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Significant Predictors of Reading Proficiency in English among Hindi Medium School Students

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It has been observed that some students find it difficult to acquire a second language (L2) although they are well versed in their mother tongue. The present study was conducted to identify the predictors of second language (English) dyslexia in students who did not suffer from dyslexia in their primary language i.e. Hindi, but were facing difficulty in acquisition of L2. A two group design was used to differentiate between good and poor readers in English among students studying in Hindi medium schools. A purposive sample of 100 participants (Good readers: 50; Poor readers: 50) from VII and VIII grade students DST-S (Dyslexia Screening Test-Secondary) was administered for assessment of second language reading proficiency. The results showed that five subtests of DST-S correctly classified 90% of the respondents into good and poor readers, where 88% of poor readers and 92% of good readers were classified correctly. Thus, identification of poor L2 (English) readers can be made by administration of only five subtest of DST-S.

Keywords: Reading Proficiency, English as second language (L2), Hindi Medium Students

Difficulties in learning to efficiently read (dyslexia), write (dysgraphia) or perform mathematical calculations (dyscalculia) have been observed despite normal intelligence. Students with specific learning disability (SpLD) may have academic problems such as reading slowly and incorrectly, skipping lines while reading aloud, making repeated spelling mistakes, untidy/illegible hand-writing with poor sequencing, and inability to perform even simple mathematics (Karande, Sholapurwala & Kulkarni, 2011). According to the 2001 Census of India, 21.9 million people were reported to have a disability (Sakhuja, 2004) and the number is likely to grow (World Bank, 2007) in India, mainly due to increase in expectations of parents' and faster life styles (Chatterjee, 2009). Literature indicates that 10-14% of the 416 million children in India have learning disability (LD) (Krishnan, 2007; Mehta, 2003) making it the most widespread disability (Suresh & Sebastian, 2003; Tandon, 2007). It has been reported that Dyslexia is the most common and most carefully studied of the SpLDs, affecting 80% of all those identified as learning disabled (Karande, Sawant, Kulkarni, Galvankar, & Sholapurwala, 2005).

In 1968, the World Federation of Neurologists defined dyslexia as "a disorder in children who, despite conventional classroom experience, fail to attain the language skills of reading, writing, and spelling commensurate with their intellectual abilities." Early intervention for dyslexia shows more favorable outcomes, however if not treated, it can persist throughout life.

Empirical observations in Hindi medium schools show that students generally are proficient in their native language (Hindi), but they face problem in second language (L2) i.e., English. Basically proficiency in a second language means that the student has the ability to understand and generate the complex syntax of L2 in formal oral and written expression (Chamot & O'Malley, 1994). Generally, students proficient in the native language face problems in second language at the structural level i.e. recognition of phonemes and words, lack of vocabulary, syntax etc. These are basic units of language and if one is unable to recognize phonemes, join them to make words or has a lack of vocabulary (does not know the meaning in L2) then it is bound to lead to dyslexia in L2, even though the person may be proficient enough in L1 (native language).

Reading requires different perceptual and cognitive processes, as well as a good

knowledge of language and grammar. Some of the processes involved in reading are concerned with identifying and extracting meaning from individual words. Other processes operate at the level of the phrase or sentence, and still other processes deal with the overall organization or thematic structure of the entire material. Factors influencing reading can be categorized into two categories i.e., text driven and conceptually driven. Text driven or structural factors include Phonemic/ Graphic decoding, Word identification and Word recognition. Whereas, conceptually driven factors consist of Intra-textual perception, Meta cognition and prior knowledge.

Research in the area of reading has implicated a greater role of text driven factors. Swanson, Cochran and Ewers (1989) assessed skilled and less skilled readers working memory performance. It was concluded that less skilled readers working memory deficiencies were pervasive in the sense that they involve deficiencies in memory components related to central executive processing. Swanson, Howard and Saez (2006) assessed the components of working memory that underlie less skilled readers' comprehension and word recognition difficulties. Ability group comparisons showed that (a) skilled readers outperformed less skilled readers on all measures of WM, updating and processing speed; (b) children with comprehension deficits only outperformed children with RD (reading disabilities) on measures of WM, STM, phonological processing and processing speed; and children with RD outperformed poor readers on WM and phonological processing measures. Archibald and Gathercole (2007) investigated verbal and visuo-spatial processing and storage skills of children with specific language impairment (SLI) in developing children. Results indicate that deficits in verbal storage, possibly twinned with slower processing, underlie the substantial SLI impairments on complex memory activities. Altmann, Wiseheart, Linda and Megdals (2009) reported that half of the variance between blending and elision, which are processes of phonological awareness, can be attributed to Executive Function and Working Memory. Surprisingly, vocabulary size also contributes to blending, but not elision. Thus, individuals with primary deficits in Working Memory or Executive Function may score poorly on both tasks, but those with poor vocabulary and intact Executive Function /Working Memory could show isolated deficits in blending.

Vellutino, Scanlon and Spearing (1995) evaluated semantics and phonological coding deficits as alternative explanation of reading disability. It was concluded that phonological coding deficits are a probable cause of reading difficulties in most poor readers. Wagner, Torgesen, Rashotte, Hecht, Barker, Burgess et al. (1997) administered multiple measures of phonological awareness, verbal short term memory and rapid naming. A key finding was that at three different time periods, phonological awareness skills predicted individual differences in word level reading while verbal short term memory skills did not. Thorn and Gathercole (1999) investigated phonological short term memory performance to language specific knowledge. They reported that phonological short term memory is not a language independent system, but rather it functions in a highly language specific way. Ransby and Swanson (2003) explored the contribution of cognitive processes to comprehension skills in adults who suffered from childhood developmental dyslexia (CD). Results indicated that constraints in phonological processing and naming speed mediate only some of the influence of high order processes on reading comprehension. Furthermore, adults with CD experience difficulties in working memory, listening comprehension and vocabulary independently of their word recognition problems and intellectual ability. Fowlert, Swanson and Scarborough (2004) studied relationships of naming skills to reading, memory and receptive vocabulary: evidence is for imprecise phonological representations of words by poor readers. The results indicated that for both good and poor readers, imprecise phonological knowledge, especially about long words, contributed to children's difficulties on all naming tasks. Memory differences, however appeared to play only a minor role in explaining the strong association between naming and reading. McNeil and Johnston (2004) assessed word length, phonemic and visual similarity effects in poor and normal readers. It was concluded that poor readers rely on visual information in tasks where the presented

images are highly codeable and where verbal recording is not obligatory, but that they make use of phonological coding when the stimuli are not as easily codeable visually in memory. Leech, Aydelott, Symons, Carnevale and Dick (2007) reported that perceptual, attentional and higher cognitive abilities interact with language acquisition and processing. They predicted that the semantic comprehension abilities and expertise are contingent upon the perceptual, attentional and semantic milieu in which language processing takes place. Steinbrink and Klatte (2008) identified deficits in phonological working memory as one factor underlies reading and spelling disorders. The results suggest that the poor readers' difficulties do not arise from an avoidance of the phonological loop, but from its inefficient use.

Thus, it is evident that working memory and phonological skills play a major role in reading proficiency.

Rationale of the study:

In India, English has the status of a second language in a number of states. It is the medium of instruction in a large number of schools where the native language of the children is an Indian language. The use of English as an official language is widespread. In India, higher education, especially at the post graduate and higher levels, places a major emphasis on English as English texts and textbooks are used extensively, particularly at advanced levels and in specialized courses. This makes the ability to read and learn from English texts as an essential academic skill. In this age of globalization, in most countries of the world, people who do not speak a second or a foreign language are at a serious disadvantage in the job market and sometimes even in their private sphere of life. It is therefore of great relevance that learners are also provided with equal and appropriate opportunities to learn a second language.

Thus, in view of the importance of learning a second language i.e. English, in India, especially when the medium of instruction and examination is the first language limits the exposure to the second language. The following problem was formulated for the present study where English is considered as a second language and Hindi as the first language.

Objective:

To identify the significant predictors of second language dyslexia among school students.

Method

Sample:

A purposive sample of 139 students (VII and VIII grade) was selected from Hindi medium schools of Rohtak district. Selection criteria of the students were the marks obtained in their preceding exams (SA-1) i.e., 60% and above marks in Hindi and less than 60% in English. Good readers in English (obtaining above 60% marks in English) were excluded from the sample. On the basis of DST-S (Dyslexia Screening Test-Secondary) scores 50 poor and 50 good readers were identified, on the basis of their global risk quotient scores.

Tools:

Dyslexia Screening Test – Secondary (DST-S) has been designed for screening diagnosis by Fawcett and Nicolson (2004). This test is for the age group of 11.6 years to 16.5 years. DST-S measures reading ability in English. The test consists of 12 subtests namely Rapid Naming (rn), Bead Threading (bt), One minute Reading (omr), Postural Stability (ps), Phonemic Segmentation (ps1) and Spoonerisms (s), Two Minute Spelling (tms), Backward Digit Span (bds), Nonsense Passage Reading (npr), One Minute Writing (omw), Verbal Fluency (vf), Semantic Fluency (sf) and Non Verbal Reasoning (nvr). The test provides a risk index for each subtest along with a global risk score. The DST-S battery includes both attainment and diagnostic tests. Tests of attainment include reading, writing and spelling i.e., One Minute Reading, Two Minute Spelling and One Minute Writing. These correspond directly to the accepted difficulties of dyslexic students. Attainment test is designed to assess a composite of fluency and accuracy. These tests cover the three critical requirements for difficulty in dyslexia. The diagnostic tests cover the range of skills known to be affected in dyslexia, and profile of difficulties can be used both to interpret the causes of attainment difficulties and also an

Table 1. Stepwise statistics entered on five subtests of DST-S

Step	Entered	Wilks' Lambda						
		Statistic	df1	df2	df3	Exact F		
						Statistic	df1	df2
1	Non Verbal Reasoning (nvr)	.558	1	1	98	77.69*	1	98
2	Two Minute Spelling (tms)	.435	2	1	98	62.98*	2	97
3	Verbal Fluency (vf)	.393	3	1	98	49.36*	3	96
4	Phonemic Segmentation (ps1)	.365	4	1	98	41.29*	4	95
5	Backward Digit Span (bds)	.350	5	1	98	34.97*	5	94

a. Maximum number of steps is 26; b. Minimum partial F to enter is 3.84; c. Maximum partial F to remove is 2.71; d. F level, tolerance, or VIN insufficient for further computation.; * p<0.01

index of which skills need support. Test-retest reliability of the test varies from 0.63 to 0.99. The test–retest correlation in Inter–Form reliability is 0.959. Inter rater reliability for two experienced testers have been reported as 0.98. Inter rater reliability between the inexperienced tester and each of the experienced testers is 0.94. Tests inter correlations vary from 0.10 to 1.00. The test excluding Semantic Fluency has Face validity as an index of dyslexia.

Procedure:

In the initial stage, permission was taken from the principals of different Hindi medium schools and then the students were contacted in their respective classes and their willingness to participate in the study was obtained. Students were selected on the basis of selection criteria. The students were tested individually. Care was taken to ensure a comfortable and free-from-distraction testing condition.

Results and Discussion

The objective of the study was to identify the significant predictors of second language dyslexia among school students. The data yielded 13 scores on different components of reading, spelling, writing and creativity in English of the 100 students (good and poor L2 readers). Differential Function Analysis (DFA) was applied in order to determine which of the 13 subtests could significantly predict L2 (English) reading disability/proficiency. The data were analyzed using the SPSS 11.5 version for Window Inc.

The computation of DFA revealed that all the cases were included within the analysis and it was observed that all the F values were statistically significant beyond the 0.01 level. Non Verbal Reasoning (nvr; λ=0.558, F=77.69) had the highest discrimination among all the variables, whereas, One minute writing (omw: λ=0.939, F= 6.42) demonstrated the least discrimination.

The stepwise analysis revealed the contribution of five significant predictors, which has been shown in the Stepwise statistics presented in Table 1.

The Stepwise Statistics Table shows that step wise inclusion of five variables i.e., nvr, tms, vf, ps1, and bds, led to an increase in the discriminability of the predictors after which no significant differences were observed and therefore only these five variables were included in further analysis. The Lambda value illustrated that "Non verbal reasoning" was the best single predictor, followed by "Two minute spelling", "Verbal Fluency", "Phonemic segmentation", and "Backward digit span" in a successively decreasing order. So, it can be said that these five variables, put together, provided the best possible predictors of L2 reading, from among the 13 subtests of DST-S. Thus, it is apparent that general intelligence i.e., Non verbal

reasoning, emerged as the strongest predictor of L2 reading, while the structural correlates including morphemes segmentation, phonemes awareness, and vocabulary along with working memory were comparatively less stronger, but significantly contributed to the discrimination between good and poor L2 learners. DFA also provides information about the combined effect of the significant predictors in differentiating between the groups in terms of Eigen values, which are related to the canonical correlations and describe how much discriminating ability a function possesses.

The present discriminant function had an Eigen value of 1.86 and a canonical correlation of 0.81. For analysis, the proportions of discriminating ability sum to one. The present correlation of 0.806 is high.

The canonical correlation provides an index of the variability of the clubbed variable (D) to the categorical variable. By squaring the canonical correlation for the discriminant function ($0.81^2 = 0.65$) it is evident that 65% of the variability among the good and poor readers is accounted for by this discriminate function and the rest 35% is unexplained (λ=0.350, chi-square = 100.358, df=5, sig=0.00 level). Further, analysis of DFA provided a measure of the relationship of each of the predictors with D, which have been presented in the Table 3. Since, in the present analysis the categorical variable was dichotomous, the coefficients of the standardized canonical discriminate function were considered.

From the table, it can be seen that the maximum contribution to the discriminating function is provided by Two Minute Spelling (0.755), while that of Non Verbal Reasoning is slightly lesser i.e., 0.645. The contribution of remaining variables i.e., ps1, bds and vf are comparatively lesser. However, the highest correlation of tms indicates that phonemic segmentation and conversion of phoneme into grapheme (which is the reverse of the process used in reading) is a major contributing factor even to L2 reading.

DFA also provides an estimation of the means of the discriminate function, in terms of z scores for each group, which are termed as the group centroids. In the present analysis the centroids for Poor readers (Gr I) was found to be -1.35 while that for Good readers (Gr II) was 1.35. The means depict that the obtained discriminate function could differentiate the good and poor readers equally well as the two means were equidistant on the continuum of the discriminate function.

Table 2. Standardized Canonical Discriminant Function Coefficients

Subtests	Function
ps1	-.583
Tms	.755
Bds	.285
Vf	.455
Nvr	.645

The computation of the Fisher's classification function coefficients provides an equation by which the five subtests, which were found to be the significant predictors in the present analysis, can be used for identification of poor L2 readers by administration of only these five subtests. The Fisher's linear discriminate functions have been tabulated in the following table.

Table 3. Fisher's linear discriminant functions

Subtests	Group	
	1	2
ps1	.416	-.267
Tms	.405	.816
Bds	1.091	1.536
Vf	.644	1.058
Nvr	.719	2.077
(Constant)	-12.164	-25.604

In order to demonstrate the utility and accuracy of using this discriminate function for prediction of group membership of the L2 readers, the equation can be used to predict group membership.

G1 = -12.164+ 0.416 x ps1+ 0.405x tms+ 1.091x bds+ 0.644x vf+0.719x nvr (1)

GII= -25.604 – 0.267x ps1+ 0.816x tms+ 1.536x bds+ 1.058x vf+2.077x nvr (2)

For each case, a G is to be computed for each group and the case is classified into the group for which G is the highest. In case the obtained value of GII > GI, the subject would be classified as a good reader and in case the obtained value of GI> GII, the subject would be classified as a poor reader. Thus, the estimated

relations (1), and (2) can be used to classify new observations into pre-existing groups. DFA also determines how well group membership can be predicted using a classification function.

Table 4. Classification results of group membership

Group		Predicted Group Membership		Total
		1	2	
Count	1	44	6	50
	2	4	46	50
%	1	88.0	12.0	100.0
	2	8.0	92.0	100.0

Table 4 indicated that from the 50 cases of the poor readers, 44 (88%) were classified correctly. In the good readers, 46 of 50 cases (92%) were classified correctly. Of the total sample of 100 cases, the overall number of cases classified correctly was 90%. Thus, the present results show that five subtests of DST-S (nvr, tms, vf, ps1, and bds) differentiate between poor and good L2 readers.

The present results revealed that Non verbal reasoning (both in terms of mean differences and discrimination function) is a significant predictor of L2 reading proficiency. Since, reading is a cognitive phenomenon, which involves top down as well as bottom up processing, where unitary inputs (simple input) is to be processed to reach the abstract level of comprehension or vice versa and since the processes are occurring concurrently, the role of general intelligence assumes importance. A number of researches have shown that there is a significant degree of linkage between general intelligence (the 'g' factor) and first language learning and a much larger connection between 'g' and second language acquisition (Bonar, 2005). A general factor exists in language skills (Carroll, 1983) or it can be said that language ability is logically a medium that might serve for the development of the most general sort of intelligence (Oller, 1992). Another significant non language variable, which was found to differentiate significantly between good and poor readers and also emerged as a significant predictor was Backward digit span, which is considered to be a simple, but accurate index of working memory capacity and processing. Reading span and other verbal Working Memory tasks actually measure language proficiency rather than Working Memory (MacDonald & Christiansen, 2002). Altmann and Efros (2006) suggested that reading span taps into both WM and language abilities, and that the scores from different levels of the "n-back" may align with different WM tasks. Since, language is an interactive process, where the learner gets the input in the form of symbolic stimuli and the process depends on the learner's potential to convert the symbols into meaningful entities, where both unit level symbols as well as the abstract level concepts have to be made readily available to the processing and output system for language comprehension /production, the importance of Working Memory storage and processing capacity assumes importance. Researchers have reported that working memory plays an important role in L1 reading tasks (Marinis, Roberts, Felser and Clahsen, 2005) and is a good predictor of success in L2 reading tasks (Ellis, 1996).

The three significant language related components, which were found to contribute significantly to the discrimination in reading proficiency were Phonemic segmentation, Two minute spellings and Verbal fluency, which measured phoneme awareness and segregation, combination of phonemes to form grapheme and speed of processing in L2 reading proficiency. For the basic processes involved in reading, first phoneme awareness then grapheme identification and then the vocabulary is required because if a word is available in the working memory then the reader will use "Look and Say" method of reading and the processing time will be lesser, otherwise the reader will have to process each grapheme and convert it into phoneme and then join these to articulate the word, thereby requiring more time. The causal role of phonological awareness in learning to read (Wagner & Torgeseen, 1987) or in prediction of proficiency of reading ability (Khatib & Fat'hi, 2012; Di Fillipo, Brizzolara, Chilosi, Luca, Judica, Peeini et.al, 2005) has been documented, whereas its role in L2 has also been shown (Hummel, 2009). Phonological processing successfully discriminates between average and poor readers and for L1 and L2 students, reading difficulties appear to be strongly linked with phonological processing

(Chiappe & Siegel, 1999). Research has shown links between expressive phonological disorders and later the ability to read either meaningful text or non-words (Bishop & Adams, 1990). In fact, phonological awareness and segmentation cannot be conceived to constitute the same variable. In DST-S also this aspect was measured in two ways i.e., Phonemic segmentation and Spoonerisms. However, Spoonerisms did not emerge as a significant contributor while Phonemic segmentation had a negative loading with DFA. This fact is explicitly evident in the Fisher's linear discriminant function equation where Phonemic segmentation is to be summated with a negative loading for the equation (ii) and a positive loading for equation (i). Thus, it is evident that the more the segmentation process, lesser will be the reading.

The next predictor, which is the two-minute spelling consisting of morpheme awareness, which has been found to be an important contributor to word level skills (Bruce & Sabatini, 2009). Poor readers are not able to use context more effectively (Bensoussan & Laufer, 1984). Accent is also uniquely related with syllable structure accuracy (Trofimovich & Isaacs, 2012). A large pool of vocabulary may aid children in making phonological distinctions within a language (Dixon, Chuang & Quiroz, 2009) and contribute to blending (Altman et.al. 2009).

Thus, it is apparent that the processes involved in reading cannot be isolated as reading is a sequential process whereby the contribution of one factor must be multifaceted or facilitated by another factor. In fact, some factors facilitate reading of the initial level, but fixation with the primitive method can lead to later difficulties (Bishop & Adams, 1990) as it does not allow automatic access to the alternative lexicons, thereby overloading the working memory capacity.

To conclude, the present results show that DST-S differentiates between good and poor readers. However, the use of only five variables can lead to effective identification of reading proficiency. In other words, it can be said that general intelligence, working memory capacity, phoneme and grapheme awareness and vocabulary assume an important role in L2 reading as proficiency in L1 makes the remaining skills less significant as they have already been acquired or are not deficient.

Reading difficulties faced by L2 learners vary upon the proficiency of first language literacy. They acquire proficiency in second language easily because the automatic processing strategies of L1 are easily transferred to L2. Children proficient in the native language face problems in the second language at some of the structural level i.e. recognition of phonemes and words, lack of vocabulary etc. These are the basic units of the language and if one is unable to recognize phonemes, and join them to make a word or lacks vocabulary (does not know the meaning in L2), then they face problems at the structure level. If deficits in reading are recognized in early stages then deficits can be overcome earlier. Recognition of the nature of structural deficits in early stage can help the child to overcome the deficiency in reading during the initial acquisition stage.

Implications

The results of the present study indicate that the reading process is influenced by both general intelligence as well as specific reading related factors. Working memory plays an important role in L2 reading. Phonological segmentation should be used only at the initial stage of reading and the reader should be encouraged to give away this effortful process as soon as possible. Lastly, increasing the second language vocabulary [by verbal interaction in L2] facilitates the reading process in L2, thereby implicating the utility of oral exposure to L2 prior to initiation of reading. The five subtests, which were found as significant predictors can be used for identification of poor L2 readers and the Fisher's linear discriminate equation can be used for prediction of reading proficiency.

Thus, second language learning can be facilitated by providing remedial training in abstract reasoning, phonemic awareness in L2, improving L2 vocabulary and mnemonic training to increase working memory capacity and executive functions.

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