Chapter-IV

Design and Methodology
Dyslexia (or specific reading disability) is the most common and most widely studied learning disability, affecting 80% of all those identified as learning-disabled. Reading ability is influenced to a great extent by the awareness of the learner to words, both written and spoken and breaking down the words into smaller units of sound. Reading is a complex process involving visual and auditory input units, processing of which leads to higher level input i.e., words, sentences and then ultimately comprehension.

Although the similarity between languages expounded by Chomsky implicates that processing of all languages would be more or less similar, yet major differences have been reported in reading in first language (native) and second language (L2). The students in India face a major handicap in terms of reading proficiency in English, especially those who start the acquisition of L2 at a late stage.

In view of the widespread use of English, and the difficulties faced by a majority of Indian students in acquiring proficiency in reading in L2 and the importance of structural factors in reading, the present study was conducted to identify structural correlates of second language reading proficiency in school children. Present research aimed to assess the role of structural correlates of reading to reading proficiency in L2. The intent of the present research was to study the role of speed of processing at phoneme and semantic level to L2 reading proficiency and to determine the mediating role of L1 in L2 processing.

To achieve the objectives delineated in Chapter III, the following experimental design was proposed for the present study.

**RESEARCH DESIGN**

The study was conducted in two phases.
Phase- I

The objective of this phase was to study the role of correlates of reading in assessment of reading proficiency in L2 (English), of Middle school children, who were proficient in first language i.e., Hindi and identify the significant predictors of reading proficiency in second language. A two groups design was used in this phase. Middle school children with Hindi medium of instruction and examination, who were proficient in reading Hindi, were selected and indices of reading, spelling, writing and creativity were assessed. The children were divided into two groups i.e., good and poor second language readers on the basis of their global risk quotient scores.

Phase- II

A two group design was used for this phase. The two groups of children (good and poor readers) identified in Phase-I was assessed for Span (letter, word) and Speed (phoneme, semantic) of processing to L2 reading proficiency along with the mediating role of L1 in L2 processing.

SAMPLE

A purposive sample of 217 children (VII and VIII grade) was selected from Hindi medium schools of Rohtak district. Selection criteria of the children were the marks obtained in their preceding exams (SA-I) 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. DST-S was applied on 217 children and 50 poor and 50 good readers were identified on the basis of their global risk quotient scores.

Inclusion criteria:

i) Bilingual, Hindi as first language (more than 60 % marks in preceding exams), learning second language (English) in school.

ii) Less than 60 % marks in English in preceding examination.

Exclusion criteria:

i) More than 60 % marks in English in preceding examination.

ii) Child is dyslexic and/or has any other problems like behavioral problems, visual deficit, hearing impairment as reported by Teacher or is physically challenge.
TOOLS

The present investigator used a standardized tool, DST - S (Dyslexia Screening Test- Secondary) for screening of second language reading proficiency in Phase I. For assessment of structural correlates of reading proficiency, in Phase II, five tasks were prepared and standardized by the investigator.

Phase I

Screening Test: Dyslexia Screening Test – Secondary (DST-S) has been designed for screening diagnosis by Fawcett and Nicolson (2004). This test is for 11.6 years to 16.5 years age group. DST-S measures reading ability in English. The test consists of 12 subtests namely Rapid Naming, Bead Threading, One minute Reading, Postural Stability, Phonemic Segmentation and Spoonerisms, Two Minute Spelling, Backward Digit Span, Nonsense Passage Reading, One Minute Writing, Verbal Fluency, Semantic Fluency and Non Verbal Reasoning. 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 children. 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 index of which skills need support.

The present investigator used this test to screen good and poor readers in English as the focus of the present study was on identifying structural correlates of basic reading proficiency, for which identification of the correlates of reading proficiency which contributed to reading difficulties was required. Therefore, children whose second language was English and who were proficient in reading the first language (had obtained more than 60% marks in Hindi in the preceding annual examination) were taken, while above average scorers (more than 60%) in English were excluded from the sample. Thus, the continuum of English reader being assessed was restricted to readers who were poor or moderate on reading proficiency.
The children were administered DST-S individually. For each child double sided record form was used. One side of the record form was used to administer the test and the other side was for comparing the child’s scores with those expected for his/ her age, thereby deriving a ‘at risk’ score. Response sheet is used to score the results of each test (See Annexure- 1).

Description of the DST-S Subtests:

1) Rapid Naming

*Items/ Material:* Eight rows of pictures, with 20 familiar pictures in top 4 lines and same pictures repeated in next 4 lines.

*Dependent Variable:* Naming speed.

Rapid Naming means thinking of the names of objects, quickly and correctly. Visual naming represents a demanding array of other skills including attentional, perceptual, conceptual, memory, and lexical processes. Using a serial testing method, children are shown a row or column of outline drawings and must name each item sequentially, as fast as possible. Good readers are able to name words, rapidly and accurately. They don’t have to ‘think’ about it: It is as if the letters announce themselves in the ‘Mind’s Ear’. Poor readers are generally poor at naming of items. This test measures the time taken to name given outline drawings. Stopwatch is used to note down the time taken. For each mistake, 5 seconds are added to the total time taken by the reader. The time (in seconds) and the number of mistakes are recorded on the response sheet. Deficits in rapid naming are viewed as part of the phonological deficit in poor readers, which plays an important role in reading proficiency.

2) Bead Threading

*Items/ Material:* Basket with the 15 round wooden beads (25 mm in diameter with a hole of diameter 6 mm), Cord (40 cm long and 3 mm in diameter).

*Dependent Variable:* Hand- eye co-ordination

This test assesses finger dexterity and manipulative skill. The child is required to thread 15 large beads onto a string as quickly as possible, holding the string in their dominant hand. A basket is to be placed with the 15 round wooden beads (25 mm in diameter with a hole of diameter 6 mm) on the table in front of the child, and a cord (40 cm long and 3 mm in diameter) is given to the child for
threading. This test finds out how many beads the child can thread in 30 seconds. Stopwatch is used to note down the time taken. For each threaded bead, 1 mark is given, except for the first three beads threaded initially.

3) **One Minute Reading**

*Items/ Material:* There are two forms of the test A and B. Any form can be selected. There are 4 columns in each form and 30 words in each column are present in each card.

*D.V.:* Reading performance

The test assesses speed and accuracy of reading performance of the child. This test examines how fluent a child’s reading is under time constraints. Although there are two equivalent forms of the test (A and B), there is only one practice form (with 6 words on it). One mark is given for each word read correctly. There are 30 words in each column, and the gap between lines is slightly wider after every tenth word. Test is to be discontinued after 5 consecutive errors (ignore passes).

4) **Postural Stability**

*Items/ Material:* Balance Tester (yellow plastic device: it has a collar that slides on the internal shaft, with a felt washer to control the friction), Blindfold, 4 trials.

*D.V.:* Motor skill.

This test assesses the motor co-ordination. Basically Postural control relies to visual-motion processing and this is thought to be deficient in dyslexics. Control of posture is a complex multi sensorial performance based on visual, somatosensory and vestibule-ocular inputs. In this task, Balance tester and blindfold is used. Four trials are given (in two trials child is asked to put his/her arms by side and in next two trials child is asked to put his arms in front). Scores vary from push to push like if child does not move, a score of 0 is assigned, moves slightly 1 score, rises up on toes 2 score, take a small step forward 3 score, marked step forward 4 score. If two steps forward are taken, the score is 5 and for several steps taken a score of 6 is given. After four trials, the score on four trials is added to get the total score.
5(a) Phonemic Segmentation

*Items/ Material:* 12 words of English.

*D.V.:* Phonemic Segmentation ability.

This test assesses both phonological skill and working memory. Phonological difficulties are an established problem in dyslexia. This test assesses the ability to hear individual sounds in words, segment words into their component sounds and manipulate those sounds. In this test, words were presented to the child in auditory form and the child is asked to break them down into sounds. One mark for each word correct is given. If the child gets the first four words wrong or if three consecutive errors are there, the test is to be discontinued.

5(b) Spoonerisms

*Items/ Material:* 7 trials and each trial have 2 words.

*D.V.:* Phonological ability.

This test also assesses Working Memory, in addition to Phonological Skills. The child is asked to exchange the initial sounds of a pair of words (7 items). One mark is assigned for each correct response i.e., 2 marks per item pair (maximum score 14) is given. If child scores only 0 or 1 marks on first 4 trials, then the test is to be discontinued.

6) Two Minute Spelling

*Items/ Material:* Nine rows of words, 2 set of words (Easy and Moderate spellings), Easy spellings: 2 rows and 4 words in each row, Moderate spellings: 7 rows of words and 4 words in each row.

*D.V.:* Spelling and writing.

This test is an index of spelling fluency and handwriting analysis under the pressure of time. This is one of the most common signs of dyslexia. Dyslexic people are often able to spell much better when time is given to think. A pencil and paper is provided to the child. One mark per correct spelling is given. Last word written, hand used and handwriting quality is noted down on the score sheet. If a child gets two or more words of the first line wrong, the examiner moves back to the first line of the easy spelling test and if a child doesn’t face this kind of any problem, eight marks are added to the score for eight easier spellings. After 5 consecutive errors the test is to be discontinued.
7) Backwards Digit Span

*Items/ Material:* 14 rows where two successive rows consisted of same number of digits. Therefore, the first row consisted of 2 items and last row consisted of 8 items.

*D.V.:* Attention, working memory.

This test is an indicator of working memory and is one in which many dyslexic adults perform poorly. Digit span is the maximum number of digits the child can remember in the right order. Backwards Span represents the maximum number of digits a child can remember in reverse order. In this task, Digits are spoken at the speed of one digit per second and the child has to repeat them in a reversed order. One mark is given for each correctly repeated row. After getting two rows wrong of the same length, the test is to be discontinued.

8) Nonsense Passage Reading

*Items/ Material:* Two sets of Passage. Passage A: Age 11:6-12:5 (42 real words and 10 nonsense words), Passage B: Age 12:6-16:5 (53 real words and 10 nonsense words).

*D.V.:* Reading Fluency.

This test gives an indication of how well a child can recognize letter patterns and translate them into sounds. This test assesses the reading skill by mixing nonsense words with real words in a nonsense passage. There are two sets of passages, one for 11:6 to 12:5 years and one for 12:6 to 16:5 years and one practice test is included in the task. One mark is awarded for each real word read correctly, 2 marks for each correctly read nonsense word (given the benefit of the doubt for the plausible pronunciations), and 1 mark for a close try. One extra point is given as a bonus score for every 2 seconds less than a minute taken to read the passage, subjected to a maximum of 10 points. One point is subtracted as a penalty score for every 2 seconds above a minute where the maximum penalty cannot reduce the score by more than half. After 5 consecutive mistakes the test is to be discontinued.

9) One Minute Writing

D.V.: Writing fluency.

This test examines the speed and accuracy of transcription of a short passage. Different passage set are provided for each age group and one practice trial is there. An unlined paper and pen is given to the child. Punctuation errors are also penalized in this subtest. One point is awarded for each complete word, 1 extra point for every 2 seconds under the minute is given as a bonus score and 1 point is deducted for each 2 errors (omitted or spelled incorrectly). Handwriting quality and punctuation errors are also observed and noted down on the score sheet and marks are deducted according to the norms given in the Manual. After 1 minute the test is to be discontinued.

10) Verbal Fluency

D.V.: Verbal fluency

This test is a test of verbal fluency and speed of processing. How quickly a child can retrieve words starting with a particular letter or sound from long-term memory is tested. In this task, child is to speak aloud as many words as possible, beginning with S as he/she can, in a minute. Child is asked to give real words and proper nouns. One point is awarded for each different valid word given. No penalty for mistakes or repetitions.

11) Semantic Fluency:

D.V.: Semantic fluency.

This test is a test of semantic fluency i.e. a test of a creative memory for words. In this task child is asked to give the names of a particular category, e.g. animals. Slow learners have a tendency to perform less well on this test. One point is awarded for each valid example. No penalty is given for mistakes or repetitions.

12) Non verbal Reasoning:

Items/Material: Set of nine questions. Set 1: 2 minutes & 3 questions, Set 2: 2 minutes & 3 questions, Set3: 90 seconds & 3 questions.

D.V.: Reasoning ability.

This sub test assesses reasoning ability of the child. It gives a useful estimation of child’s non-verbal or fluid intelligence. Slow learners have a tendency to perform less well on this test. Nine set of questions divided in three groups and a practice trial for each group is used in this test. For two groups 2 minutes and for
third group 90 seconds are given to the child and the child is instructed not to spend too much time on each item. 1 point for each correct answer is given.

**Reliability:** Test-retest reliability varies from 0.63 to 0.99. Reliability is excellent (better than 0.9) for the tests of Reading, Spelling, Writing and Nonsense passage reading and reliability is above average (0.631) for Non verbal reasoning. 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. Test inter correlations vary from 0.10 to 1.00.

**Validity:** The test excluding Semantic Fluency has Face validity as an index of dyslexia.

**Phase – II**

The investigator conducted a pilot study in order to select the material, i.e. determine the letters and words used for letter span task and word span task in the study. The meaningful text used for letter cancellation task was also assessed to determine the difference in attentional deficits among good and poor readers. The words of lexical decision task were also assessed in order to determine how priming effects lexical fluency among good and poor readers. The words used in bilingual Hindi-English interference task were also assessed in the study. The details of the pilot work and the outcome have been detailed below.

**Pilot Work**

*Selection of alphabets for Letter Span task in L2:* For each sequence unrelated alphabets of English language were selected i.e., alphabets did not follow each other according to the alphabets pattern [P, Q, R, S etc.]. Alphabets were not to be repeated in each sequence. Alphabets were presented in auditory form. (See Appendix - II)

*Selection of material used in word span task (Discrete, Neutral Words) in L2:* A list of 100 neutral concrete words, in English, was prepared. All words consisted of minimum 4 and maximum 6 letters. Twenty children (ten good and ten poor readers) were asked to rate each of the 100 words on a three point scale (Frequently used, Average and Rarely used). The responses of 20 children were obtained and on the basis of the responses, those words which were rated as Average used by minimum 15 of the children were selected. From those words 77 words
Design and Methodology

were selected for the final study. Words were presented in auditory form. (See Appendix- III)

Selection of Passage used for Letter Cancellation Task in L2: Meaningful text passage was selected from a panchtantra story book. The worksheet was given to 10 children (5 good and 5 poor readers) and responses (number of correct cancelled alphabets and no. of wrong cancelled or omitted alphabets) were obtained. Consecutive 5 trials (1 minute for each trial) were given. Times New Roman, font style, 12.5 points text size and Bold character formatting style was applied. (See Appendix – IV)

Determination of words used for lexical decision task in L2: Initially, the words to be used for lexical decision task were prepared. Fifty six pairs of word i.e., one hundred twelve words, were selected, where the two words in each pair was associated with the other either phonetically or semantically. In each pair, first word was kept meaningful and second word(word or letter sequence) was associated with first word. After pairing, 30 pair of words was selected for the task. All words consisted of minimum 4 and maximum 6 letters. A computer program C++ was designed for showing words. Same font size but different exposure times were selected for the two words of a pair, where the prime word appeared after 1 second on the screen and after 0.30 seconds test word appears on the screen. The test was tried out on a sample of 10 children (5 good and 5 poor readers). Each child was asked to focus on the fixation point, after which a word was flashed on the screen, which was followed by a word. For the presentation, initially, the screen was blank. After a delay of 10 seconds a fixation point was flashed in the center of the screen. After a 5 seconds delay, the first word(prime) appears for 0.30 seconds which would be followed by the test word or letter string. The child was asked to judge as fast and accurately as possible whether the second string of alphabets was a word or non word and indicate by simultaneously pressing the “Z” key with Enter key on the computer keyboard if the second string of alphabets was a word and the “C” key with Enter key if the second string of alphabets was non- word. Reaction time was automatically recorded in the program. In this way, the reaction time of all the 10 children (5 good and 5 poor readers) on 30 pairs were collected and on the basis of the responses and time taken by good and poor readers 48 items or 24 pairs (which discriminates good and poor readers) were selected. The comparison of the response
time of the subjects for right and wrong identification of the test items was not found to be markedly different, and the subjects committed very few errors, therefore it was decided that the total time for the twenty four pairs would be taken as the measure of speed of processing at the word level. (Appendix- V)

Selection of words used in Bilingual Hindi-English interference task: The investigator proposed to assess the mediating role of L1 in L2 processing. Psycholinguistics have frequently used the Stroop paradigm to study the ability to control and regulate bilingual language processing (Gerhand, DerCgowski, McAllister, 1995; Goldfarb, Tzelgov, 2007; Lee& Chan, 2000) as being bilingual means having more than one active lexical representation to express the same meaning (Desmet, Duyck, 2007). While producing a word in L2, the bilingual person activates, in parallel, the lexical representations of words in both L1 and L2. The Stroop task is often used to study whether such a parallel activation from semantic representation (color meaning) evokes competition between lexical representations or one of the activated representations undergoes further inhibitory mechanisms leading to producing one correct color name in a required language.

After analyzing Stroop Interference task and its variants, it was felt that designing a similar task may provide a simple, yet effective tool for studying the interference of L1 in L2 and obtain indices of L1 and L2 processing along with it. This task deviated from the traditional Stroop word task and Interference task as the aim of using the task in the present study was different. The bilingual Stroop word task is used to study within language proficiency whereas Stroop interference task measures 'Restraint', an inhibitory process which occurs at the output level of processing. It is the prevention of automatic, momentarily inappropriate responses, from gaining control so that less probable, but appropriate responses may gain access to the processing system. In the present study this task was proposed to study the between as well as within language proficiency but, neither Bilingual Stroop Word nor Stroop interference task fulfilled the aim of the study, therefore to fulfill the present aim, five cards were designed by investigator.

Bilingual Hindi-English interference task provided measures on five different variables i.e. reading speed in Hindi (L1), Reading speed in English (L2), vocabulary in L2, phoneme awareness in L2 and mediating role of L1 in L2 reading. In the first card, Hindi script was used to study reading speed in Hindi (first
Design and Methodology

language), in the second card Hindi words in English grapheme was used to study the phoneme awareness, in the third card Hindi script was used (subject was to utter English equivalent of Hindi word) to assess the vocabulary in L2, in the fourth card English grapheme was used to study reading speed in English (L2) and in the fifth card Hindi words in English grapheme was used (child was to speak English equivalent of Hindi word written in English grapheme) to study the mediate role of L1 in L2. A list of 30 words (proper noun) was prepared. All words consisted of minimum 3 and maximum 7 letters. Each child was asked to rate each of the 30 words on a three point scale (Frequently used, Average and Rarely used). The responses of 20 children (10 good and 10 poor readers; 7 English medium & 13 Hindi medium) were obtained and on the basis of the responses, those words which were rated as average used by minimum 15 of the children were selected. From these words 21 words were selected for the study. Words were same in all the five subtasks. To write down the Hindi words in English grapheme, a Hindi teacher was consulted. All the words were presented in printable form. Text size 20 points and Times New Roman font style was selected for all the five cards. For card 1 and 3 Hindi font was used. The instructions for each card were written on the reverse side of the card. All the five cards were to be presented in a sequential order, without any time gap between the successive cards, and the time taken for completing each card was recorded, in seconds, with the help of a stop watch. The participants were instructed to answer quickly and accurately. Bilingual Hindi-English interference task was administered along with Stroop Interference task to the 20 children who were taken from Hindi medium /English medium schools, and the mean time taken for each card was compared for the two tasks by computing correlations. The correlations were found to range from 0.63 to 0.77 indicating that the task prepared by the investigator was measuring the interference. Text size 20 points and Calibri font style was used to show words in printed form.

On the basis of the pilot work the five tasks were designed. The details of these tasks have been presented below:

1) *Letter Span task in L2*

   *Items/Material:* Three sets, 11 rows where first row consists 2 items and last row consists 12 items.

   *D.V.:* Attention, Memory span for alphabets in L2
The task measures memory span in L2 and number of correct sequences are the index of the task. The task required the construction of three sets with 11 rows of alphabets in each, where the first row has 2 alphabets and one alphabet was increased in each subsequent row such that the last row has 12 alphabets (each set comprised of 77 letters in). Care was taken that no two successive letters were related according to alphabetic sequence. Letters were presented to the participants at the rate of one alphabet per second, in auditory form. Children are asked to recall all the letters in the same order immediately after the last alphabet was pronounced. They were advised to report the letters out of order than to not report it at all. One point was given for each correct sequence. A set was continued until the child failed to give a correct recall for two consecutive rows. After discontinuation of first set, second set was started i.e., investigator presented the letters in same way as presented for first set. Similarly, third set was also presented. After presenting all the lists, scores of the three sets was added and average was calculated. This average score was used for statistical analysis.

2) **Word Span task**

**Items/ Material:** Three sets of task, 11 rows whereas first row consists 2 items and last row consists 12 items.

**D.V.:** Attention, Memory span of words in L2.

The task measures memory span of words in L2 and number of correct responses were the index of the task. The task required the construction of three sets where in each set there were rows of two to twelve words, increasing in length by 1 word and a total of 77 words was used in each set. On each set words were presented at the speed of one word per second, in auditory form. Children were asked to recall all the words in the same order when the recall signal was given. They were advised to report the material out of order than to not report it at all. The task continued until the child failed on two consecutive sequences. Children were tested individually. One score was given for each correct sequence. The sequence had be correct to score one mark, so no score was given for a sequence if the words were in the wrong order. Scores were added for all the three sets and average score was calculated. This average score is used for statistical analysis.

3) **Processing speed task:** **Lower Level: Letter cancellation task in L2**

**Items/Material:** Worksheet of meaningful text, Pencil or Biro.

**D.V.:** Attention.
Letter cancellation tasks is a paper and pencil test widely used in clinical and research settings as quick measures of attention/concentration, visual-spatial scanning abilities or it can be said that task examines the speed and accuracy. The letter cancellation task consisted of a test worksheet which specified the target letter to be cancelled. Children are given a passage of meaningful text in English and are required to cancel the specific alphabet consecutively. Five trials were given to the child (one minute for each trial). A biro was given to the child for cancelling the alphabets. The child was asked to cancel as many of the target letter as possible in the specified time i.e., 1 minute. Numbers of alphabets cancelled were the performance score while number of omission or wrong cancellation are counted as measure of errors. One point was awarded as performance score for cancelling each correct letter in every trial and 1 point as error score for omission or wrong cancellation of each letter in every trial is awarded. Two index were decided (Speed and Accuracy) but on the speed index, there were no discriminable differences between the groups ($\lambda = 1.00$, $F = 0.027$), so, accuracy index was considered. To compute the accuracy percentage, obtained scores were divided by total number of possible scores and multiplied by 100. Accuracy percentage was considered for the final score.

4) **Lexical decision task in L2**

*Items/ Material:* Computer program.

*D.V.:* Speed, within language proficiency in L2.

The Lexical Decision Task is an implicit memory task in which children are given a stimulus (a string of letters), and asked to decide whether this string is a word or a non word. Response time was the index in the task. Non words were made by replacing at least one letter, adding one letter or omitting one letter in a word with another letter. In the Lexical Decision Task; children were required to make a forced-choice word/ non-word discrimination on stimuli presented (Visually). Selected 24 pair of words/ non words were used to design the task. The task consisted of a stimulus pair that comprised of either a pair of words or a word and a non word (the first word was kept meaningful). Lexical decision task measures time taken to decide that a string of letters primed by associated word is a word or non word. The task was administered individually on a computer with the C++ software. The 48 test items appeared in a randomized order, individually, and
centered on a computer screen. For the task, prime and target words were presented in one at a time in the centre of the computer screen. Initially, a fixation point (Ready) was presented for 1 second. Prime word appeared after 1 second on the screen and after 0.30 seconds test word appeared on the screen on the same location. The target word remains on the screen until the child responded. After the response was given by the child for the target word, next prime word appeared on the screen, after 1 second. Each word was preceded by an associated priming stimulus. The decision time of the child provides a measure of speed of processing in L2. The children were asked to focus on the fixation point and respond only to the second letter string. Children were asked to judge as fast and accurately as possible whether the string of alphabets was a word or non word. The children were told to press the “Z” key along with Enter key on the keyboard to indicate that the second string of alphabets was a word and the “C” key alongside Enter key to indicate that the second string of alphabets was a non word. Reaction times of every pair of word (i.e. from when participants saw the target word and pressed the response button with Enter key) were recorded automatically Time taken for all the twenty four trials is added and average is calculated for statistical analysis.

5) Bilingual Hindi-English interference task

*Items/ Material:* Five printed cards.

*D.V. Card I: Reading in L1*

*Card II: Phoneme awareness in L2*

*Card III: Between language proficiency*

*Card IV: Reading speed in L2*

*Card V: Transfer in L1 and L2.*

A Bilingual Hindi-English interference task was used to assess automaticity of lexical access in L2. Time taken was the index of the task. Between languages phonological and semantic interference and proficiency were studied by varying the nature of stimuli (Hindi & English words). This test measured between language and within language proficiency. The Bilingual Hindi-English interference task consisted of five cards. Each card comprised 21 items (proper noun) presented in 4 rows, with 4 items are there, while in 5th row only 1 item was there. The same set of words (21) is used in each card. Words were printed in Times New Roman 20 points, left
justified for English words and Kruti Dev 22 points, centre alignment for Hindi words. The instructions for each card were given on the reverse side. In card I words were given in Hindi and subject was asked to read out the words in Hindi. In 2nd card Hindi words in English grapheme were written and child was asked to read out the words as they were printed, in 3rd card Hindi word (grapheme) was written and child was asked to give the English equivalent of printed Hindi words; in 4th card English words were used and child was asked to read out the words in English, whereas in 5th card Hindi words in English grapheme were presented and child was asked to give English equivalent of printed words. Time taken was noted down for each card.

METHODOLOGY

Phase - I

In the initial stage, permission was taken from the Principals of different Hindi medium schools. After getting the permission, the children were contacted in their respective classes and their willingness to participate in the study was obtained. For Phase I, children were selected on the basis of selection criteria. First, child’s particulars were filled and rapport was established and to help the child to relax and reassured him/her, the following instructions were given:

“I am going to give you some puzzles and games to do. We will always have a practice trial to start off with to make sure you know what to do. We think these are mostly good fun, and we are going to start off by seeing how fast you can say the names of some easy pictures.” Then instructions for each test were read out to the child from Manual. The children were tested individually. Care was taken to ensure a comfortable and free-from-distraction testing condition: a separate room, silence, good lighting.

Most tests involved both a practice and a main test. The purpose of the practice was to make sure the child understood the task he/she was being asked to do. Several of the tests involved the ability to analyze speech. Double sided record form was used to score the results of each test. One side of the record form was used to administer the test and the other side for comparing the child’s scores with those expected for his/her age, thereby deriving an ‘at risk’ index. For a quantitative measure, score 3 for ---, 2 for --, 1 for -, 0 for the remainder, was used and all the
scores were added. To get the 'at risk quotient' (ARQ) the sum was divided by 12. An ARQ of 0.9 or greater was evidence of being at risk, and an ARQ of 0.6-0.8 was mild evidence of being risk. Then chart profile was completed. The profile started with the three critical tests, reading, spelling and writing. It then continued with three related tests, nonsense passage, Phonemic segmentation and Spoonerisms; and backwards memory span, and three other diagnostic tests, Rapid Naming, balance and bead Threading, and finally the two creativity tests, Verbal Fluency and Semantic Fluency; and Non-verbal Reasoning. Profile indicated difficult areas.

1) **Rapid Naming**

First card was shown to the child and quickly names of each picture were spoken. Then the child was given practice trial. After practice trial main test was conducted. Stopwatch was started when the child started naming and stopped when the child finished the whole sheet. Errors and time taken was noted down on the response sheet.

2) **Bead Threading**

After showing the material, demonstration was given to the child for threading the bead. After demonstration, required instructions were given. After finishing practice trial, main test was started. Instructions for main test were given from the Manual. Child was asked work as fast as he/she could. Stopwatch was started as the child touched the first bead and the child was stopped after 30 seconds. Number of beads strung were counted and noted down on the response sheet.

3) **One Minute Reading**

Practice form was shown to the child and instructions were given. In this task, the child was instructed to read aloud the individual words as fast as he/she could, without making mistakes. If child got stuck on a word, he was instructed to say 'pass' and go on to the next one. After practice trial main test was started. For main test either of form A or B was selected and then instructions were given. Stopwatch was started when the child started to say the first word and after one minute the child was asked to stop. E for each error and P for each pass was entered on the score sheet. The last word read was also noted down when the child completed the reading i.e. exactly after one minute.
4) **Postural Stability**

Children were asked to stand straight with feet together and both hands by their side. Now child was pushed gently in the back, and was instructed to try to stay as still as he/she can. 2 trials were done in the same position, and then the Child’s position was changed. This time child is instructed to put his arms straight out in front and then 2 more trials were conducted and scores were noted down on the response sheet.

5) a) **Phonemic Segmentation**

Instructions regarding breaking the words into sounds were given and 3 practice trials were given to the child. After practice trials, main test was started. Responses were noted down on the response sheet.

5) b) **Spoonerisms**

Instructions regarding switching the first letter of both words were given to the child and then practice trial was given to the child. After practice trial main test was started and responses were noted down on the response sheet.

6) **Two Minute Spelling**

Instructions for test were given to the child as mentioned in the Manual. Words were dictated to the child for practice test and hand used was also noted down. Then main test was started and for the main test child was asked to write down as fast and as legibly as he/she could. Child was intimated that if he/she was not sure of a spelling, then he/she was to just write down the way he/she thinks most likely. Stopwatch was started when first word was spoken to the child, and stopped after 2 minutes.

7) **Backward Digit Span**

Child was instructed to repeat aloud the digits being spoken by the investigator, but reverse in a backward sequence. Each set was stopped when the child was unable to repeat the digits on two consecutive trials. The maximum number of digits repeated correctly for each set was noted.

8) **Nonsense Passage Reading**

Child was instructed to read a given passage aloud for the practice trial and say ‘Pass’ if stuck on any word. After practice trial, main test was started. The main
test card appropriate for the age was given to the child. The stopwatch was started as soon as the child started reading, and stopped when he/she reached the end or has taken 3 minutes. Errors and Passes were noted down on the score sheet, and the time taken is recorded.

9) **One Minute Writing**

Child was instructed to copy the given passage as quick, accurate and as legible as possible. Time taken for practice trial was also noted down with stopwatch and feedback was given to the child. For the main test, age appropriate passage was given to the child and the child was asked to start. The test was stopped after one minute.

10) **Verbal Fluency**

For practice trial, child was instructed to think as many words as possible in a minute, starting with a particular letter. After practice trial, main test was started. Instructions for main test were given to the child who was asked speak out as many words as possible, starting with the letter S. The test was stopped after 60 seconds.

11) **Semantic Fluency**

For practice test, child was instructed to say as many names of foods items as the child could. After practice test main test was started. For the main part, child was asked to give names of animals. Test was stopped after 60 seconds.

12) **Non-verbal Reasoning**

First, practice trial was given to the child to make the child understand about the procedure for performing the tasks. One practice trial for each set was given. Stopwatch was started as child turned the card and after 2 minutes he/she was stopped for the first and second main task while for third main task 90 seconds were given.

For Phase II the students, who selected on the basis of DST-S, were tested individually on the 5 tasks, in the school in a separate room, where all the tasks were conducted in a single setting. The sequence of the tasks was varied across subjects in order to mitigate the effect of sequence and fatigue and a gap of 5 minutes was given between each consecutive test.

1) **Letter Span Task**

For administration of the Letter span task, the child was seated and the following instructions were given:
“I will say alphabet some aloud. You have to listen to the letters until the last alphabet is pronounced. Then, after listening to last alphabet, try to say the letters in the same order. So if I said a, r, you would say the same a, r. We will start with just two letters and then their number will be increase to three, and so on. Let’s have the practice first.” Practice test was given to the child. The child tried to recall the spoken alphabets. After practice trial main task was started. There were three sets in the task and each set was stopped when the child was unable to repeat the letters on two consecutive sequences. The maximum number of sequence of letters repeated correctly for each set was noted down and one mark for each correct sequence was given.

2) **Word Span Task**

For administration of the Word span task, the child was seated and the following instructions were given:

“I am going to say some words. You have to listen to the words. Then, immediately after I stop speaking, try to say the words in the same order. So if I said ‘cat, wall’, you would say the same ‘cat, wall’. We will start with just two words and then their number will increase to three, and so on. Let’s have the practice first.” Practice test was given to the child. The child then tried to recall them back. After practice set, main set was started. Instructions were same for main test. There were three sets in the task and each set was stopped when the child was unable to repeat the words on two consecutive sequences. The maximum number of sequence of words repeated correctly for each set was noted down and one mark for each correct sequence was given.

3) **Processing speed task: Lower Level: Letter Cancellation task**

For administration of the Letter cancellation task, the following instructions were given:

“Now I want to see how quick and accurate you can cancel the letters. Do the work as fast as you can. You are required to cancel the particular alphabet given to you in each trial. Let’s have a practice first. Start when I say go and cancel the letter specified. Ready,..... Go.” After one minute the child was asked to stop and feedback was given and instructed for the main task, “Good, now let’s try the main passage. Cancel the letters as fast as you can. Starts when I say go. Ready, Go”. The task was stopped after 5 minutes. One mark was given for each correct cancel alphabet. Accuracy scores were in terms of percentage.
4) Lexical Decision Task

For administration of the Lexical decision task, the child was seated in front of computer and the following instructions were given:

“In this task the words will be presented visually at the centre of the computer screen. First fixation word “Ready” will be presented followed by some words individually, which will appear in the center of the screen in the same location as the fixation word. You might initially see a flash of light or a word flash on the screen. Then a second letter string will appear. You are to decide as fast and accurately as possible whether the second string of alphabets is a word or non word. If it is a word then you are to press the “Z” key along with Enter key on the keyboard to indicate that the second string of alphabets was a word and the “C” key alongside Enter key to indicate that the second string of alphabets was a non word. Ready,..... Go.” 24 pair of words/ non words were used in the task. As subject responded to the target word, time taken in seconds was recorded in the software automatically and at the last of the task, time taken was noted down on the answer sheet.

5) Bilingual Hindi-English interference task

For administration of the Bilingual Hindi-English interference task the following instructions were given:

“There are five cards in the task. I am going to show you the cards one by one. You will be given the instructions for each card. In some of the cards you will have to read in English while in others you have to read in Hindi. Start reading from the upper left corner and proceed from the left to the right side, i.e. read each row. You are to speak aloud as fast and as accurately as possible”. Each card was placed in front of the child with the reverse side facing upwards. The instructions were read out and the card was turned over. Time taken for completing each card was recorded.

The response of the child on each card was scored as per the scoring pattern described in the tools section. The score obtained by each respondent in the two phases have been presented in Appendix B (i) and B(ii).

The Phase wise statistical analysis, results and discussion have been presented in the next chapter.