks of phonological awareness, reading words and nonwords and orthographic knowledge in both languages Malayalam and English. Responses from participants were scored and statistically analyzed using SPSS version 16 for windows. A series of repeated measures two-way Analysis of Variance was performed with language as within-subject factor and grade as between-subject factor. Results showed significant main effect of language and grade on all measures and significant interaction of language and grade for all tasks measured. Phonological awareness skills developed more gradually in Malayalam in comparison to English language, except for rhyme recognition skills. Maturation of rhyme recognition was observed by Grade IV, syllable deletion by Grade IV and phoneme deletion by Grade V though phoneme oddity scores did not reach 100% scores till Grade VII. Therefore, syllable awareness was found to develop ahead of phoneme awareness. Reading word and nonword performances were superior in Malayalam compared to English language. However in English language, reading of regular and irregular words did not differ. Orthographic recognition was superior to recall in both languages. Orthographic recognition matured by Grade III, wherein scores in Malayalam language were superior to that of English. In English language also, the lower case recognition was found to be better than upper case recognition. Orthographic recall on the other hand was found to be superior in Malayalam language and dependent on the complexity of akshara. Akshara like vowel in primary form, akshara with inherent vowel and akshara without inherent vowel were acquired earlier than akshara types as akshara with ligatures, consonant conjuncts (vertical and horizontal) and consonant clusters. These differences in acquisition of literacy skills like phonological awareness, reading of words and nonwords and orthographic knowledge arises as an influence of orthography and its influence on the phonology of Malayalam language.

Implications of the study

Findings of the study reflect the differences in learning to read in two different orthographies, of which Malayalam alphasyllabary is more transparent and maps akshara to either phoneme or syllable, and English (an alphabetic script) is opaque in nature that maps grapheme to phoneme in the language. This finding is of interest, given the fact that children learn to read in these languages simultaneously, having equal opportunities to interact with either script. Results of the study have implications for research in children with reading impairments.

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APPENDIX - A
ENGLISH STIMULI

Phonological Awareness Task

1. Rhyme identification

Instructions: *I will say a few words. Listen to them carefully and tell me which of the two words rhyme.*

For E.g., I say 'tin' and 'bin'.

Do the two words sound similar or rhyme with each other. Yes you are right they rhyme with each other. Now I say car and bike. Do those two words rhyme with each other. Yes you are right they do not rhyme with each other. Now you try.

Sl. No.	Item	Response
1	Bed - Fed	Rhyming
2	Pin - Bat	Not rhyming
3	Funny - Bunny	Rhyming
4	Run – Cat	Not rhyming
5	Mass - Ear	Not rhyming
6	White - Write	Rhyming
7	Humanity - Zebra	Not rhyming
8	Great - Hate	Rhyming
9	Conviction - Prediction	Rhyming
10	Mightily - Vital	Not rhyming
11	Explanation - Excavate	Not rhyming
12	Daffodil - Dog	Not rhyming
13	Blue – Shoe	Rhyming
14	Knee – Tea	Rhyming
15	Cotton – Shower	Not rhyming
16	Top - Hop	Rhyming
17	Hand – Sand	Rhyming

2. Syllable deletion

Instruction: Now I will say some words. Listen to the word carefully. Remove the sound which I say from the word and say the remaining.

Sl. No.	Target word - syllable	Remaining word	Syllable deleted
1	Cat – ca	t	Initial
2	Table – ta	ble	Initial
3	Carpenter – pen	carter	Medial
4	Telephone – le	tephone	Medial
5	Register – re	gister	Initial
6	Cartoon – car	toon	Initial
7	Pantaloons – ta	panloons	Medial
8	Location – ca	lotion	Medial
9	Wonderful – der	wonful	Medial
10	Festival – val	festi	Final
11	Tennis – nis	Ten	Final
12	Sudden – den	sud	Final
13	Cinema – ma	Cine	Final
14	Coconut – nut	coco	Final
15	Kangaroo – kan	garoo	Initial
16	Chocolate – co	cholate	Medial
17	Shampoo – poo	sham	Final

3. Phoneme deletion:

Instruction: Now I will say some words. Listen to it carefully and take off the sound which I say from the word and say the rest of the new word left out after deletion.

Sl. No	Target word - phoneme	Remaining word	Phoneme deleted
1	Table - /t/	eibəl	Initial
2	Melon - /m/	elon	Initial
3	Jelly - /i/	jell	Final
4	Butter - /b/	utter	Initial
5	Bus - /s/	ba	Final
6	Calendar - /k/	alender	Initial
7	Sleep - /s/	leep	Initial
8	Tomato - /o/	tomat	Final
9	Skin - /k/	sin	Medial
10	Clutter - /l/	cutter	Medial
11	Belt - /t/	bel	Final
12	Shrug - /sh/	rug	Initial
13	Create - /e/	crate	Medial
14	Lend - /d/	len	Final
15	Basket - /k/	baset	Medial
16	Clip - /k/	lip	Initial
17	Smell - /m/	sell	Medial

4. Phoneme oddity

Instructions: I will be speaking a set of words. You need to pick the odd word out based on the differences in the sound.

Sl. No	Word set	Odd phoneme
1	<u>man</u> , sat, sick, sing	/m/ Initial
2	pen, <u>sat</u> , ten, fun	/t/ Final
3	<u>kitten</u> , missing, lesson, dressing	/t/ Medial
4	take, <u>feet</u> , lake, tame	/e/ Medial
5	yes, get, <u>got</u> , bed	/o/ Medial
6	<u>gave</u> , gun, <u>jump</u> , goat	/j/ Initial
7	all, <u>after</u> , pull, fall	/r/ Final
8	better, <u>fusion</u> , cotton, rotten	/s/ Medial
9	good, look, <u>gun</u> , cook	/a/ Medial
10	ten, team, take, <u>when</u>	/v/ Initial
11	white, like, ride, <u>gave</u>	/a/ Medial
12	meal, seat, mess, <u>clown</u>	/a/ Medial
13	toothbrush, twitch, <u>fever</u> , toy	/f/ Initial
14	packed, sickness, <u>party</u> , tracking	/t/ Medial
15	bought, got, <u>cat</u> , sort	/a/ Medial
16	cruel, <u>game</u> , people, jail	/m/ Final
17	admire, lecture, ignore, <u>talent</u>	/t/ Final

Reading Words and Nonwords Task

Instruction: Read the given words/nonwords. If you find difficulty reading any word, you may skip it and move to the next one.

Grade I

Sl. No	Word		Nonword
	Regular	Irregular	
1	Sun	Why	Kip
2	Bus	When	Rud
3	Box	Where	Kot
4	Table	Knife	Paxi
5	Apple	Elephant	Lofee
6	Baby	Girl	Com
7	Banana	Walk	Hin
8	Father	Watch	Itaso
9	Grandmother	Queen	Fotito
10	Seventy	Head	Pomalo
11			Hob
12			Fol
13			Rel
14			Gead
15			Palk
16			Dorn
17			Gatch
18			Nat
19			Soy
20			Pirl

Grade II

Sl. No	Word		Nonword
	Regular	Irregular	
1	Car	Bread	Pagi
2	Tree	Catch	Dake
3	House	Talk	Rull
4	Lid	Know	Fape
5	Ride	Night	Rit
6	Morning	Bucket	Bix
7	Scissors	Could	Wot
8	Banana	Laugh	Ponpital
9	Grandfather	Giraffe	Kittle
10	Watermelon	Often	Pomato
11			Cread
12			Gatch
13			Palk
14			Tage
15			Taugh
16			Kight
17			Guck
18			Iliphus
19			Chail
20			Dow

Grade III

Sl. No	Word		Nonword
	Regular	Irregular	
1	Tea	Wrote	Fape
2	Dog	Phone	Rull
3	Chair	Hour	Dake
4	Sleeping	Kneel	Slove
5	Monkey	Could	Kisp
6	Eagle	Night	Hast
7	Triangle	Palm	Prab
8	Atmosphere	Half	Guff
9	Vegetable	Pocket	Paxi
10	Introduce	Knowledge	Tallow
11			Dight
12			Pow
13			Gatch
14			Cread
15			Taugh
16			Chail
17			Tage
18			Pould
19			Dalk
20			Kolice

Grade IV

Sl. No	Word		Nonword
	Regular	Irregular	
1	Observe	Sign	Dake
2	Talent	Wrist	Fape
3	Obey	High	Rull
4	Average	Wine	Guff
5	Assist	Chair	Pove
6	Medium	Often	Kisp
7	Widest	Bicycle	Womic
8	Microscope	Education	Soser
9	Dentition	Leopard	Dockelate
10	Gigantic	Ghost	Dactory
11			Phore
12			Wrick
13			Tign
14			Cread
15			Bicket
16			Tingow
17			Pettuce
18			Cibycle
19			Polonel
20			Sinosaur

Grade V

Sl. No	Word		Nonword
	Regular	Irregular	
1	Occasional	Highest	Hasl
2	Seldom	Half	Drant
3	Picture	Yolk	Twesk
4	Paragraph	Meant	Murn
5	Instrument	Debt	Slove
6	Government	Knock	Narine
7	Millionaire	Island	Soser
8	Discovered	Monologue	Tegwop
9	Monument	Christmas	Ponpital
10	Culture	Narration	Dockelate
11			Bough
12			Knos
13			Tawch
14			Digh
15			Tign
16			Logue
17			Glistow
18			Hubtle
19			Wrobe
20			Sinosaur

Grade VI

Sl. No	Word		Nonword
	Regular	Irregular	
1	Contain	Knife	Mosp
2	Culture	Wine	Sted
3	Cradle	Hour	Gromp
4	Accept	Sign	Pove
5	Muscle	Laugh	Balras
6	Neighborhood	Debt	Hinshink
7	Electricity	Island	Sloskon
8	Surrounded	Mustache	Tallow
9	Conversation	Education	Baffodil
10	Observe	Butcher	Skiticult
11			Tign
12			Digh
13			Dolk
14			Ciril
15			Knobail
16			Kipthirm
17			Hausage
18			Losemn
19			Ponscoit
20			Psyfotory

Grade VII

Sl. No	Word		Nonword
	Regular	Irregular	
1	Afterward	Knight	Tobe
2	Duplicate	Wrap	Gromp
3	Invalid	Honor	Tutter
4	Kerosene	Island	Nolcrid
5	Submission	Foreign	Molsmit
6	Throughout	Naughty	Hinshink
7	Unique	Rhinoceros	Chamgalp
8	Shuffle	Mnemonic	Womic
9	Particular	Catalogue	Comeecitate
10	Extraordinary	Condemn	Penneriful
11			Gilart
12			Phyle
13			Hubtle
14			Kipthirm
15			Psyfotory
16			Pnuetoller
17			Empliforvent
18			Knobail
19			Talatogue
20			Defermication

Orthographic Knowledge Task

1. Alphabet Recognition

Instruction: Identify the alphabet that I speak from the given set.

Sl. No	Upper case	Lower case
1	A <u>D</u> C R B	<u>q</u> l b f p
2	L M N <u>E</u> M	t r <u>a</u> e <u>i</u>
3	I <u>T</u> F Z A	w <u>x</u> z v y
4	V <u>Z</u> T K F	v z t k <u>f</u>
5	<u>C</u> N O S P	x v r <u>j</u> n
6	D K <u>Q</u> N B	o d n m <u>g</u>
7	M <u>N</u> V W H	q l <u>b</u> p f
8	Q L B <u>F</u> P	<u>r</u> g f d n
9	L R <u>A</u> E I	c <u>n</u> o m l
10	W X Z <u>V</u> Y	h <u>t</u> i f l
11	<u>X</u> V R J N	y v u <u>w</u> m
12	H T <u>I</u> E L	s <u>g</u> f z a
13	M W P <u>B</u> Z	c r h <u>u</u> d
14	I L <u>J</u> B N	<u>e</u> b q c t
15	U Z G B <u>W</u>	v <u>h</u> d w q
16	O D N <u>M</u> G	c r h u d
17	R H <u>U</u> D Q	<u>i</u> l j b n
18	<u>G</u> F M S R	v u z n e
19	K N V <u>L</u> Z	a b d s <u>g</u>
20	<u>Y</u> D G M L	n w p b l

2. Alphabet recall

Instruction: Write down the alphabets that I say.

Sl. No	Upper case	Lower case
1	A	Y
2	T	U
3	F	P
4	N	L
5	B	G
6	Q	X
7	I	Z
8	M	D
9	R	H
10	S	M
11	E	O
12	G	Q
13	P	C
14	X	w
15	L	n
16	Y	t
17	U	r
18	V	f
19	D	j
20	C	k

APPENDIX - B**MALAYALAM STIMULI****Phonological Awareness Task***1. Rhyme recognition*

Instruction

ഞാൻ ഒരു ജോടി പദങ്ങൾ പറഞ്ഞ് കേൾപ്പിക്കാം. നിങ്ങൾ അത് ശ്രദ്ധിച്ചു കേട്ട ശേഷം അവ പരസ്പരം സാമ്യമുള്ളതാണോ അല്ലയോ എന്ന് പറയുക. ഞാൻ കുറച്ച് ഉദാഹരണങ്ങൾ ഇവിടെ കാണിക്കാം. നിങ്ങൾ അതു മനസ്സിലാക്കിയ ശേഷം അത് പരസ്പരം സാമ്യം ഉള്ളതാണോ അല്ലയോ എന്ന് കണ്ടെത്തുക.

/nʃa:n oru dʒa:di pəɖəŋə! pəɾəŋj ke:lp'ik'a:m. əvə pəɾəspəɾəm sa:mjəmuləɖa:no ələjə en niŋəl əɖə
 ʃɾəɖɪf' ke:tə sʰe:ʃəm pəɾəjukə. Nʃa:n kuɾəʃ uɖa:harəŋəŋəl pəɾəja:m/

Practice Items

Sl. No.	Item	IPA	Response
a.	ചരണം - മരണം	/ʃaraɳam/ - /maraɳam/	Rhyming
b.	തടി - വണ്ട്	/t̪aɖi/ - /vaɳɖɳ/	Non-rhyming
c.	എവിടെ - അവിടെ	/ɛviɖe/ - /aviɖe/	Rhyming
d.	കോടി - നെറ്റി	/ko:ɖi/ - /netti/	Non-rhyming
e.	തരണം - വരണം	/t̪araɳam/ - /varaɳam/	Rhyming

Stimuli

Sl. No.	Item	IPA	Response
1	കരം - മരം	/karam/ - /maram/	Rhyming
2	പേന - കച്ച	/pe:na/ - /katʃa/	Non-rhyming
3	കല്ല - പല്ല	/kalla/ - /palla/	Rhyming
4	കടി - വടി	/kaɖi/ - /vaɖi/	Rhyming
5	പശ - തുഴ	/paʃʰa/ - /tuʒʰa/	Non-rhyming
6	കറ - പറ	/kaɾa/ - /paɾa/	Rhyming
7	വാതിൽ - കസേര	/va:ɖil/ - /kase:ra/	Non-rhyming
8	കാട് - നാട	/ka:ɖɳ/ - /na:ɖɳ/	Rhyming
9	പട്ടി - പൂച്ച	/patʰi/ - /pu:ʃa/	Non-rhyming
10	പറഞ്ഞു - ജോടി	/paɾaɳu/ - /dʒo:ɖi/	Non-rhyming
11	ആർപ്പ് - പറഞ്ഞു	/a:ɾpa/ - /paɾaɳu/	Non-rhyming
12	മാല - മാങ്ങ	/ma:la/ - /ma:ŋa/	Rhyming

2. Syllable deletion

Instruction

ഞാൻ കുറച്ച് വാക്കുകൾ ഇവിടെ പറയാം. അവയിൽ നിന്ന്

ഒരക്ഷരം മാറ്റി കഴിഞ്ഞാൽ ശേഷിക്കുന്ന പദം എന്താണെന്ന് നിങ്ങൾ പറയണം. നിങ്ങൾക്ക് വേണ്ടി കുറച്ച് ഉദാഹരണങ്ങൾ ഞാൻ ഇവിടെ കാണിക്കാം.

അതുപോലെ ഞാൻ പറയുന്ന പദങ്ങളും ചെയ്യുക.

/nja:n kuɾəʃ va:k'ukəl pəɾəja:m. avəjɪl nin nja:n pəɾəjunə orəkʃəm ma:tɪja:l s'h'e:ʃikun'ə pəðəm e:ðen pəɾəjukə. kuɾəʃ uɖa:həɾəneɪl ɪvɪðe pəɾəja:m/.

Practice Items

Sl. No.	Target word – syllable (IPA)	Remaining word (IPA)	Syllable deleted
a.	കരുണ - രു [karuɳə/ - /ru/]	കണ [kaɳə/]	Medial
b.	ചതുരം - രം [tʃaturəm/ - /rəm/]	ചതു [tʃatu/]	Final
c.	മരണം - മി [marəɳəm/ - /ma/]	രണം [raɳəm/]	Initial
d.	കവചം - ക [kavəʃəm/ - /ka/]	വചം [vəʃəm/]	Initial
e.	കാർത്തിക - തി [ka:ɾtʃika/ - /tʃi/]	കാർക [ka:ɾka/]	Medial

Stimuli

Sl. No.	Target word – syllable (IPA)	Remaining word (IPA)	Syllable deleted
1	കമ്മൽ - ക [kəmməl/ - /ka/]	മ്മൽ [mməl/]	Initial
2	ചങ്ങാതി - ച [tʃəɳa:ti/ - /tʃa/]	ങ്ങാതി [ɳa:ti/]	Initial
3	തൃകോണം - തൃ [tɾʌko:ɳəm/ - /tɾə/]	കോണം [ko:ɳəm/]	Initial
4	പവിത്രം - ത്രം [pəvi:ɾəm/ - /ɾəm/]	പവി [pəvi/]	Final

5	രോഹിണി - ണി [ro:hiɳi/ - /ɳi/]	രോഹി [ro:hi/]	Final
6	പുസ്തകം - കം [pustakam/ - /kam/]	പുസ്തകം [pustak/]	Final
7	തലയിണ - ണ [talajina/ - /ɳa/]	തലയി [talaji/]	Final
8	മോതിരം - തി [mo:tiram/ - /ti/]	മോരം [mo:ram/]	Medial
9	ചങ്ങാടം - ങ്ങ [ʃaŋa:dam/ - /ŋa:/]	ചടം [ʃadam/]	Medial
10	പരിപ്പ് - റി [paripɳ/ - /ri/]	പപ്പ് [papɳ/]	Medial
11	പ്രവൃത്തി - പ്ര [pravɳɳi/ - /prə/]	വൃത്തി [vɳɳi/]	Initial
12	സുഹൃത്ത് - ഹൃ [suhrɳɳ/ - /hrɳ/]	സുത്ത് [suɳɳ/]	Medial

3. Phoneme oddity

Instruction

ഞാൻ പറയുന്ന ഒരു കൂട്ടം പദങ്ങളിൽ നിന്ന് കൂട്ടത്തിൽ ചേരാത്ത പദം ഏതെന്ന് നിങ്ങൾ കണ്ടെത്തി പറയുക. നിങ്ങൾക്ക് വേണ്ടി കുറച്ച് ഉദാഹരണങ്ങൾ ഞാൻ ഇവിടെ കാണിക്കാം. അതുപോലെ കൂട്ടത്തിൽ ചേരാത്ത പദങ്ങൾ നിങ്ങൾ കണ്ടെത്തി പറയുക.

/nja:n pəɾəjun'ə oru ku:təm pəðəŋəɻil nin ʃe:ra:tə pəðəm e:ʃən niŋəɻ kəndəɻ pəɾəjukə. Nja:n kuɾəɻ uɖa:harəŋəɻəɻ pəɾəja:m/

Practice items

Sl. No.	Word set (IPA)	Odd phoneme
1	ജൂത ജെപി മെച്ചി ജസ [dʒuʈə/, /dʒepi/, /metʃi/, /dʒasa/]	Initial
2	ടിക തഫ തിക ടിപ [tika/, /tafa/, /tika/, /tipa/]	Medial
3	കമ ലട നഖ നരു [kama/, /lada/, /tika/, /tizu/]	Final
4	മീല താട മീഫ മനി [mi:la/, /ta:da/, /mika/, /mani/]	Final
5	ഗത ചിപ ലിട പിത [gata/, /tʃipa/, /lida/, /pita/]	Medial

Stimuli

Sl. No	Word set (IPA)	Odd phoneme
1	പിഗി ജിത തര മീസ [pigi/, /dʒiɖə/, /tara/, /misa/]	Medial
2	തൊന്ന കൊരി മൊറ ഇസു [tɔːna/, /koːri/, /mɔra/, /isu/]	Initial
3	ലട്ടി പട മട്ടി പര [lati/, /pəɖə/, /məti/, /pəra/]	Medial
4	തബ തലു കിര തജു [təbə/, /təlu/, /kɪrə/, /təɖʒu/]	Initial
5	കബ കന കസി തലി [kəbə/, /kənə/, /kəsi/, /təli/]	Initial
6	കവി ചപ തപ കിറ [kəvi/, /tʃava/, /tʃava/, /kɪra/]	Final
7	ബക മലീ മിക ചക [baka/, /maliː/, /mika/, /tʃaka/]	Final
8	പെലീ കെടി ചട കെപ [peliː/, /kɛɖi/, /tʃada/, /kepa/]	Medial
9	കന ബുല ചിന കുന [kana/, /buːla/, /tʃina/, /kuna/]	Final
10	രൂമ പര കമ ലമ [ruma/, /para/, /kama/, /lama/]	Final
11	കിമ പെട തിട പില [kɪma/, /pɛɖə/, /tɪɖə/, /pɪla/]	Medial
12	കുഗ ചുല പിണ ലുട [kuga/, /tʃula/, /pɪna/, /luɖə/]	Medial

4. Phoneme deletion

Instruction

ഞാൻ കുറച്ച് വാക്കുകൾ ഇവിടെ പറയാം. അവയിൽ നിന്ന് ഒരക്ഷരം മാറ്റി കഴിഞ്ഞാൽ അവിടെ ശേഷിക്കുന്ന പദം എന്താണെന്ന് നിങ്ങൾ പറയണം. നിങ്ങൾക്ക് വേണ്ടി കുറച്ച് ഉദാഹരണങ്ങൾ ഞാൻ ഇവിടെ കാണിക്കാം. ഇത് പൊലേ ഞാൻ പറയുന്ന പദങ്ങളും ചെയ്യുക.

/nja:n kuɾəʃ va:kukə! ɪviɖə pəɾəja:m. aɖɪl nɪn nja:n pəɾəjun'ə akʃərəm maːti sʰeːʃikun'ə pəɖəm eːɖɛn pəɾəjukə/

Practice items

Sl. No.	Target word – phoneme (IPA)	Remaining word (IPA)	Phoneme deleted
1	ഭംഗി - ി [bʰəŋi/ - /i/]	ഭംഗ് [bʰəŋ/]	Final
2	പകൽ - ൽ [pəkalʰ/ - /lʰ/]	പക [paka/]	Final
3	കരം - ക് [kəɾəm/ - /k/]	അരം [aram/]	Initial
4	ശിക്ഷ - ഷ് [ʃikʃʰa/ - /ʃʰ/]	ശിക [ʃika/]	Final
5	കുന്തം - ന് [kuntam/ - /n/]	കുതം [kutam/]	Medial

Stimuli

Sl. No	Target word – phoneme (IPA)	Remaining word (IPA)	Phoneme deleted
1	വാതിൽ - ൽ [va:ɪlʰ/ - /lʰ/]	വാതി [va:ɪ/]	Final
2	സന്തുലനം - ന് [səntulanam/ - /n/]	സതുലനം [sətulanam/]	Medial
3	മനം - മ് [manam/ - /m/]	അനം [anam/]	Initial
4	സ്നേഹം - സ [sne:ham/ - /s/]	നേഹം [ne:ham/]	Medial
5	ത്യാഗം - യ് [tja:gam/ - /j/]	താഗം [ta:gam/]	Medial
6	കർമ്മം - ൽ [kəɾmam/ - /r/]	കമ്മം [kəmam/]	Medial
7	ശക്തി - ത് [ʃakti/ - /t/]	ശക്തി [ʃakti/]	Medial
8	സാമ്പാർ - സ് [sa:mba:r/ - /s/]	ആമ്പാർ [a:mba:r/]	Initial
9	കാന്തി - ത് [ka:nti/ - /t/]	കാന്തി [ka:ni/]	Medial
10	മകൻ - ന് [makən/ - /n/]	മക [maka/]	Final
11	പാലം - പ് [pa:lam/ - /p/]	ആലം [a:lam/]	Initial
12	ജാലകം - ജ [dʒa:lakəm/ - /dʒ/]	ആലകം [a:lakam/]	Initial

Reading words and nonwords task

Instruction

ഞാൻ കുറച്ച് വാക്കുകൾ നിങ്ങൾക്ക് പരിചയപ്പെടുത്താം . അത് എന്ന് വായിച്ച് കേൾപ്പിക്കണം . ഇതിൽ വായിക്കാൻ ബുദ്ധിമുട്ടായി തോന്നുന്ന വാക്കുകൾ വായിക്കേണ്ട ആവശ്യമില്ല. ആദ്യം ഞാൻ കുറച്ച് ഉദാഹരണങ്ങൾ ഇവിടെ കാണിക്കാം.

/nɔːn kʊɹətʃ vɑːkʊkəl nɪɳəlk pərɪtʃəjə pɛdʊtɑːm. ədʌ enɛ vɑːjɪtʃ keːlpɪkənəm/.

Grade I

Sl. No.	Word (IPA)	Nonword (IPA)
1	മല [/'mala/]	നിത [/'nɪtə/]
2	മനം [/'manam/]	കുവട [/'kudava/]
3	ചിരി [/'tʃɪrɪ/]	തളവ [/'tʃələva/]
4	ചുണ [/'tʃʊnə/]	കിടാ [/'kɪdɔ/]
5	പായൽ [/'paːjəl/]	മിൻ [/'mɪn/]
6	പല്ലി [/'pəlɪ/]	ഇലി [/'ɪlɪ/]
7	തയ്യൽ [/'təjɪjəl/]	പിട്ടം [/'pɪtəm/]
8	വാഴ [/'vɑːzə/]	കരിട [/'kərɪdɔ/]
9	മരം [/'maram/]	റിത [/'rɪtə/]
10	തറ [/'təɾə/]	നലി [/'nəlɪ/]

Grade II

Sl. No.	Word (IPA)	Nonword (IPA)
1	സിംഹം [/simham/]	യദ [/jadɑ/]
2	ക്ഷമ [/kʃam/]	കീട് [/ki:ɖʌ/]
3	മേഘം [/me:ɡʱam/]	കിരൂണ [/kiruɳa/]
4	കാറ്റ് [/ka:ttʌ/]	രമം [/ramam/]
5	വെള്ളം [/vellʱam/]	രിച്ചു [/ritʃu/]
6	ശ്രദ്ധ [/ʃradʱa/]	ലതിക്കം [/latʱikam/]
7	ഉത്സാഹം [/utʃa:ham/]	ചിരു [/tʃiru/]
8	പുഞ്ചിരി [/puɳʃiri/]	കുളിമ [/kuʎima/]
9	ഭരണകാലം [/bʱaraɳaka:lɑm/]	കമ്പാരം [/kamba:ram/]
10	പൂമ്പാറ്റ് [/pu:mba:tta/]	ഗാരം [/ga:rʌm/]

Grade III

Sl. No.	Word (IPA)	Nonword (IPA)
1	വാത്സല്യം [va:ʈsaljam/]	കപൽ [kapal/]
2	ദുഷ്ടീലം [duʃʈi:lam/]	ടകൽ [ʈakal/]
3	സുഹൃത്ത് [suhraʈʈ/]	ഗരനം [garanam/]
4	രാഷ്ട്രീയം [ra:ʃʈri:jam/]	സുലാത്ത് [sula:ʈʈ/]
5	ആർപ്പുവിളി [a:ʃpuvili/]	കയാലലം [kaja:lalam/]
6	ബന്ധനസ്ഥൻ [bandhanastan/]	ക്രാമി [kra:mi/]
7	കാരുണ്യം [ka:runjam/]	തപാക [ʈapa:k/]
8	സ്വീകരണം [svi:karanam/]	മസൂദ്രം – [masudram/]
9	ശുണ്ഠി [ʃunʈʈi/]	രാകുണ്ഡം [ra:kunjam/]
10	അഹങ്കാരം [ahanka:ram/]	മേഹം [me:hām/]

Grade IV

Sl. No.	Word (IPA)	Nonword (IPA)
1	ആർദ്രം [a:rdram/]	മസുറു [masuru/]
2	പുഴിക്കുക [puʃ'ikuka/]	താവിൽ [ta:vil/]
3	കടങ്കഥകൾ [kaɖaŋkatakʌ/]	പെരുച്ച [peruʃ/]
4	തപസ്സ് [tʌpasʌ/]	തൊളുക്ക് [tʌlʌkʌ/]
5	സ്വപ്നം [swapnam/]	കാത്തോൽ [ka:tʌ:1/]
6	മഴവില്ല് [mazavil/]	കൃവിതി [krʌviti/]
7	അക്ഷരം [akʃaram/]	സതപ്പ [satap/]
8	ഭിക്ഷാടനം [bʰikʃa:ɖanam/]	തിനുമ [tinuma/]
9	മനസ്സാക്ഷി [manas'a:kʃi/]	കളിത [kalita/]
10	കൃതജ്ഞത [kriʃanata/]	വാപ്പ [va:pʌ/]

Grade V

Sl. No.	Word (IPA)	Nonword (IPA)
1	കൈവല്യം [/'kaivaljam/]	മിന്തുര [/'mindura/]
2	ചൈതന്യം [/'tʃaitanjəm/]	കൃപല [/'kripala/]
3	പുർത്തീകരണം [/'pu:rti:karaṇəm/]	പതസ്സ് [/'patəs'/]
4	മൃഗശാല [/'mrigasʰa:la/]	കുഴത്ത് [/'kuʒʰətʃ/]
5	ക്രൂരത [/'kru:raʃ/]	പിതക്കുക [/'pitək'ukə/]
6	കഷ്ടപ്പാട് [/'kəʃtəpa:d/]	പഷ്ടം [/'pəʃtəm/]
7	ചിത്രശലഭം [/'tʃitʃra:ʃəbʰəm/]	മുച്ചുകുറുക്കി [/'muʃʃukuru:ki/]
8	നിശാഗന്ധി [/'ni:ʃa:gəndi/]	നിന്ദോത [/'nindota:/]
9	വിശ്വരൂപം [/'vi:ʃva:rupəm/]	പ്രക്കോ [/'prakə/]
10	അശ്വാരൂഢൻ [/'a:ʃva:ru:ḍan/]	ക്രച്ചവത്രി [/'krətʃavətʃi/]

Grade VI

Sl. No.	Word (IPA)	Nonword (IPA)
1	നീലാംബരം [ni:la:mbərəm/]	ചന്ദ്രം [tʃəntʃəm/]
2	ആത്മാഭിമാനം [a:tʃmabʰina:nəm/]	പ്രിയന്യം [priɔɔnjəm/]
3	അഭിരുചി [abʰirufi/]	വാസയതി [va:səjətʃi/]
4	നിർവീകാരത [nirvika:rətʃə/]	കൃതിപാരം [krutʃipa:rəm/]
5	ശരത്ചന്ദ്രൻ [sʰərətʃəndrən/]	അണിയഞ്ചം [anɔɔjəndʒəm/]
6	കേന്ദ്രബിന്ദു [ke:ndrəbɪndu/]	തോരിപാഷികം [to:ripa:kʃikəm/]
7	മുത്തുച്ചിപ്പി [mutʃufipi/]	വാർപ്പതാത്ര [va:rptʃ:tʃə/]
8	ഗാനസുധ [ga:nasudʰə/]	പലജാനം [pələdʒa:nəm/]
9	അപൂർവരാഗം [apu:rvəra:gəm/]	വഴിമല്ല [vəzʰiməl/]
10	മന്ദസ്ഥിതം [məndʃstʃidəm/]	നമസ്സാക്ഷി [nəmsʌsəkʃi/]

Grade VII

Sl. No.	Word (IPA)	Nonword (IPA)
1	ചലച്ചിത്രം [tʃələtʃɪtrəm/]	പൂച്ചെത്തി [puːtʃɛtʃɪ/]
2	സുമംഗലി [suməŋgəli/]	മിളികാനൂർ [miːlikaːnuːr/]
3	പ്രചോദനം [prətʃoːdɒnəm/]	വിൽമാരി [vilmaːri/]
4	പ്രജാപതി [prətʃəːdʒəpəti/]	സുകത്രാരൻ [sukʈrəːrən/]
5	വിദ്യാരംഭം [vidjəːrəmbʱəm/]	വൃല്ലകക്ഷം [vriːlpəkəkʃəm/]
6	ഉത്തരവാദിത്വം [uttərəvəːdɪtvəm/]	കുളംമുമ്പ് [kulaːmumb/]
7	ഗാനഭൂഷണം [gəːnəbʱuːʃəɳəm/]	പവിചട്ടിൽ [pəviːtʃɪɽil/]
8	നമസ്കരിക്കുക [nəːmɪskəːrikʷəkə/]	മഖമേഴം [mɪkʰəːmɛːʒəm/]
9	അന്വേഷണം [əːnveːʃəɳəm/]	ഗലിമസു [gəːliməsɪ/]
10	കാഞ്ചനകാഞ്ചി [kəːɳdʒinəkəːɳdʒɪ/]	ബീലാരണം [biːləːrəɳəm/]

Orthographic knowledge test

1. Akshara recognition

Instruction

ഞാൻ നിങ്ങൾക്ക് ഒരു കൂട്ടം അക്ഷരങ്ങൾ തരാം. തന്നിരിക്കുന്ന അക്ഷരങ്ങളിൽ നിന്നും ഞാൻ പറയുന്ന അക്ഷരം ഏതെന്ന് കണ്ടെത്തി അടയാളപ്പെടുത്തുക. ഞാൻ ഇവിടെ തന്നിരിക്കുന്ന ഉദാഹരണങ്ങൾ പോലെ ചെയ്യുക

/nja:n niṇaḷk oruku:təṃ akʃərəṇə! t̪ərə:m. t̪ənir̪ikun'a akʃərəṇə!il nin nja:n pərəjun'a akʃərəṃ e:ḍḍen kəndəṭṭə adəja:ləp'əduṭṭukə/.

Stimuli

Sl. No	Akshara set	IPA
1	ജ ധ ഷ കൃ ഫ	/dʒə/ /d̪ə/, /ʃə/, /kə/, /fə/
2	ഘ ല റ ഷ ഫ	/gʱə/, /lə/, /rə/, /ʃə/, /fə/
3	വ ഭ പ മ ള	/və/, /bʱə/, /pə/, /t̪ʱə/, /ʒʱə/
4	ഡ ള്ല ണ്ണ ണ്	/dʒʱə/, /kʱə/, /n̪ə/, /ɳə/, /d̪ʱə/
5	ത ക റ ണ്	/t̪ə/, /kə/, /t̪ʱə/, /bə/, /jə/
6	സ മ ന ഹ റ്	/sə/, /t̪ʱə/, /nə/, /hə/, /d̪ə/
7	ഗ ച ര മ്ല ണ്	/gə/, /t̪ʃə/, /rə/, /n̪ja/, /t̪ʱə/
8	ത്ത കൃ ണ്ണ ന്	/t̪ʱə/, /kʃə/, /ɳ̪/, /n̪ə/, /iva/
9	ൻ ണ്	/n̪/, /m̪/, /r̪/, /l̪/, /il/
10	കൃ ക കൃ കൃ കൃ	/kʃə/, /kvə/, /kr̪/, /klə/, /kra/
11	ന്ത കൃ കൃ കൃ	/m̪d̪ə/, /n̪gə/, /t̪ʃə/, /ika/, /iva/
12	മ്പ ബ സ ൻ	/m̪bə/, /bə/, /sə/, /d̪ʱə/, /m̪d̪ə/
13	ക ന്ത സ്മ സ്മ	/n̪kə/, /m̪d̪ə/, /sə/, /l̪ə/, /d̪ʱə/
14	അ ഏ ഓ ആ	/a/, /e/, /o:/, /a:/, /r̪/
15	അം ഊ ഓ ഐ	/ʌm/, /u:/, /əu/, /o/, /i/
16	ബ്ബ ള്ല ന്	/ibaə/, /t̪ə/, /n̪ə/, /n̪ə/, /m'a/
17	റ ള്ല ള്ല ള്ല	/t̪ə/, /il/, /g'a/, /d̪ə/, /d̪ʱə/
18	കൃ കൃ കൃ കൃ	/n̪kə/, /t̪ʃə/, /k'a/, /n̪d̪ə/, /n̪d̪ə/
19	സ്മ ള്ല പ്ല സ്മ	/d̪ʱə/, /g'a/, /p'a/, /m̪bə/, /s'a/
20	ഡ കൃ ണ്	/dʒʱə/, /k'a/, /l̪', /d̪ʱə/, /n'a/

2. Akshara recall

Instructions

ഞാൻ ഇവിടെ കുറച്ച് അക്ഷരങ്ങൾ പറയാം. അത് നിങ്ങൾ എന്നെ എഴുതി കാണിക്കുക.

/nʝa:n ividɛ kurəʃ akʃərəɳə! pərəʝa:m aɖɹ ɛnɛ ɛʒʰuʈɹ ka:nɪkukə/.

Sl. No	Vowels in primary form (IPA)	Akshara with inherent vowel (IPA)	Akshara with vowel diacritic (IPA)	Akshara without inherent vowel (IPA)
1	അ [a]	ക [ka]	കോ [ko:]	ൻ [m]
2	ഐ [e:]	ച [tʃa]	കി [ki]	ൾ [l]
3	ഇ [i]	ത [ta]	തൊ [to]	ർ [r]
4	ഏ [e]	ഗ [ga]	സൈ [sai]	ൽ [l]
5	ഓ [o:]	ള [la]	ടെ [de]	ൺ [n]
6	അം [am]	ദ [da]	ചി [tʃi]	
7	ഈ [i:]	ട [da]	പേ [pe]	
8		സ [sa]	ഗൗ [gau]	
9		ഷ [ʃa]	ദു [du]	
10		ഡ [dʰa]		
Sl. No	Akshara with consonant diacritics (IPA)	Consonant conjuncts (vertical) (IPA)	Consonant conjuncts (horizontal) (IPA)	Consonant clusters (IPA)
1	കവ [kva]	ടവ [dʰva]	ക [ka]	സ്ര [stra]
2	സ്യ [sja]	ച്ഛ [tʃʃa]	കത [kta]	സ്ര [skra]
3	ത്ര [tra]	ട [ta]	ക [ka]	സ്ര [stra]
4	ക്ല [kla]	ഛ [tʃda]	ങ്ങ [ŋa]	
5		ഡ [dʰa]	ഞ്ഞ [nna]	
6		ണ്ണ [nja]	ഞ്ച [nda]	
7		പ്ല [pʃa]	ണ്ട [nda]	
8		ബ്ല [bʃa]	ണ്ഡ [nda]	
9		സ്ന [sna]	ത്ത [ta]	
10		പ് [pa]	ത്ഥ [tʃma]	
11		സ്സ [sa]	ന്ത [nta]	
12		യ് [ja]	ന്ദ [nda]	
13		വ് [va]	ന്ധ [nda]	
14			ന് [na]	
15			ന്മ [nma]	
16			മ്മ [ma]	
17			ത്ഥ [tʃta]	

