IMPLICIT LINGUISTIC PROCESSING

IN

BILINGUAL CHILDREN WITH LEARNING DISABILITY

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A

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CERTIFICATE

This is to certify that the dissertation entitled "***Implicit Linguistic Processing in Bilingual Children with Learning Disability***" is a bonafide work submitted in part fulfilment for the degree of ***Master of Science (Speech-Language Pathology)*** of the student Registration No. 09SLP033. This has been carried out under the guidance of a faculty of the institute and has not been submitted earlier to any other university for the award of any other Diploma or Degree.

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DECLARATION

This dissertation entitled "***Implicit Linguistic Processing in Bilingual Children with Learning Disability***" is the result of my own study under the guidance of Dr. K. C. Shyamala, Professor in Language Pathology, Department of Speech-Language Pathology, All India Institute of Speech and Hearing, Mysore, and has not been submitted earlier to any other university for the award of any Diploma or Degree.

Mysore,
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Register No. 09SLP033

By the grace of God

In the fond memory of

Dr. VIJAYALAKSHMI BASAVARAJ

We love you Ma'am

With Blessings From

Mummy

Pappa

Amma

Thatha

Dedicated

To

My Guide

Dear

Shyamala Ma'am

Bowing with deep respect

to a

very very special teacher

"Savithri Ma'am"

And Love…

Priyanka

…Oli…

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CHAPTER I

INTRODUCTION

Language has been conveniently thought of as a rule governed system which could be used to express ones thoughts and feelings. This is only possible due to the fact that language is a form of representing ideas and emotions. For one to understand, mediate or express this representation, it requires the individual to possess certain processing abilities. These abilities are what are referred to as 'linguistic processing abilities'.

Linguistic processing has in its scope, the study of how one decodes information that arrives in the form of linguistic symbols, how it is integrated with existing internal representations, and how expression through similar codes is encoded. However, nature is such that a supposedly complex conceptualization of linguistic processing is hardly ever noticeable as the output is generously simple as it is discussed either in terms of the ability to understand language or to express it. This difficulty in explaining the implicit information through the explicit responses has led several scholars of cognitive-, neuro-, psycho-linguistics to establish methods of investigating the implicit linguistic processes.

The simplest and the most direct examination of implicit processes involved in linguistic processing have been made possible using a 'priming' paradigm. The idea involved in this approach is that if any entity (target) is preceded by another entity (prime) at certain duration before it, the preceding entity may influence the explicit response of the following entity. The influence may be positive or negative depending on the nature of the preceding entity and its relationship with the succeeding one (Glasger & Dungelhoff, 1984). It can be conveniently argued that this phenomenon of

priming should follow a predictable pattern in the typically developing and typical adult population at large. The scenario may be clear only until the same concept is thought of in populations that demonstrate deviations from the norm in terms of explicit linguistic skills (speaking, understanding, reading, and writing).

This generic introduction brings us to the subject matter of the current study. The study attempts to investigate implicit linguistic processing abilities in a bilingual clinical population. The clinical population chosen are bilingual children with 'Learning Disability (LD)'. This population has been chosen as it suffers from a holistic disruption of language. The National Joint Committee on Learning Disabilities' (NJCLD, 1988) definition of LD illustrates the same. According to them, "Learning Disabilities is a general term that refers to a heterogeneous group of disorders manifested by significant difficulty in the acquisition and use of listening, speaking, reading, writing, reasoning, or mathematical abilities. These disorders are intrinsic to the individual, presumed to be due to central nervous system dysfunction, and may occur across the life span. Problems in self-regulatory behavior, social perception, and social interaction may exist with learning disabilities but do not by themselves constitute a learning disability. Although learning disabilities may occur concomitantly with other handicapping conditions (for example, sensory impairment, mental retardation, social and emotional disturbance) or with extrinsic influences (such as cultural differences, insufficient or inappropriate instruction), they are not the result of these conditions or influences". The present study considers the participants on the basis of the first half of the definition, excluding LDs associated with other conditions. As 'Learning Disability' is a largely unobservable construct, the investigation of implicit processes becomes imperative.

There have been a few studies in literature that have explored implicit linguistic processing in children with Learning Disability. Booth, MacWhinney and Perfetti (1999) investigated the effects of non-word primes of short and long durations in poor and good readers and found that short duration priming effects were limited to good readers. Nation and Snowling (1999) investigated the effects of two types of semantic priming (categorical and functional) in a group of participants with poor reading comprehension. It was found that they performed better on functionally related words than on categorical pairs illustrating that individuals with reading problems may have a specific type of semantic deficit in addition to problems at lower levels of processing. Assink, Bergen, Teeseling and Knuijt (2004) compared orthographic priming effects using related, unrelated and neutral primes (without script, # marks) in 11 year old poor readers and reading-age matched typical children. It was found that the groups did not differ in the effects of the related and unrelated prime conditions, but differed in the neutral prime condition with the poor readers being significantly slower than the controls. In 2006, Boada and Pennington discovered that children with Learning Disability who were poor readers had less mature implicit phonological representations. Betjemann and Keenan (2008) found that children with Reading Disability had deficits in both phonological and semantic priming when tested using auditory and visual lexical decision tasks. Gnanavel (2009) also found that children with dyslexia performed poorly compared to children without dyslexia on reaction time tasks. Thus, it is evident that children with Learning Disability have some form of implicit linguistic processing deficit. However, the evidence from the existing body of work is not sufficient enough to conclude regarding the implicit linguistic processing deficits in Learning Disability from

multiple perspectives. This necessitates the utility of a comprehensive framework or model to be considered prior to investigating further.

The present study bases itself on a comprehensive model of language processing for single words given by Patterson and Shewell (1987), called the 'Logogen Model of Word Processing'. The modified version of the model (Whitworth, Webster & Howard, 2005) clearly delineates the various levels and modules involved in processing single words. It is represented as follows:

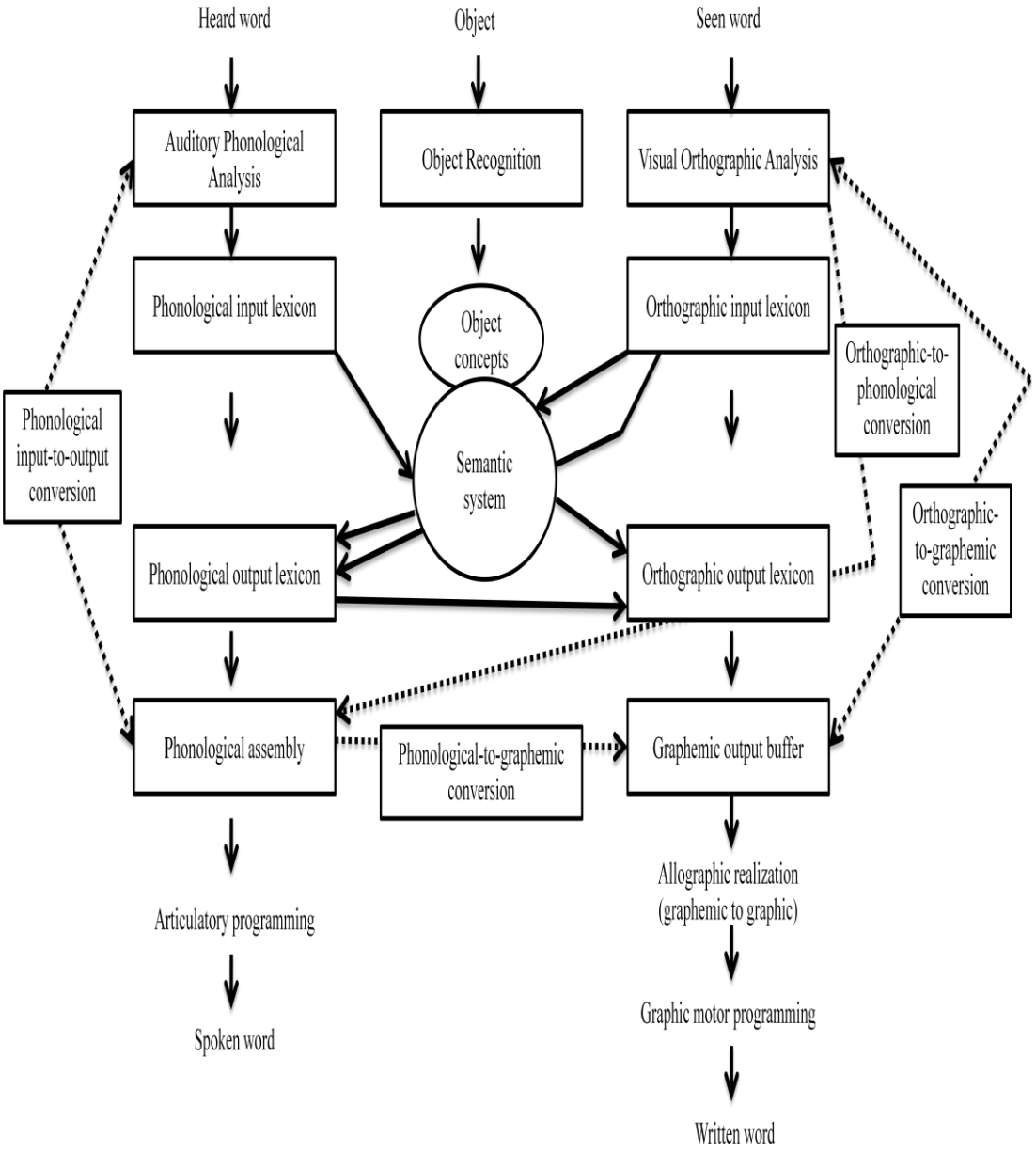

Figure 1.1. Modified Representation of the 'Logogen Model of Word Processing' (Patterson & Shewell, 1987).

According to the model, the selection of a lexeme is governed by the route of access to and from the semantic system. The three major routes illustrated are phonological, orthographic and object or picture based. This implies, that the lexical entities could be accessed through the auditory channel (phonological) or the visual channel (orthographic and object/picture-based, unless tactile). Likewise, the lexical entities could be expressed through the phonological-articulatory channel or the graphemic-motor channel. The current study considers this multi-channel processing of linguistic units in order to investigate relative effects of one channel over the other in children with Learning Disability. It also attempts to understand Learning Disability as a group that may use salient processing strategies compared to the typically developing population.

The conceptual idea of the model is incorporated in the design of the present study through a 'Naming' task. A simple task of eliciting a naming response on the presentation of a picture as stimulus, encompass several internal processes ranging from perception of the image to the selection of the lexeme to the production of the word. When this multi-stage process of naming is influenced by the addition of a 'prime' introduced independently through each of the channels mentioned in the model, the responses observed may very well be a reflection of the implicit processes at work. Thus, the study uses a 'Naming' task in the influence of a 'Priming' paradigm.

The present study uses a set of 13 types of 'prime-target' pairs designed by the investigator for the 'Naming' task. The 13 types of pairs are decided on the bases of the channels illustrated in the Logogen model and the possible linguistic relations that two linguistic entities posses at a word level. The 'target' stimulus is chosen to be presented pictorially, as its naming would be through the direct route of access from

the semantic system. The ‘primes’ however are presented through either of three input channels given in the model, the auditory-phonological channel (called ‘phonological’ in the study), the visual-pictorial channel (called ‘pictorial’ in the study) or the visual-orthographic channel (called ‘orthographic’ in the study). In each of the three modalities of presentation of the prime, four possible linguistic relations form a set of twelve ‘prime-target’ pairs in all. The four linguistic relations chosen are such that they represent most facets of linguistic processing at the organizational level of language. They are ‘repetition’ (prime was same as the target), ‘semantic’ (prime belonged the same lexical category as the target), ‘phonological/orthographic’ (prime had the first phoneme and corresponding grapheme in common with the target) and ‘unrelated’ (prime had no semantic or phonological/orthographic relation with the target) relations. Thus, the stimulus comprise a variety of ‘prime-target’ relations, each to be presented through the different modalities or channels of linguistic processing; which is central to the idea of investigating implicit linguistic processing in a holistic manner at the single-word level. The thirteenth ‘prime-target’ pair is the ‘No Prime’ condition where the target picture is preceded by an empty screen.

The ‘prime-target’ pairs are presented in the current study at a ‘Stimulus Onset Asynchrony’ (SOA) of - 400 milliseconds. Stimulus Onset Asynchrony refers the duration between the onset of the prime and the onset of the target stimulus. This value is chosen due to the findings of a study by Glaser and Dungelhoff (1984) where it was found that long negative SOAs (- 400 ms) yielded faster response in naming when the prime was a semantically related word compared to when the prime was unrelated. Also, it has been largely documented that long negative SOAs elicit the maximum facilitatory effects of related ‘prime-target’ pairs while short negative SOAs elicit no differences between related and unrelated ‘prime-target’ pairs and very

short negative SOAs elicit a reverse pattern of responses. As the facilitatory effect of related 'prime-target' pairs were observed at this SOA in this systematic study, and no conclusive evidences regarding the best SOA for the other types of prime are documented in literature, in order to keep the SOA constant for all the types of 'prime-target' pairs (except 'phonological' where the duration of the word was the duration of the prime), - 400 ms is selected.

The current investigation opts to evaluate the 'Reaction Time' of the 'Naming' responses. Reaction time is considered as most of the previous investigations (Booth, MacWhinney & Perfetti, 1999; Nation & Snowling, 1999; Assink, Bergen, Teeseling & Knuijt, 2004; Boada & Pennington, 2006; Betjemann & Keenan, 2008; Gnanavel, 2009) on implicit linguistic processing in Learning Disability/Dyslexia/Reading Disability have used the same measure, although the tasks have been minimally different.

To date, no study in the Indian sub-continent has attempted to investigate implicit linguistic processing in children with Learning Disability with a holistic approach to processing. The present study is the first of its kind in that it aimed to explore the multi-dimensional aspects of implicit linguistic processing in Learning Disability in one design of research. The population accessible in India to the investigator during the period of study is mainly Kannada-English bilingual individuals. Hence, the participants of the study are Kannada-English bilingual children with and without Learning Disability. The study uses 'English' as the language of testing as the children are chosen from the population attending schools with English as their medium of instruction, particularly because orthographic priming forms a significant component of the study. In addition, findings with English

could be compared with the existing global evidence for better understanding of the issue.

1.1 Need for the study

Children with Learning Disability have been found to have deficits in various processing domains. But, the relative impact of each of the routes of lexical access has not been studied using a single paradigm. It becomes imperative to investigate various processes using the same paradigm as even a change in a single variable could yield results that may not be feasible for comparison. The present study provides a holistic view of the implicit networks at work on a basic explicit task. The study is of current need simply, due to the increasing number and variety of children with LD; where some present with pure writing and reading errors, some with reading comprehension deficits, some with phonological processing deficits etc. The method of investigation of the current study would be useful clinically, to tap the specific deficit areas and the findings would also offer directions regarding intervention strategies. In the Indian context, where most of the population is bilingual if not multilingual, and studies of this nature are hardly available, this study is certainly warranted.

The study thus aims at investigating implicit linguistic processing in Kannada-English bilingual children with and without Learning Disability on an explicit task such as 'Naming' using an implicit 'Priming' tool.

1.2 Objectives of the study

1. To compare and contrast the implicit linguistic processing abilities of Kannada-English bilingual children with Learning Disability and typically developing Kannada-English bilingual children

2. To compare and contrast the effects of the 13 ‘prime-target’ conditions on picture naming in Kannada-English bilingual children with Learning Disability
3. To compare and contrast the effects of the 13 ‘prime-target’ conditions on picture naming in typically developing Kannada-English bilingual children
4. To compare and contrast the effects of phonological, orthographic and pictorial priming (modality of presentation of the prime) on picture naming in Kannada-English bilingual children with Learning Disability
5. To compare and contrast the effects of repetition, semantic, phonological/orthographic and unrelated priming (relation between the ‘prime’ and ‘target’) on picture naming in Kannada-English bilingual children with Learning Disability
6. To compare and contrast the effects of phonological, orthographic and pictorial priming (modality of presentation of the prime) on picture naming in typically developing Kannada-English bilingual children
7. To compare and contrast the effects of repetition, semantic, phonological/orthographic and unrelated priming (relation between the ‘prime’ and ‘target’) on picture naming in typically developing Kannada-English bilingual children.

CHAPTER II

REVIEW OF LITERATURE

The present study focused on investigating the implicit linguistic processes that influence picture naming in bilingual children with Learning Disability and typically developing bilingual children with the use of a comprehensive priming-based stimulus set. The current study emerged due to the keen interest generated by studies on both these populations that led to the discovery of some very complicated findings. The outcome of the research in this area had been influenced by several factors such as the nature of the task, the type of prime, the composition of the prime, the temporal parameters considered between the 'prime-target' pairs, the modality of presentation of the prime and target, the relationship between the prime and target, the age of the population under consideration, the diagnostic/descriptive terms used for the purpose of selection of the participants, the variability in perspectives and theoretical bases etc. This diversity in research, although had been of significant advantage, called for a venture in to collating information for the purpose of conceptualizing a comprehensive research framework to arrive at an integrated explanation. Hence, an account of the existing body of work in this arena had been made.

2.1 The beginning of implicit linguistic investigations in Learning Disability

The early work in the area of Learning Disability with reference to understanding the effects of implicit networking for linguistic entities began through studies that incorporated 'priming' paradigms. The 'priming' principles that were gaining pace with investigations of typical individuals, gradually made its entry in to the fields of 'Learning Disability' or 'Dyslexia' or 'Reading Disability' or 'poor

readers' in the 1980s. The central idea that led researchers to consider 'priming' for this population was the well documented 'contextual effects' on reading or word recognition (particularly, sentence context) in poor readers (Stanovich, 1980). Sentence primes were used in the early experiments and the findings were positive in terms of word identification accuracy and speed (Stanovich, 1980; 1984). Merrill, Serber and McCauley (1980) were among the earliest to use single word primes in experiments with poor readers. They found no differences between good and poor readers in the semantic priming effects. Simpson, Lorsbach and Whitehouse (1983) also used single word primes and interestingly found that semantic priming effects were greater in poor readers compared to good readers. The research that followed gained impetus gradually and the designs of the studies became more specific.

2.2 Change in perspective: multi-modal implicit processing using priming in Learning Disability

In 1985, Perfetti added another dimension to the priming experiments that were in vogue then, by investigating the priming effects across modalities. Semantic primes were presented to children with 'Reading Disability' through the visual (written word) and auditory (speech) modalities. He found no significant semantic priming effects in both the conditions, which led to the speculation that children with 'Reading Disability' may have broader deficits in terms of activation of semantic representations. This minimally dispensed the thought that deficits in reading were only due to difficulties in mapping the orthographic input and converting in to phonological representations. The study came as a support to the possibility of parallel deficits in implicit semantic processing as was being reported for explicit semantic abilities (Mann, Liberman & Shankweiler, 1980; Mann, Shankweiler & Smith, 1984; Bjorklund & Bernholtz, 1986). The results of the study opened the door

for future experiments on the implicit nature of the semantic system in individuals with Learning Disability.

2.3 Additional evidences for priming in Learning Disability: ERPs

The turn of the next decade saw a new breed of experimental methods being employed. The 'priming' stimuli were combined with event related potentials (ERPs) to substantiate the evidences for implicit deficits. Stelmack and Miles (1990) studied visual ERPs in normal and disabled readers for a recognition memory task for 'primed' and 'unprimed' words. The 'primed' words had words with the same denotative meaning as the target word as primes, where as the 'unprimed' words were preceded by words with no meaningful association with the target. N_{400} (around 455 milliseconds) was found to be higher in amplitude for 'unprimed' words compared to 'primed' words in the normal group. However, the disabled group had reduced N_{400} amplitude for 'unprimed' words too indicating their failure to engage information from the stored memory (necessary to find similarities between the prime and target) while the short-term linguistic processing was relatively typical. The same authors in the year 1994 obtained ERPs for both auditory (spoken word) and visual (picture) primes (both semantically related and unrelated) in three groups of children with Learning Disabilities and a control group. The N_{450} was found to be higher in amplitude for the 'unprimed' condition than the 'primed' on both the pictorial and spoken word presentations in the control group. The group which scored deficiently on tests of arithmetic resembled the control group for the 'unprimed' condition when the prime was presented as a spoken word only. The groups with deficient performance on tests of reading and spelling and on tests of both arithmetic and reading and spelling did not follow the pattern of the control group for the 'unprimed'

condition. The findings indicated that ‘Learning Disability’ may manifest differently across individuals and that these differences could be tapped using implicit tasks.

The variability in the responses across modalities and different ‘prime-target’ relations was evident from the above research. Thus, researchers attempted to evaluate each of these aspects exclusively in greater detail in the future studies.

2.4 Semantic priming in Learning Disability

Nation and Snowling (1999) investigated the effects of two types of semantic priming, categorical and functional on children with good and poor reading comprehension abilities. The association strength of each of the functional and categorical ‘prime-target’ pairs were rated as low or high. The children with good and poor comprehension, both were primed by functional primes irrespective of their association strength. The categorical primes did not elicit the same effects across the two groups. Priming was positive for children with good comprehension irrespective of the association strength. The children who had poor reading comprehension abilities however, did not experience positive priming for categorical primes if their association strength was low. On the other hand, if their association strength was high, the priming effects were evident. The findings revealed the significance of association strength, with reference to children with poor comprehension of text.

In another study of a similar kind by Assink, Van Bergen, Van Teeseling and Knuijt (2004) where the effects of categorical and thematically associated primes were compared between normal and poor readers (aged 11 years), no effects of the type of association or the degree of association was observed. The study had also investigated the effects of related, unrelated and neutral primes which showed that both good and poor readers responded at short latencies for related primes followed

by unrelated primes and neutral primes respectively. The authors supposed that this pattern occurred due to the dependency in the neutral condition on grapheme-to-phoneme correspondence, while lexical mediation would have supported for both the related and unrelated primes, although differently. The difference between the two groups was in terms of the additional delay shown by the poor readers in the neutral prime condition, possibly indicative of a greater difficulty in grapheme-to-phoneme conversion in poor readers.

2.5 Implicit phonological deficits in Learning Disability

Implicit phonological deficits had been studied mainly using three types of tasks: priming, lexical gating and syllable similarity. In 2006, Boada and Pennington used all the three measures to find differences between 11 to 13 year old children with 'Reading Disability' and 'Reading Age' and 'Chronological Age' matched controls. The findings of the priming task clearly demonstrated the deficits in phonology. The target words of the 'prime-target' pairs were lexically gated at 120 milliseconds and 240 milliseconds. These gated items were presented as primes. It was found that children with 'Reading Disability' could not be primed by the '120 ms' prime, but were primed by the '240 ms' prime. The other two groups were primed in both the conditions. Differences between the groups were found on all the tasks. The authors commented that the phonological representations in children with 'Dyslexia' were less mature than the other groups. On the contrary, Griffiths and Snowling (2001) had found no significant differences between three such groups on lexical gating. Thus, there remained a lot be explored in terms of implicit phonology.

2.6 Semantic priming Vs phonological priming in Learning Disability

Betjemann and Keenan (2008) explored the differential effects of semantic and phonological priming using visual and auditory lexical decision tasks for children with 'Reading Disability'. The absence of semantic priming was common across the two tasks confirming that the semantic system was not modality dependent. The phonological/graphemic prime caused priming on the auditory lexical decision task, while it did not on the visual lexical decision task. This was possibly due to the modular routing of phonological input, and the damage occurring only in this module. The studies comparing semantic and phonological priming effects had come up with equivocal findings. Jednorog, Marchewka, Tacikowski and Grabowska (2010) examined children with 'Dyslexia' and a control group using ERPs obtained for semantic and phonological priming-based stimuli. In the control group, N_{400} was enlarged to both primes for incongruent words relative to congruent words. The semantic priming effects in children with dyslexia were similar to the control group, with the only difference being a minimal delay of the response. The phonological prime however exhibited a reverse pattern of N_{400} with reduced amplitude for the incongruent pairs and enhanced amplitude for the congruent pairs. Thus, the results of this study demonstrated a greater degree of implicit phonological processing deficits compared to semantic deficits in terms of the resolution of phonological similarities and differences in quick time.

2.7 Phonological priming Vs orthographic priming in Learning Disability

In 1999, Booth, Mac Whinney and Perfetti compared second to sixth grade children with good and poor reading abilities on non-word priming tasks (orthographic, pseudo-homophonic and control primes) where the duration of the target display was either 30 or 60 ms. The primes were presented for 30 ms in upper

case letters followed by the target in lower case letters without any inter-stimulus interval. In addition to naming, the responses were also in the written mode. In the good readers, accuracy of the responses was least where no letters of the prime and target matched (control prime); followed by orthographic and pseudo-homophonic primes yielding more accurate responses. Both the primes were effective even in the poor readers, only for the 60 ms target display. The pseudo-homophonic prime however, continued to elicit priming effects in poor readers even for 30 ms target displays, although they were not as robust as was seen with good readers. This led to the speculation that poor readers may have deficits in implicit phonological and orthographic representations.

Brain activation for phonological and orthographic inputs was studied by Temple, Poldrack, Salidis, Deutsch, Tallal, Merzenich and Gabrieli (2001) in 8 to 12 year old children with 'Dyslexia' and children with normal reading abilities. The fMRI data showed reduced activation for dyslexics on rhyming and matching letter pairs, indicative of a neural basis for deficits in the phonological and orthographic processes essential for reading. Savill and Thierry (2011) attempted to discover, which among the phonological and orthographic primes would elicit earlier priming/no priming effects in developmental dyslexics and control adults using ERPs. The pseudo word – word priming task was used. The responses were obtained for phonological, orthographic and combined prime conditions. Orthographic modulations (between 'primed' and 'unprimed' conditions) were observed in the control group in the N_1 range, but were absent in dyslexics indicating that orthographic analysis had not occurred. For phonological primes, the two groups could not be differentiated until P_{600} where the dyslexic group showed attenuated priming compared to the controls. These findings pointed towards differences in the

temporal aspects for deficits in the resolution of phonological or orthographic confusions, although both routes demonstrated the presence of implicit deficits.

2.8 Evidence for differences in implicit processing in Learning Disability

Howard, Howard, Japikse and Eden (2006) compared the differences between higher order implicit sequence learning and spatial configurational processing in college students with 'Dyslexia'. They found startling differences between the tasks. The students performed poorly on the former task only. This was explained as being due to an increased difficulty in integrating temporally non-adjacent elements in dyslexics. The authors proposed that the findings meant that although implicit linguistic processing was affected in Learning Disability, their effects were not uniform.

Thus, research on individuals with Learning Disability had been pointing towards the presence of implicit semantic, implicit phonological and implicit orthographic deficits on tasks or measures ranging from fMRI to lexical decision. In the present study, 'Naming' was chosen as the explicit task, on the basis of whose response the inferences on implicit linguistic processing was to be made. The reason for choosing this task was that it was the simplest and earliest of all explicit linguistic responses. In addition, the task allowed for systematic manipulation of the 'prime-target' pairs. Typical individuals had been studied in great detail using 'Naming' tasks, which allowed for comparisons with the target population of the current study. The following review is with reference to these issues.

2.9 Pictured object naming

The current study used the 'Pictured Object Naming' task (henceforth called 'Picture Naming') to obtain reaction times, representing the implicit processes. The

comparison of this task with another similar task in 'Word Naming' was done by Ferrand, Grainger and Segui (1994) on orthographic and phonological primes that were either repetition primes or pseudo-homophones. The findings indicated the existence of functional modularity in that the responses to picture naming were faster when the primes were phonological and the responses to word naming were faster when the primes were orthographic. The authors opined that in picture naming, the activation of the phonological prime would have facilitated the phonological lexicon activation for the target, while the activation of the orthographic prime would have facilitated the activation of the phonological lexicon for the target only after the activation of the orthographic lexicon followed by the activation of the phonological lexicon for the prime. With reference to the word naming task, the orthographic primes would have directly activated the orthographic lexicon for the target, while the phonological primes would have followed the indirect route of activation, with the activation of the orthographic lexicon for the prime through its phonological lexicon. Thus, the findings pointed towards the activation of whole word phonological representations for pictures according to the researchers.

Grainger and Ferrand (1996) compared the effects of masked orthographic and phonological priming (non-word prime) for 29, 43 and 57 milliseconds on three tasks namely, word naming, lexical decision and perceptual identification. All the three responses were facilitated through both primes if the primes were such that only the initial phoneme/letter was not the same between the prime and target. With reference to word naming, the authors found that only orthographic overlap facilitated the target at 29 ms, while phonological overlap did not facilitate the targets for any duration of the prime. The word naming results were thus different from the results of the other tasks.

Johnson, Paivio and Clark (1996) in their review article, concluded that picture naming comprised three basic stages. They were 'Object Identification', 'Name Activation' and 'Response Generation'. This implied that picture naming could be influenced by factors that altered object recognition, name activation or response generation. A priming-based tool was to be used in the present study on this basis; and was also well supported by the modified version (Whitworth, Webster & Howard, 2005) of the 'Logogen Model of Word Processing' (Patterson & Shewell, 1987).

Also, as early as 1976, Denckla and Rudel found that children with dyslexia performed slower than normal controls on a picture naming test. Thus, 'Picture Naming' appeared to be an appropriate task for the purpose of the study.

2.10 Priming in typical individuals

Typical individuals had been participants of numerous researches using priming-based tasks. In most of the studies, typical individuals belonged to control groups and their findings have already been reported under their respective sections. Semantic, phonological, orthographic and repetition priming had all been investigated. A brief account of a few studies is provided here with the purpose of highlighting some established effects.

Ferrand, Humphreys and Segui (1998) investigated the effects of masked repetition and phonological (homophones) priming on picture naming. They found that repetition primes were facilitative for the naming of target pictures irrespective of the frequency of occurrence. On the other hand, homophones primed low frequency targets better than the high frequency targets. In addition, the effects of repetition priming were comparable to the effects of homophone priming for high frequency

homophone primes. This indicated that if the frequency of occurrence of the primes were controlled, repetition and phonological priming could yield similar effects in typical individuals.

Alario, Segui and Ferrand (2000) investigated semantic and associative priming in picture naming four experiments. The two types of prime were presented at stimulus onset asynchronies (SOAs) of 114 ms and 234 ms to arrive at four experimental conditions. The results indicated no uniformity either between relations of the prime and target or between the SOAs. The semantic (coordinate pairs) relation showed interference at the SOA of 114 ms, while there were no differences between the associative and unrelated prime conditions at this SOA. The effect of the semantic prime disappeared at the SOA of 234 ms, but a significant facilitatory effect of associative prime was emerged. The authors argued that the implicit findings pointed towards the presence of atleast two types of meaning relatedness.

In a more recent study by Gonnerman, Seidenberg and Anderson (2007) using a lexical decision task, a significant conclusion was made with reference to the effects of usage of graded stimuli as primes. They found that the magnitude of priming was almost directly proportional to the degree of similarity between the ‘prime’ and ‘target’ in terms of semantic and phonological overlap.

Bi, Xu and Caramazza (2009) attempted to evaluate the effects of phonological and orthographic primes by separating their inter-dependence effects by using the logographic script of Mandarin-Chinese for primes on a picture naming task. The results revealed that both phonologically and orthographically related primes were facilitatory independently. But, the extent of facilitation through orthography was interestingly more.

2.11 Developmental influence on priming

The present study considered as participants, children in age range of 7 to 12 years. Hence, a brief account of the studies that demonstrated developmental trends in priming in typical individuals was made. Perraudin and Mounoud in 2003 investigated the effects of unrelated, categorical and functional primes on picture naming using a 250 ms prime presentation and inter-stimulus interval of 150 ms on 48 children aged 5, 7, and 9 years respectively and 22 young adults. The results showed that functional relations were facilitative at 5 years of age while categorical primes were similar to the unrelated primes. In all the other groups, both categorical and functional relations elicited faster naming compared to the unrelated primes. The same authors in the year 2009 replicated the findings of the previous study in addition to finding that neutral primes were similar to the unrelated primes. These findings indicated that implicit categorical connectivity was established after functional networking was achieved, not that the former was a pre requisite. Ganesh and Subba Rao (2009) found that 5 to 6 year old school going children were primed by auditory presentation of semantic primes.

The findings of the existing literature were thus found to be largely inconclusive, although broad inferences had been drawn in terms of the presence of facilitation through priming using various types of stimuli on a variety of tasks in typically developing children and children with Learning Disability. Several factors affected the generalization of the findings of the existing body of work. They were stimulus related (semantic, phonological, categorical, functional, associative, orthographic, repetition, non-word, pseudohomophone, homophone and gated primes; and visual word, spoken word, pictorial, masked priming routes), response related (reaction time, accuracy, ERPs), task related (picture naming, word naming, lexical

decision, word recognition, gating), time related (prime duration, target duration, masker duration, prime position, stimulus onset asynchrony) and participant related (children, adults, poor readers, good readers, reading age-matched participants, children with good reading comprehension and children with poor reading comprehension; use of diagnostic labels such as Learning Disability, Reading Disability, Dyslexia). Atleast some of the factors that led to this extensive variation had to be examined under one roof to get a holistic idea of the findings. The present study was thus necessitated. It was conceptualized from an attempt to consider as many stimulus related variables as possible on the basis of a specifically holistic psycholinguistic model of word processing to understand the implicit linguistic processing abilities of children with Learning Disability in comparison with age-matched typically developing children.

CHAPTER III

METHOD

The present study attempted to investigate the similarities and differences within and across typically developing bilingual children and bilingual children with Learning Disability on a naming task with a 'priming' based stimulus specifically designed to tap their implicit linguistic processing abilities.

3.1 Participants

Two groups of participants were considered for the study. The first group comprised 6 bilingual children with Learning Disability aged between 7 to 12 years. The second group comprised 5 age-matched typically developing bilingual children.

3.1.1 Participant selection criteria

1. The participants of both the groups had to be Kannada-English bilinguals, with Kannada as their mother-tongue and English as their medium of instruction in school.
2. The participants of the first group had to be diagnosed as having Learning Disability by a qualified Speech-Language Pathologist/Psychologist.
3. The participants of the second group had to be matched pair-wise with the chronological age of the participants of the first group.
4. The participants of the second group had to have no positive history of speech, language, hearing, psychological and neurological problems.

3.1.2 Participant details

The details of the participants chosen in Groups 1 and 2 are depicted in Tables 3.1 and 3.2.

Table 3.1

Details of the participants of Group 1

Participant Code	Chronological Age	Gender
LD 1	7 years	Male
LD 2	8 years	Male
LD 3	9 years	Female
LD 4	9 years	Male
LD 5	11 years	Male
LD 6	12 years	Female

Note. Group 1 – children with Learning Disability (LD)

Table 3.2

Details of the participants of Group 2

Participant Code	Chronological Age	Gender
TD 1	7 years	Female
TD 2	8 years	Male
TD 3	9 years	Female
TD 4	11 years	Female
TD 5	12 years	Male

Note. Group 2 – typically developing children (TD)

3.2 Materials

A battery of standardized/non-standardized tools was administered for various purposes. They are tabulated as follows.

Table 3.3

Tools used in the study and their purpose

S.No.	Test/Stimulus, Author, Year	Purpose in the current study
1.	Early Reading Skills (Visual & Auditory Discrimination Sections) (from Rae & Potter, 1981)	To evaluate the differences in the perceptual abilities across visual and auditory channels; the data of which was used in the interpretation of the final results.
2.	Screening Checklist for Auditory Processing (Yathiraj & Mascarenhas, 2003)	To screen for the presence or absence of auditory processing deficits; the data of which was used in the interpretation of the final results.

Table 3.3 contd.

S.No.	Test/Stimulus, Author, Year	Purpose in the current study
3.	International Second Language Proficiency Rating Scale (Wylie & Ingram, 1999)	To evaluate the proficiency of all the participants in speaking, listening, writing and reading English language; the data of which was used in the interpretation of the final results.
4.	13 sets of 'prime-target' pairs (10 pairs in each set = 130 items) – designed by the investigator based on the Logogen Model of Word Processing (Patterson & Shewell, 1987).	To evaluate the implicit linguistic processing abilities in the two groups.

3.3 Stimulus preparation

The 130 'prime-target pairs' (Stimulus 4) were prepared in the following manner.

Step 1: A list of 60 words that could be pictorially represented was selected from Kinder Garten books. The words were items from common lexical categories such as animals, clothing, stationary, common objects, electrical appliances, nature, grooming items, food items, vegetables, vehicles and fruits.

Step 2: Two post graduate students of Speech-Language Pathology were asked to rate the appropriateness on a three point rating scale (highly appropriate, appropriate or inappropriate) of the 60 words, in terms of the ease of naming those words in English for typical children just below 6 years of age. Only words those were rated by both the judges as 'highly appropriate' were shortlisted. Out of the 43 words that were rated 'highly appropriate' by both the judges, 30 words were pseudo-randomly selected for the final list of target items.

Step 3: These 30 words were divided in to three sets of 10 words each such that no more than two items of a lexical category were repeated in each set of 10 words.

Three more lists of 30 words each (3 sets of 10 words each) were extracted using pseudo-random sampling from the original list of 30 words. Also, 10 words from the original list of 30 words were selected pseudo-randomly. Thus, the total number of target items was equal to 130 (4 lists of 30 words each and 1 list of 10 words).

Step 4: The first 4 lists of 30 words each were grouped under 4 heads namely Repetition, Semantic, Phonological/Orthographic and Unrelated respectively. Each of the lists that were further divided into ten items each were grouped under the following three sub-heads namely Pictorial, Orthographic and Phonological respectively. The fifth list of 10 words formed the 'No-prime' group.

Step 5: Words that were suitable as semantic, phonological/orthographic and unrelated primes for the target stimuli were chosen from the same books as the target. None of the priming words were repeated. Semantic primes were chosen such that they belonged to the same lexical category as the target word and that they had no phonological/orthographic relationship in terms of similarity of the initial phoneme/grapheme. Phonological/Orthographic primes were chosen such that their initial phoneme/grapheme was same as that of the target word and that they were not semantically related. Unrelated primes were chosen such that they bore no semantic relationship or phonological/orthographic similarity with the target words.

Thus, a set of 130 'prime-target' pairs were finalized. Refer to 'Appendix 1' for the details.

3.4 Stimulus characteristics

Colour pictures of all the words selected as targets were taken in the 'bmp' format and resized within a range of 5 inches X 5 inches and 6 inches X 6 inches. Similarly, pictures for all pictorial primes were selected. Orthographic primes were

presented in block letters in 'Times New Roman' format, sized 100. Phonological primes were recorded by proficient English speaking Kannada-English bilingual adult male using 'PRAAT' software.

3.5 Instrumentation

The prime-target pairs were programmed using the DMDX software. The pictures and graphemes were presented on the 17" screen of a Compaq Presario CQ 60 laptop and the phonological primes were presented through Zippo headphones at a fixed volume level. The Check Vocal software was used for analysis of the recorded naming responses.

3.6 Procedure

1. The participants were seated comfortably in a quiet room with adequate lighting.
2. Each of the participants of Group 1 were administered the Visual Discrimination and Auditory Discrimination sections of Early Reading Skills. For the former, the participants were asked to match a shape/sequence of letters to the one of the same kind given in a set of 4 options. For the latter, the participants had to discriminate (same or different) between pairs of words read by the investigator. They were scored in terms of the number of correct responses in each of the sections.
3. The Screening Checklist for Auditory Processing was administered to the participants of Group 1. The participants and their parents were questioned for the items of the checklist. They were scored as either 'yes' or 'no' and the total number of 'yes' responses were calculated.

4. For administration of the International Second Language Proficiency Rating Scale, each participant of the two groups was interviewed in English language for a period of approximately 5 minutes, asked to read passages/sentences/words from a book just appropriate for their chronological age and asked to write letters/sentences/passages as per their chronological age. In addition, information from their parents/caregivers was also considered to score the participants across the four domains (speaking, listening, reading and writing) of ISLPR.
5. The participants were then tested using the 130 'prime-target' pairs' stimulus, presented on a Compaq Presario CQ 60 17" laptop screen and Zippo headphones, comfortably positioned for clear visibility and audibility, respectively. The stimuli were grouped under four separate programs: No Prime, Pictorial Priming, Orthographic Priming and Phonological Priming. The designs of the presentation of each prime-target pair in the four programs were as shown in the *Figures 3.1 to 3.4*.

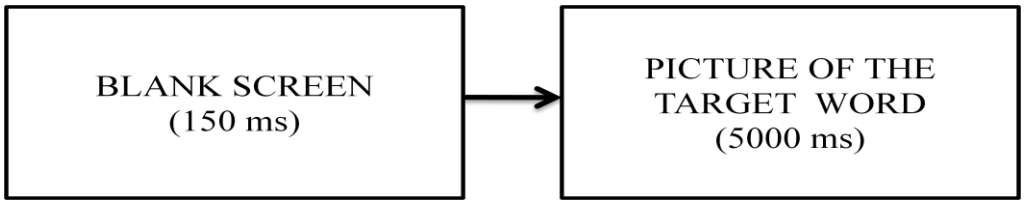

Figure 3.1. Design of the stimulus presentation for the 'No Prime' condition.

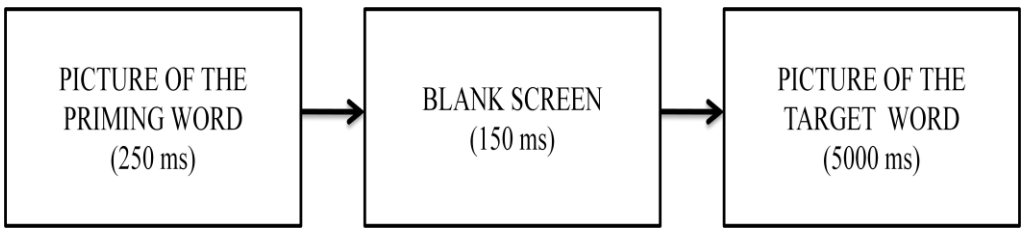

Figure 3.2. Design of the stimulus presentation for 'Pictorial Priming'.

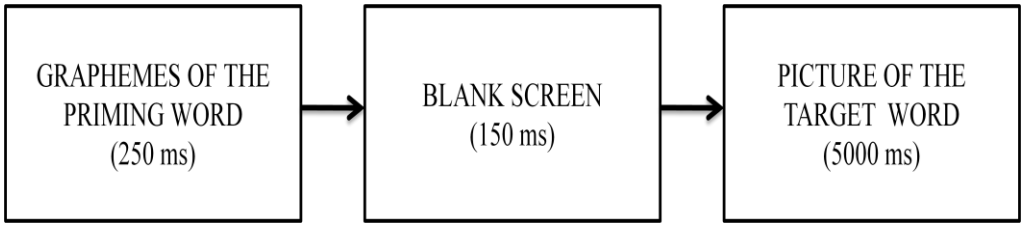

Figure 3.3. Design of the stimulus presentation for 'Orthographic Priming'.

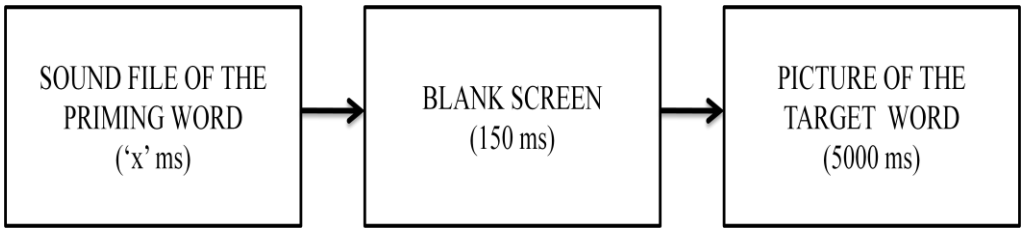

Figure 3.4. Design of the stimulus presentation for 'Phonological Priming'.
Note. 'x' – duration of the sound file (minimum: 157 ms for /cup/ to maximum: 764 ms for /bench/)

Apart from the 'No Prime' program, the 'primes' were presented on the screen for a duration of 250 ms (barring Phonological Priming), followed by a gap of 150 ms (Stimulus Onset Asynchrony = - 400 ms) before the presentation of the picture of the target word. The picture of the target word was displayed for duration of 5000 ms.

The order of presentation of these four programs was pseudo-randomized across the participants. In addition, the order of presentation of the items within each of the programs was randomized by the DMDX software. The rate of presentation of each prime-target pair was controlled by the investigator, to ensure that the items were presented only when the participants were ready to respond.

The participants were instructed to name the picture of the target words as quickly as possible in English. A sufficient number of practice trials resembling the four types of priming sets (No Prime, Pictorial Priming, Orthographic Priming and Phonological Priming) were given to each

participant using another set of 'prime-target' practice items which were not repeated in the actual test, till they performed according to the requirements of the task. This was followed by the presentation of the 130 'prime-target' pairs' stimulus.

3.7 Analysis

The obtained data from all the participants on the naming task was stored. The recorded responses from the DMDX software were analysed using the Check Vocal software. The software provided the option of recording the responses in a time window of 5000 ms, starting from the onset of the presentation of the picture of the target word. The onset of each of the named responses (correct/wrong) was marked through visual inspection of the waveform and/or spectrogram, which was noted as the 'reaction time'. The marking was followed by judgement regarding the correctness of the responses. The responses were judged as either correct, wrong or no response.

The responses were considered 'correct' if any of the following conditions were satisfied:

1. The target was named correctly
2. The target was named correctly, but with articulatory errors
3. The target word was named correctly after an incorrect response

The responses were considered 'wrong' in all instances of any word being recorded in the allotted time window that did not satisfy the criteria for correctness.

The responses were judged 'no response' in all instances when the participants did not respond or when some unrelated vocal expressions were recorded.

The measured reaction times of all the items for each participant were noted and grouped according to the 13 conditions (No Prime – NP, Pictorial Repetition – PIREP, Pictorial Semantic – PISEM, Pictorial Phonological/Orthographic – PIPHOR, Pictorial Unrelated – PIUR, Orthographic Repetition – ORREP, Orthographic Semantic – ORSEM, Orthographic Phonological/Orthographic – ORPHOR, Orthographic Unrelated – ORUR, Phonological Repetition – PHREP, Phonological Semantic – PHSEM, Phonological Phonological/Orthographic – PHPHOR and Phonological Unrelated – PHUR) inherent in the 'prime-target' pairs. The terms 'Pictorial', 'Orthographic' and 'Phonological' referred to the modality of presentation of the prime and 'Repetition', 'Semantic', 'Phonological/Orthographic' and 'Unrelated' referred to the nature of the relationship of the prime with the target. The reaction times of the correct responses within each of the 13 conditions were averaged and Mean values were obtained. The Mean values across the 13 conditions for all the participants were entered in the SPSS software for statistical analyses.

The Mean values were used to obtain descriptive statistical information (group Mean, group Median and group Standard Deviation) across the two groups (participants with Learning Disability and typically developing participants) in all the 13 conditions. The Mann-Whitney test was used to compare the scores across the two groups. The Friedman test was used to compare the differences across the modalities of presentation and across the different relationships of the prime with the target, within each of the groups. If differences were discovered on the Friedman test, the Wilcoxon Signed Ranks test was used for pair-wise comparisons.

In addition to the above statistical procedures, the following analyses were done:

1. Qualitative profiling of the errors/corrections made by the participants during the naming task.
2. Pair-wise comparison of each participant with Learning Disability and a chronological age-matched typically developing participant.
3. Comparisons of the results obtained on International Second Language Proficiency Rating Scale, Early Reading Skills (Visual and Auditory Discrimination sections), Screening Checklist for Auditory Processing and the 130 ‘prime-target’ stimulus.

CHAPTER IV

RESULTS

Implicit linguistic processing and related abilities were tested in bilingual children with Learning Disability and typically developing bilingual children using a battery of tools. Their performances were compared both across and with in the groups for determining the effects of the 'prime-target' relations and modalities of presentation of the prime on the naming reaction time obtained using the 13 'prime-target' pair stimulus. The Mann-Whitney Test, Wilcoxon Signed Ranks Test and Friedman Test were used for the purpose. Pair-wise comparison of the reaction times of individuals with Learning Disability and age-matched typically developing children was made on the basis of their performance on ERS (Visual and Auditory Discrimination), SCAP and ISLPR. The results are represented below.

4.1 Early Reading Skills (ERS) (Visual & Auditory Discrimination Sections)

The Visual and Auditory Discrimination sections of 'Early Reading Skills' (from Rae & Potter, 1981) were administered to the participants of Group 1. The scores obtained were as follows:

Table 4.1

Scores of the participants of Group 1 on Visual and Auditory Discrimination in ERS

Participant Code	Visual Discrimination (Level – I)	Visual Discrimination (Level – II)	Auditory Discrimination
LD 1	16/16	14/17	23/30
LD 2	15/16	9/17	28/30
LD 3	14/16	14/17	25/30
LD 4	12/16	10/17	27/30
LD 5	15/16	14/17	29/30
LD 6	15/16	14/17	25/30

Note: LD – children with Learning Disability/Group 1

4.2 Screening Checklist for Auditory Processing (SCAP)

The Screening Checklist for Auditory Processing (Yathiraj & Mascarenhas, 2003) was administered to the participants of Group 1. The scores obtained were as follows.

Table 4.2

Scores of the participants of Group 1 on SCAP

No.	Questions	LD1	LD2	LD3	LD4	LD5	LD6
1	Does not listen carefully and does not pay attention (requires repetition of instruction)	N	N	N	N	N	N
2	Has short attention span of listening (approx. 5 – 15 mins)	N	N	N	Y	N	N
3	Easily distracted by background sound	N	Y	N	Y	Y	Y
4	Has trouble in recalling what has been heard in the correct order	Y	N	N	Y	Y	N
5	Forgets what is said in few minutes	N	N	N	Y	N	N
6	Has difficulty in discriminating one speech sound from other similar sound	N	N	N	N	N	N
7	Has difficulty in understanding verbal instruction and tend to misunderstand what is said which other children of the same age would understand	N	Y	Y	Y	Y	Y
8	Show delayed response to verbal instruction or questions	N	N	N	N	Y	N
9	Has difficulty in relating what is heard with what is seen	N	N	N	Y	N	N
10	Poor performance in listening task, but performance improves with visual cues	N	N	N	N	Y	N
11	Has pronunciation problem (mispronunciation of words)	N	N	N	N	N	N
12	Performance is below average in one or more subjects, such as social subjects, I/II language	Y	Y	Y	Y	Y	Y
Total number of 'yes' (Y) responses		2	3	2	7	6	3

Note: Group 1 – children with Learning Disability

4.3 International Second Language Proficiency Rating Scale

The International Second Language Proficiency Rating Scale (Wylie & Ingram, 1999) was administered to the participants of both the groups. The results are tabulated below.

Table 4.3

Scores of the participants of Groups 1 and 2 on the speaking, listening, writing and reading levels in ISLPR

Participant Code	Speaking level	Listening level	Writing level	Reading level
LD 1	S:3 minimum vocational proficiency	L:3 minimum vocational proficiency	W:2 minimum social proficiency	R:2 minimum social proficiency
LD 2	S:1 minimum survival proficiency	L: 1 minimum survival Proficiency	W:1 minimum survival proficiency	R:1 minimum survival proficiency
LD 3	S:2 minimum social proficiency	L:2 minimum social proficiency	W:2 minimum social proficiency	R:2 minimum social proficiency
LD 4	S:1 minimum survival proficiency	L: 1 minimum survival Proficiency	W:1 minimum survival proficiency	R:1 minimum survival proficiency
LD 5	S:3 minimum vocational proficiency	L:3 minimum vocational proficiency	W:2 minimum social proficiency	R:2 minimum social proficiency
LD 6	S:4 vocational proficiency	L:4 vocational proficiency	W:3 minimum vocational proficiency	R:3 minimum vocational proficiency
TD 1	S:2 minimum social proficiency	L:2 minimum social proficiency	W:2 minimum social proficiency	R:2 minimum social proficiency
TD 2	S:3 minimum vocational proficiency	L:3 minimum vocational proficiency	W:3 minimum vocational proficiency	R:3 minimum vocational proficiency
TD 3	S:1 minimum survival proficiency	L:1 minimum survival proficiency	W:1 minimum survival proficiency	R:1 minimum survival proficiency
TD 4	S:4 vocational proficiency	L:4 vocational proficiency	W:4 vocational proficiency	R:4 vocational proficiency
TD 5	S:4 vocational proficiency	L:4 vocational proficiency	W:4 vocational proficiency	R:4 vocational proficiency

Note: LD – children with Learning Disability/Group 1; TD – typically developing children/Group 2

4.4 Thirteen sets of 'prime-target' pairs (10 pairs in each set = 130 items) – designed by the investigator based on the 'Logogen Model of Word Processing' (Patterson & Shewell, 1987)

The analyses of reaction time of the naming responses (using Check Vocal software) obtained on the administration of the 130 'prime-target' stimulus to all the participants in the two groups yielded 13 mean values representing all the 13 conditions for each group.

4.4.1 Descriptive statistics

Descriptive statistics' were obtained using the SPSS software. The Mean, Standard Deviation and Median values were calculated for each of the two groups for the 13 'prime-target' conditions and are represented in Table 4.4.

Table 4.4

Mean, Median and Standard Deviation (SD) values of Groups 1 and 2 in the 13 'prime-target' conditions

Conditions	Group 1			Group 2		
	Mean	**SD**	**Median**	**Mean**	**SD**	**Median**
NP	1248	254	1226	983	237	885
PIREP	892	272	824	744	266	621
PISEM	1168	203	1213	1005	293	1078
PIPHOR	1263	274	1233	1028	284	1056
PIUR	1163	179	1152	1037	291	933
ORREP	898	219	958	774	241	675
ORSEM	1347	420	1349	1053	204	1014
ORPHOR	1090	341	1069	1145	290	1048
ORUR	1165	240	1143	1102	306	1031
PHREP	626	79	656	650	152	652
PHSEM	1104	288	1078	1019	223	974
PHPHOR	1134	258	1063	888	184	845
PHUR	1102	126	1076	906	162	944

Note: Legend as in Table 4.5

4.4.2 Comparison: Group 1 versus Group 2

The two independent groups were then compared using the Mann-Whitney Test for all the 13 parameters. The results showed no significant difference in any of the conditions, except the 'Phonological Unrelated' condition ($p \leq 0.05$) between the two groups. The results are depicted in the following table.

Table 4.5

Comparison of the 13 'prime-target' conditions across Groups 1 & 2

'Prime-Target' Conditions	**/Z/**	**Asymp. Sig. (2-tailed)**
NP	1.826	0.068
PIREP	1.278	0.201
PISEM	0.913	0.361
PIPHOR	1.095	0.273
PIUR	0.730	0.465
ORREP	0.913	0.361
ORSEM	1.095	0.273
ORPHOR	0.548	0.584
ORUR	0.548	0.584
PHREP	0.183	0.855
PHSEM	0.548	0.584
PHPHOR	1.643	0.100
PHUR	2.008	0.045

Note: NP - No Prime, PIREP - Pictorial Repetition, PISEM - Pictorial Semantic, PIPHOR - Pictorial Phonological/Orthographic, PIUR – Pictorial Unrelated, ORREP – Orthographic Repetition, ORSEM – Orthographic Semantic, ORPHOR – Orthographic Phonological/Orthographic, ORUR – Orthographic Unrelated, PHREP – Phonological Repetition, PHSEM – Phonological Semantic, PHPHOR – Phonological Phonological/Orthographic, PHUR – Phonological Unrelated; Group 1 – children with Learning Disability (LD), Group 2 – typically developing children (TD)

4.4.3 Comparison of the 'No Prime' condition with the 12 'prime-target' conditions in Groups 1 and 2

The 'No Prime' condition was compared with each of the remaining 12 'prime-target' pairs using the Wilcoxon Signed Ranks Test in each of the groups. The 'No Prime' condition showed statistically significant differences ($p \leq 0.05$) with the 'Pictorial Repetition' and 'Phonological Repetition' conditions in both the groups. In

Group 1, the 'No Prime' condition was also significantly different ($p \leq 0.05$) from the 'Orthographic Repetition' condition. No other conditions were significantly different from the 'No Prime' condition in both the groups. The results of the Wilcoxon Signed Ranks Test for groups 1 and 2 are depicted in Table 4.6.

Table 4.6

Comparison of the 'No Prime' condition with 12 'prime-target' conditions in Groups 1 and 2

Compared Conditions	**Group 1**		**Group 2**	
	/Z/	**Asymp. Sig. (2-tailed)**	**/Z/**	**Asymp. Sig. (2-tailed)**
NP – PIREP	2.201	0.028	2.023	0.043
NP – PISEM	0.734	0.463	0.135	0.893
NP – PIPHOR	0.105	0.917	0.405	0.686
NP – UR	0.734	0.463	0.674	0.500
NP – ORREP	1.992	0.046	1.753	0.080
NP – ORSEM	0.524	0.600	0.674	0.500
NP – ORPHOR	0.734	0.463	1.753	0.080
NP – UR	0.943	0.345	0.944	0.345
NP – PHREP	2.201	0.028	2.023	0.043
NP – PHSEM	0.734	0.463	0.405	0.686
NP – PHPHOR	0.734	0.463	1.214	0.225
NP – UR	0.943	0.345	1.095	0.273

Note: Legend as in Table 4.5

4.4.4 Group 1: Comparison with in modalities of presentation

The Friedman Test was administered to evaluate the effect of the 'prime-target' relations (Repetition/Semantic/Phonological-Orthographic/Unrelated) with in each modality of presentation (Pictorial/Orthographic/Phonological) for each of the groups independently. There was no significant difference across the different 'prime-target' relations when the modality of presentation was pictorial in Group 1. There were significant differences across the 'prime-target' relations when the modalities of presentation were orthographic and phonological ($p \leq 0.05$) in Group 1. The results are depicted in the following table.

Table 4.7

Comparison of the effect of 'prime-target' relations with in each modality in Group 1

Modality	Chi-Square	df	Asymp. Sig.
Pictorial	7.800	3	0.050
Orthographic	9.400	3	0.024
Phonological	19.733	3	0.001

To identify the specific 'prime-target' relations that led to the statistically significant differences in the Orthographic and Phonological modalities in Group 1, the Wilcoxon Signed Ranks Test was administered. Pair-wise comparisons were made between each of the four 'prime-target' relations in both the modalities. Significant differences ($p \leq 0.05$) were found between 'Semantic' and 'Repetition', 'Unrelated' and 'Repetition' and 'Phonological/Orthographic' and 'Semantic' relations in the Orthographic mode of presentation. The 'Repetition' relation was found to be significantly different ($p \leq 0.05$) from the 'Semantic', 'Phonological/Orthographic' and 'Unrelated' relations in the Phonological mode of presentation. Table 4.8 represents the results of the Wilcoxon Signed Ranks Test.

Table 4.8

Pair-wise comparison of the four 'prime-target' relations in the Orthographic and Phonological modalities in Group 1

Prime-Target Relation	Modality – Orthographic		Modality – Phonological	
	/Z/	Asymp. Sig. (2-tailed)	/Z/	Asymp. Sig. (2-tailed)
S-R	1.992	0.046	2.201	0.028
P/O-R	1.782	0.075	2.201	0.028
U-R	2.201	0.028	2.201	0.028
P/O-S	2.201	0.028	0.734	0.463
U-S	0.943	0.345	0.105	0.917
U-P/O	0.734	0.463	0.314	0.753

Note: S-R: Semantic – Repetition, P/O-R: Phonological/Orthographic – Repetition, U-R: Unrelated – Repetition, P/O-S: Phonological/Orthographic – Semantic, U-S: Unrelated – Semantic, U-P/O: Unrelated – Phonological/Orthographic

4.4.5 Group 2: Comparison with in modalities of presentation

The results of the Friedman Test for Group 2 that was done to evaluate the effect of the 'prime-target' relations with in each modality of presentation revealed statistically significant differences ($p \leq 0.05$) across the 'prime-target' relations in all the modalities of presentation. The results are depicted in the following table.

Table 4.9

Comparison of the effect of 'prime-target' relations with in each modality in Group 2

Modality	**Chi-Square**	**df**	**Asymp. Sig.**
Pictorial	9.240	3	0.026
Orthographic	9.240	3	0.026
Phonological	9.720	3	0.021

To identify the specific 'prime-target' relations that led to the statistically significant differences in the three modalities in Group 2, the Wilcoxon Signed Ranks Test was administered. Pair-wise comparisons were made between each of the four 'prime-target' relations in the three modalities. Significant differences ($p \leq 0.05$) were found between 'Unrelated' and 'Repetition' and 'Phonological/Orthographic' and 'Repetition' relations in the Pictorial mode of presentation. The 'Repetition' relation was found to be significantly different ($p \leq 0.05$) from the 'Semantic', 'Phonological/Orthographic' and 'Unrelated' relations in both the Orthographic and Phonological modes of presentation. Table 4.10 represents the results of the Wilcoxon Signed Ranks Test.

Table 4.10

Pair-wise comparison of the four 'prime-target' relations in the Pictorial, Orthographic and Phonological modalities in Group 2

P-T Relation	Pictorial		Orthographic		Phonological	
	/Z/	As. Sig.	/Z/	As. Sig.	/Z/	As. Sig.
S-R	1.753	0.080	2.023	0.043	2.023	0.043
P/O-R	2.023	0.043	2.023	0.043	2.023	0.043
U-R	2.023	0.043	2.023	0.043	2.023	0.043
P/O-S	0.674	0.500	1.214	0.225	1.483	0.138
U-S	0.674	0.500	0.405	0.686	0.944	0.345
U-P/O	0.405	0.686	0.944	0.345	0.405	0.686

Note: P-T: Prime-Target, As. Sig.: Asymp. Sig (2-tailed); Legend as in Table 4.8

4.4.6 Group 1: Comparison with in 'prime-target' relations

The Friedman Test was administered to evaluate the effect of the modality of presentation (Pictorial/Orthographic/Phonological) with in each 'prime-target' relation (Repetition/Semantic/Phonological-Orthographic/Unrelated) for each of the groups independently. There was no significant difference across the different modalities of presentation when the 'prime-target' relations were Semantic, Phonological/Orthographic and Unrelated in Group 1. However, there was a significant difference ($p \leq 0.05$) across the modalities of presentation when the 'prime-target' relation was Repetition in Group 1. The results are depicted in the following table.

Table 4.11

Comparison of the effect of modalities with in each 'prime-target' relation in Group 1

'Prime-Target' Relation	Chi-Square	df	Asymp. Sig.
Repetition	7.000	2	0.030
Semantic	1.333	2	0.513
Phonological/Orthographic	3.000	2	0.223
Unrelated	2.333	2	0.311

The Wilcoxon Signed Ranks Test was administered to identify the specific modalities that led to the statistically significant differences in the Repetition relation

in Group 1. Pair-wise comparisons were made between each of the three modalities in the Repetition relation. A significant difference ($p \leq 0.05$) was found only between the 'Phonological' and 'Orthographic' modalities of presentation when the 'prime-target' relation was that of Repetition. No significant differences were found between either the 'Pictorial' and 'Orthographic' modalities or the 'Pictorial' and 'Phonological' modalities. Table 4.12 represents the results of the Wilcoxon Signed Ranks Test.

Table 4.12

Pair-wise comparison of the three modalities in the Repetition relation in Group 1

Modality	**Relation – Repetition**	
	/Z/	**Asymp. Sig. (2-tailed)**
Orthographic – Pictorial	0.105	0.917
Phonological – Pictorial	1.782	0.075
Phonological – Orthographic	2.201	0.028

4.4.7 Group 2: Comparison with in 'prime-target' relations

The effect of the modality of presentation with in each 'prime-target' relation for Group 2 was also investigated using the Friedman Test. The results revealed that there was no significant difference across the different modalities of presentation when the 'prime-target' relations were Repetition, Semantic and Unrelated in Group 2. However, there was a significant difference ($p \leq 0.05$) across the modalities of presentation when the 'prime-target' relation was Phonological/Orthographic. The results are depicted in the following table.

Table 4.13

Comparison of the effect of modalities with in each 'prime-target' relation in Group 2

'Prime-Target' Relation	**Chi-Square**	**df**	**Asymp. Sig.**
Repetition	2.800	2	0.247
Semantic	0.400	2	0.819
Phonological/Orthographic	7.600	2	0.022
Unrelated	2.800	2	0.247

The Wilcoxon Signed Ranks Test was administered to identify the specific modalities that led to the statistically significant differences in the Phonological/Orthographic relation in Group 2. Pair-wise comparisons were made between each of the three modalities in the Phonological/Orthographic relation. Significant differences were found between the 'Phonological' and 'Pictorial' ($p \leq 0.05$) and 'Phonological' and 'Orthographic' ($p \leq 0.05$) modalities of presentation. However, no significant difference was found between the 'Pictorial' and 'Orthographic' modalities. Table 4.14 represents the results of the Wilcoxon Signed Ranks Test.

Table 4.14

Pair-wise comparison of the three modalities in the Phonological/Orthographic relation in Group 2

Modality	**Relation – Phonological/Orthographic**	
	/Z/	**Asymp. Sig. (2-tailed)**
Orthographic – Pictorial	1.214	0.225
Phonological – Pictorial	2.023	0.043
Phonological – Orthographic	2.023	0.043

4.4.8 Combined descriptive statistics

The SPSS software was used to obtained descriptive statistics for combined values of all 'prime-target' relations with in each modality and all modalities with in each 'prime-target' relation. The combined Mean, combined Standard Deviation and combined Median values were obtained for the two groups. The same is represented in Table 4.15.

Table 4.15

Mean, Median and Standard Deviation (SD) values of Groups 1 and 2 in the 7 combined conditions and 'No Prime' condition

Combined Conditions	Group 1			Group 2		
	Mean	**SD**	**Median**	**Mean**	**SD**	**Median**
NP	1248	254	1226	983	237	885
PI	1121	187	1099	953	247	1028
OR	1125	261	1153	1018	236	1029
PH	991	159	985	866	144	805
REP	805	153	773	723	207	717
SEM	1206	262	1232	1026	187	1128
PH/OR	1162	252	1170	1020	246	983
UR	1143	143	1133	1015	197	1089

Note: NP – No Prime, PI {Pictorial} – Pictorial Repetition + Pictorial Semantic + Pictorial Phonological/Orthographic + Pictorial Unrelated, OR {Orthographic} - Orthographic Repetition + Orthographic Semantic + Orthographic Phonological/Orthographic + Orthographic Unrelated, PH {Phonological} – Phonological Repetition + Phonological Semantic + Phonological Phonological/Orthographic + Phonological Unrelated, REP {Repetition} - Pictorial Repetition + Orthographic Repetition + Phonological Repetition, SEM {Semantic} – Pictorial Semantic + Orthographic Semantic + Phonological Semantic, PH/OR {Phonological/Orthographic} – Pictorial Phonological/Orthographic + Orthographic Phonological/Orthographic + Phonological Phonological/Orthographic, UR {Unrelated} – Pictorial Unrelated + Orthographic Unrelated + Phonological Unrelated; Group 1 – children with learning Disability, Group 2 – typically developing children

4.4.9 Group 1 versus Group 2: Combined Conditions

The two groups were compared on the above mentioned combined conditions using the Mann-Whitney Test. The results showed no significant difference ($p > 0.05$) between the two groups in any of the combined conditions. They are tabulated as follows.

Table 4.16

Comparison of the 'Combined Conditions' across Groups 1 & 2

Combined Conditions	/Z/	Asymp. Sig. (2-tailed)
NP	1.826	0.068
PI	1.095	0.273
OR	0.730	0.465
PH	1.095	0.273
REP	0.913	0.361
SEM	1.095	0.273
PH/OR	0.913	0.361
UR	1.095	0.273

Note: Legend as in Table 4.15

4.4.10 Group 1: Comparison between modalities

The Friedman Test was employed to compare across the three modalities (PI, OR, and PH) and the 'No Prime' condition in Group 1. The results showed no significant differences ($p > 0.05$) between any of the parameters. Table 4.17 depicts the same.

4.4.11 Group 2: Comparison between modalities

The Friedman Test was administered to compare across the three modalities (PI, OR, and PH) and the 'No Prime' condition in Group 2. The results showed no significant differences ($p > 0.05$) between any of the parameters. The results of the Friedman Test (for Group 1 and Group 2) are tabulated as follows.

Table 4.17

Comparison between the Combined Modalities and the 'No Prime' condition in Groups 1 & 2

Group	Chi-Square	df	Asymp. Sig.
1	5.600	3	0.133
2	4.920	3	0.178

Note: Group 1 – children with Learning Disability, Group 2 – typically developing children

4.4.12 Group 1: Comparison between 'prime-target' relations

The four 'prime-target' relations (REP, SEM, PH/OR, and UR) and the 'No Prime' condition in Group 1 were compared using the Friedman Test. The result revealed statistically significant difference ($p \leq 0.05$) between the five conditions. Table 4.18 represents the same.

The Wilcoxon Signed Ranks Test was administered for the purpose of pair-wise comparison between each of the five conditions of Group 1. Statistically significant differences ($p \leq 0.05$) were observed between 'Repetition' and 'No Prime', 'Semantic' and 'Repetition', 'Phonological/Orthographic' and 'Repetition' and 'Unrelated' and 'Repetition' pairs. There were no significant differences between the other pairs. Table 4.19 represents the results of the Wilcoxon Signed Ranks Test.

4.4.13 Group 2: Comparison between 'prime-target' relations

The four 'prime-target' relations (REP, SEM, PH/OR, and UR) and the 'No Prime' condition in Group 2 were compared using the Friedman Test. The result revealed statistically significant difference ($p \leq 0.05$) between the five conditions. The results of the Friedman Test (for Group 1 and Group 2) are tabulated as follows.

Table 4.18

Comparison between the Combined Relations and the 'No Prime' condition in Groups 1 & 2

Group	Chi-Square	df	Asymp. Sig.
1	12.800	4	0.012
2	10.240	4	0.037

Note: Group 1 – children with Learning Disability, Group 2 – typically developing children

The Wilcoxon Signed Ranks Test was administered for the purpose of pair-wise comparison between each of the five conditions of Group 2. As in Group 1,

statistically significant differences ($p \leq 0.05$) were observed between 'Repetition' and 'No Prime', 'Semantic' and 'Repetition', 'Phonological/Orthographic' and 'Repetition' and 'Unrelated' and 'Repetition' pairs. There were no significant differences between the other pairs. Table 4.19 represents the results of the Wilcoxon Signed Ranks Test.

Table 4.19

Pair-wise comparison of four 'prime-target' relations and 'No Prime' condition in Group 1 and 2

'Prime-Target' Relation Pairs	**Group 1**		**Group 2**	
	/Z/	***Asymp. Sig.**	**/Z/**	***Asymp. Sig.**
REP – NP	2.201	0.028	2.023	0.043
SEM – NP	0.524	0.600	0.135	0.893
PH/OR – NP	0.524	0.600	0.405	0.686
UR – NP	0.734	0.463	0.135	0.893
SEM – REP	2.201	0.028	2.023	0.043
PH/OR – REP	2.201	0.028	2.023	0.043
UR – REP	2.201	0.028	2.023	0.043
PH/OR – SEM	0.943	0.345	0.405	0.686
UR – SEM	0.524	0.600	0.405	0.686
UR – PH/OR	0.314	0.753	0.135	0.893

Note: * - Asymp. Sig. (2-tailed); Legend as in Table 4.15

4.5 Summary of the results

The results obtained from the comparison of children with Learning Disability and typically developing children across all the 'prime-target' pairs, the comparison of the 'No Prime' condition with the other 12 primed conditions, the comparisons of the effects of 'prime-target' relations within modalities and modalities within 'prime-target' relations in each group and similar comparisons of the 'combined conditions' are summarized in Table 4.20.

Table 4.20

Summary of the results

Comparison		Group 1 (LD)	Group 2 (TD)
NP – PIREP NP – ORREP NP – PHREP		PIREP < NP ORREP < NP PHREP < NP	PIREP < NP No difference PHREP < NP
Modality specific 'prime-target' relation effects	PI OR PH	No differences REP < SEM, REP < UR, PH/OR < SEM REP < SEM, REP < UR, REP < PH/OR	REP < PH/OR, REP < UR REP < SEM, REP < UR, REP < PH/OR REP < SEM, REP < UR, REP < PH/OR
'prime-target' relation specific modality effects	REP SEM PH/OR UR	PH < OR No differences No differences No differences	No differences No differences PH < PI, PH < OR No differences
Combined modalities – NP		No differences	No differences
Combined relations – NP		REP < SEM, REP < PH/OR, REP < UR, REP < NP	REP < SEM, REP < PH/OR, REP < UR, REP < NP

Note: 'x < y' – 'x' leads to faster naming than 'y'; NP – No Prime; Modalities of presentation: PI – Pictorial, OR – Orthographic, PH – Phonological; 'prime-target' relations: REP – Repetition, SEM – Semantic, PH/OR – Phonological/Orthographic, UR – Unrelated; Conditions: PIREP – Pictorial Repetition, ORREP – Orthographic Repetition, PHREP – Phonological Repetition; Group 1 (LD) – children with Learning Disability, Group 2 (TD) – typically developing children

4.6 Pair-wise comparison of each participant with Learning Disability and a chronological age-matched typically developing participant

The average scores of the reaction time for correct responses in all the 13 'prime-target' conditions for each participant were considered for the purpose of pair-wise comparison. Each participant of Group 1 (Children with Learning Disability) was compared subjectively with an age-matched participant of Group 2 (Typically Developing Children) as shown in *Figures 4.1 to 4.6*.

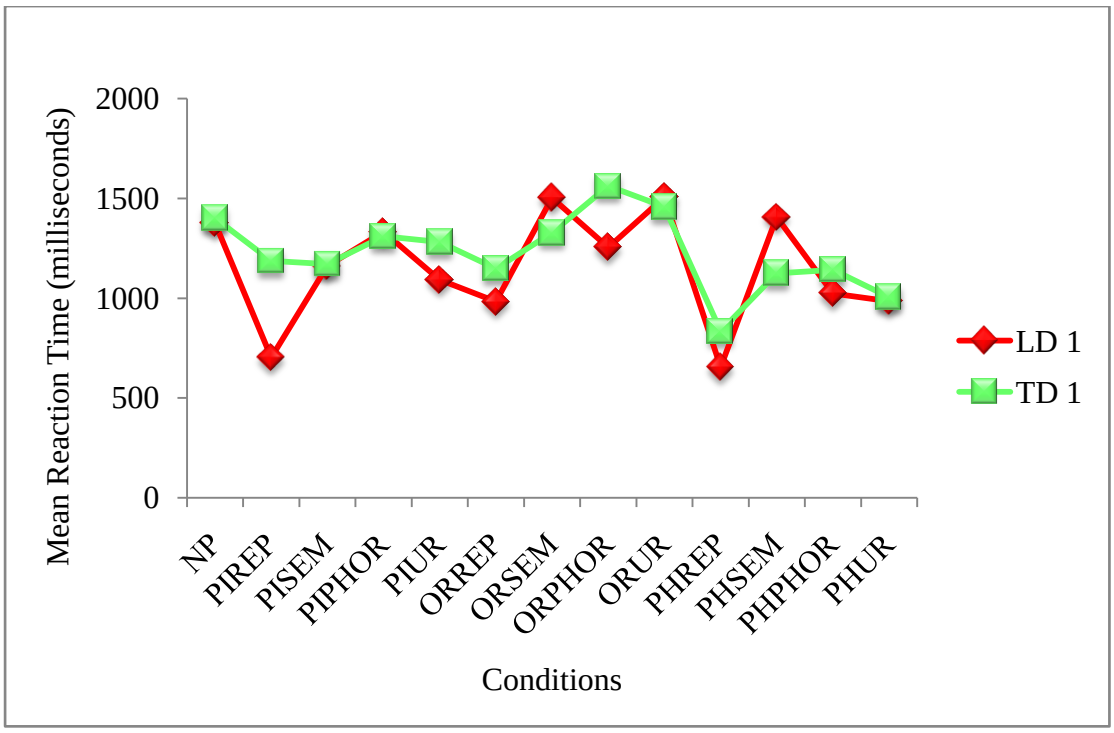

Figure 4.1. Comparison of reaction time for the 13 'prime-target' conditions between LD 1 & TD 1.

Note: Legend as in Table 4.5

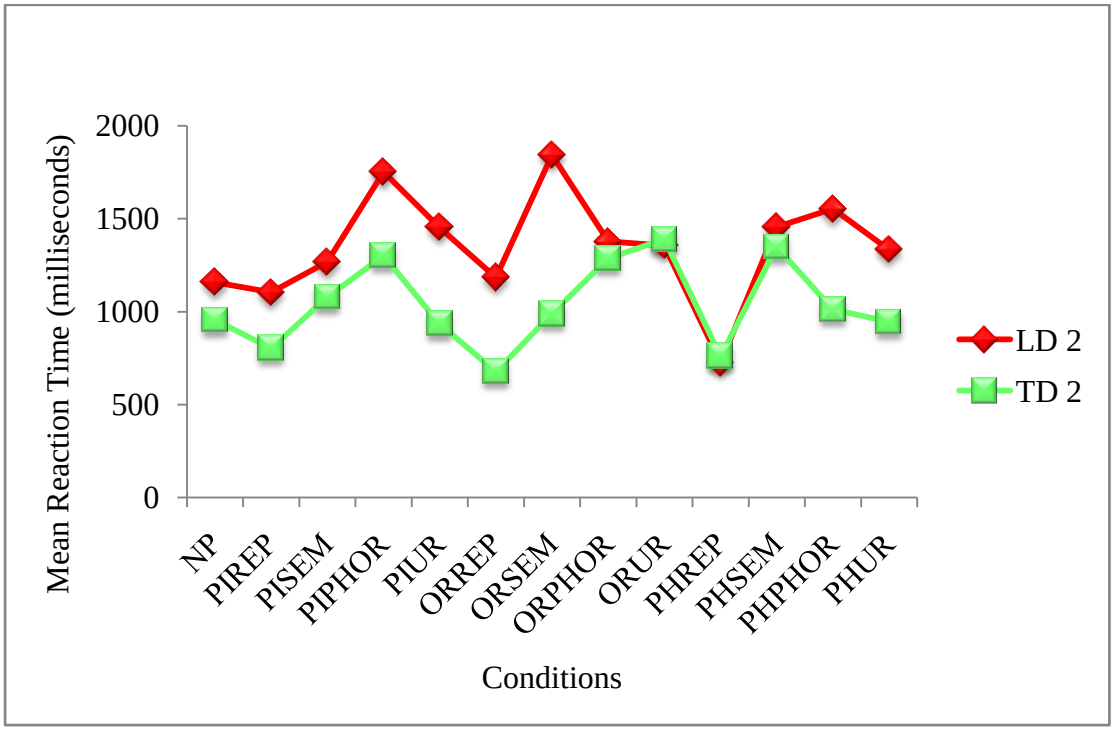

Figure 4.2. Comparison of reaction time for the 13 'prime-target' conditions between LD 2 & TD 2.

Note: Legend as in Table 4.5

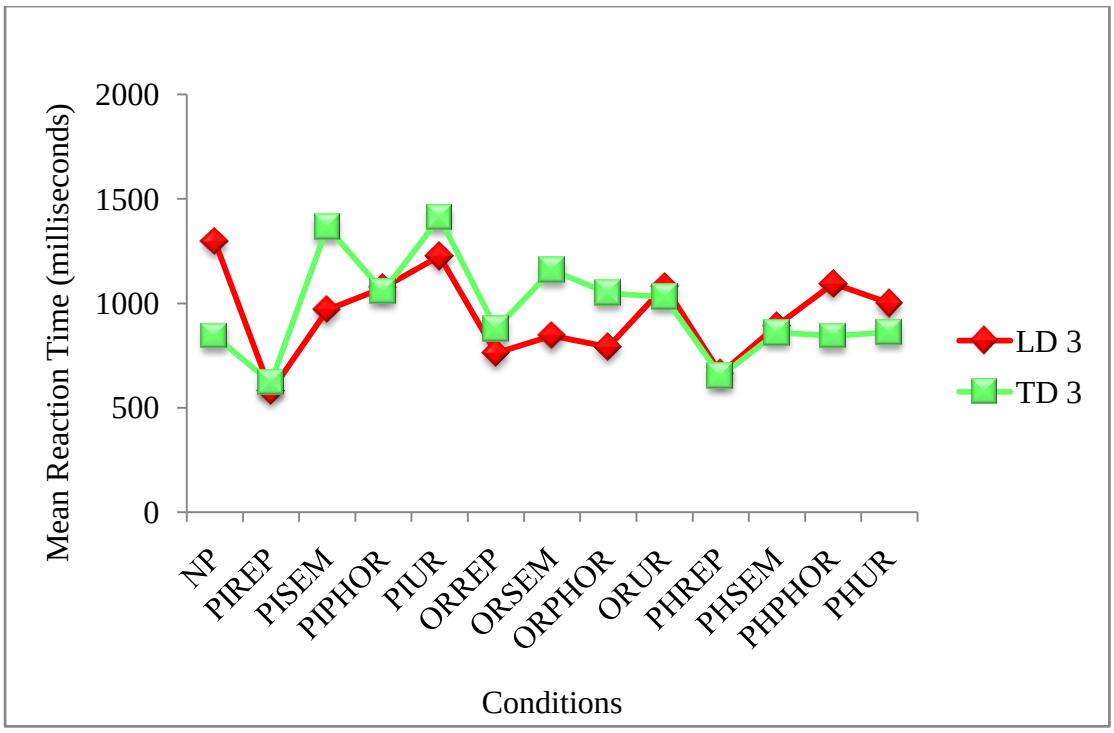

Figure 4.3. Comparison of reaction time for the 13 'prime-target' conditions between LD 3 & TD 3.

Note: Legend as in Table 4.5

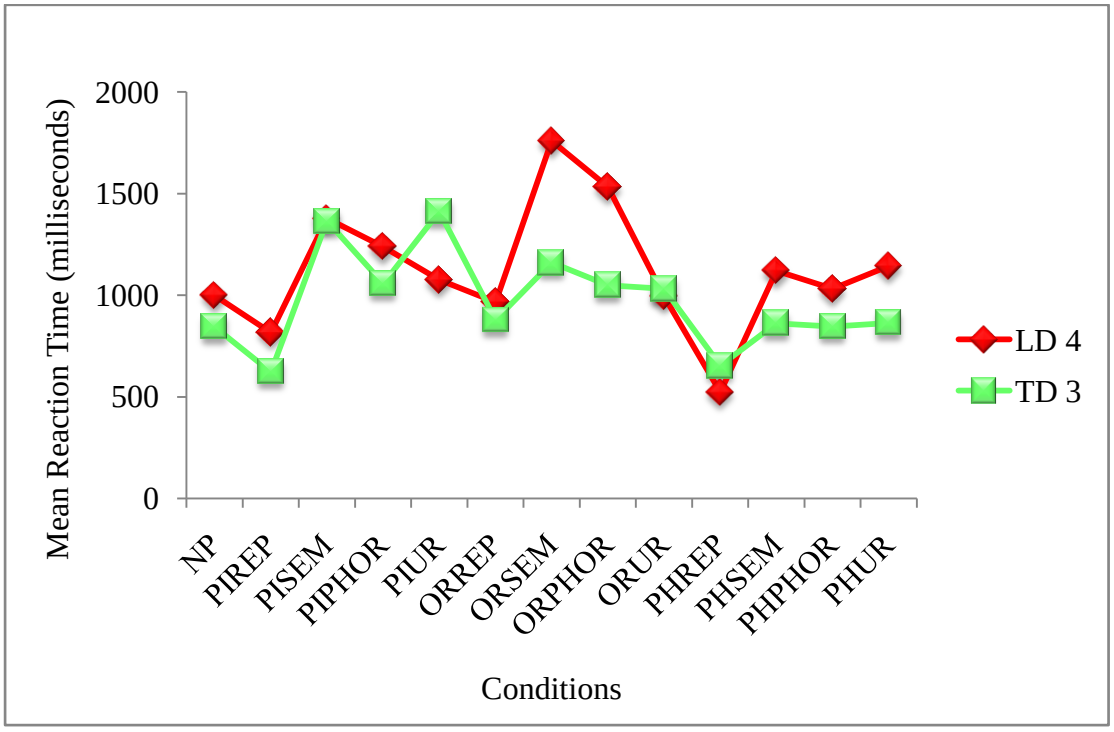

Figure 4.4. Comparison of reaction time for the 13 'prime-target' conditions between LD 4 & TD 3.

Note: Legend as in Table 4.5

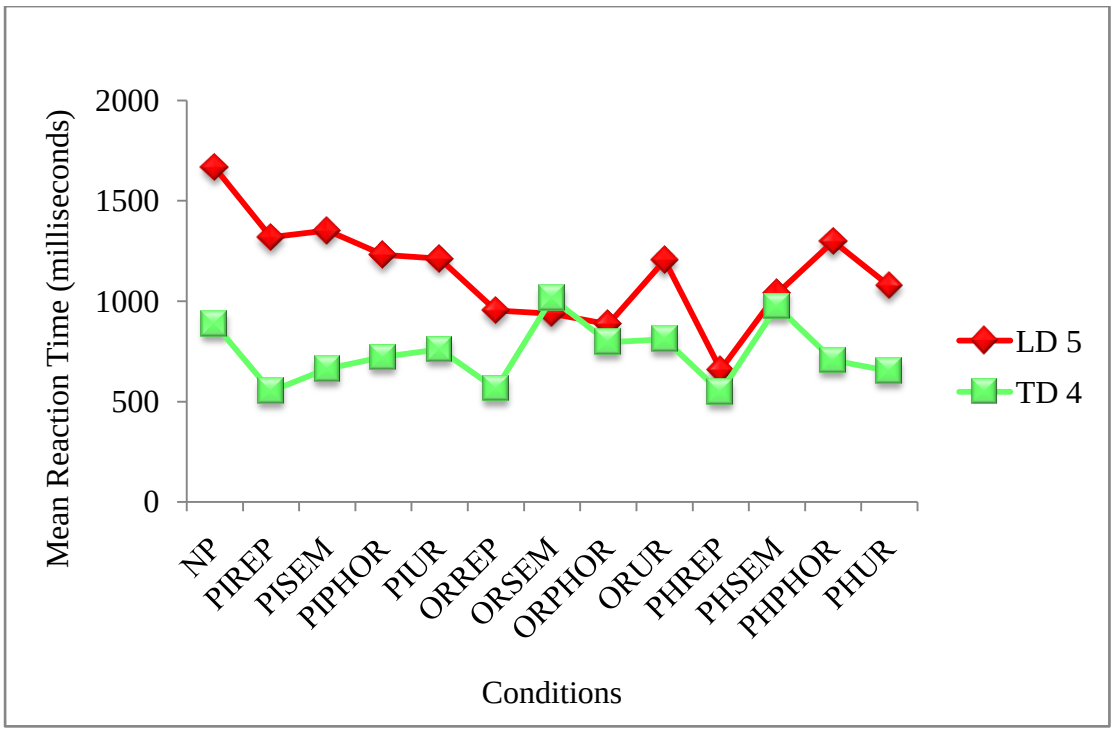

Figure 4.5. Comparison of reaction time for the 13 'prime-target' conditions between LD 5 & TD 4.

Note: Legend as in Table 4.5

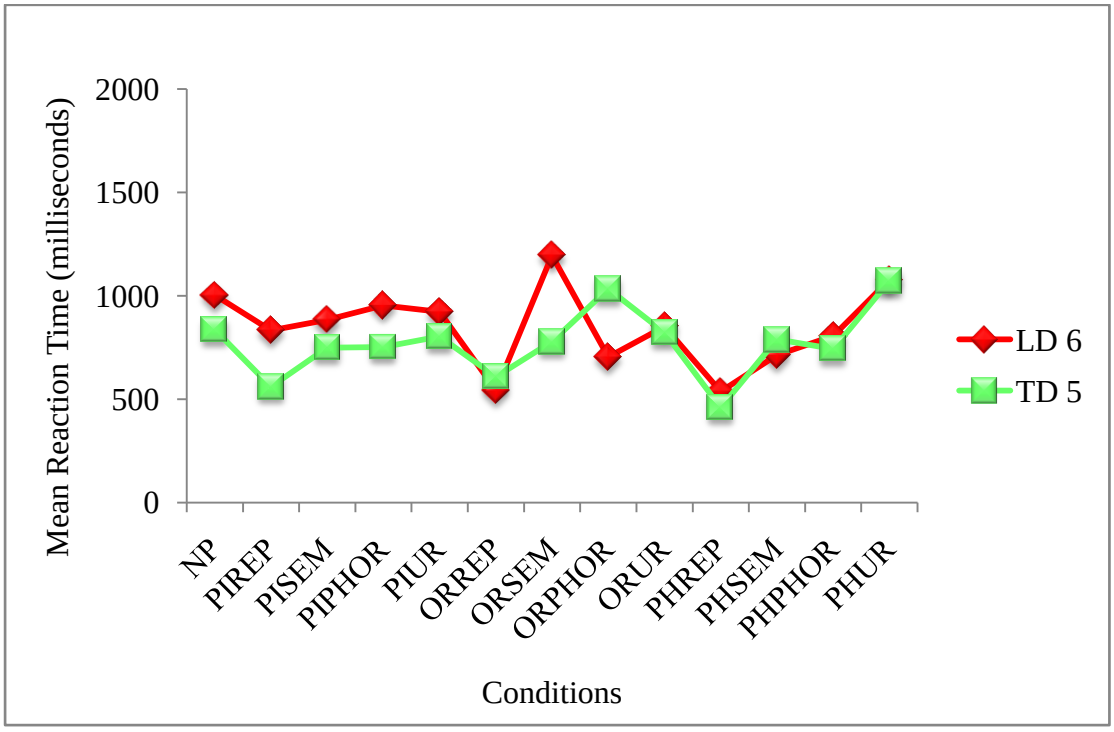

Figure 4.6. Comparison of reaction time for the 13 'prime-target' conditions between LD 6 & TD 5.

Note: Legend as in Table 4.5

CHAPTER V

DISCUSSION

The current study aimed at unravelling the nature of implicit linguistic processing involved in a simple explicit task such as naming in two groups of participants namely, bilingual children with Learning Disability and bilingual typically developing children. The implicit responses measured in terms of 'Reaction Time' were systematically analyzed. In addition, a rating scale, a questionnaire and two sub-tests of a reading test were also administered to obtain additional information. The obtained results were nothing short of fascinating.

5.1 Comparison of bilingual children with Learning Disability with typically developing bilingual children on the 13 'Prime-Target' conditions and 7 'Combined' conditions

Children with Learning Disability are found to be performing in a similar manner as age-matched typically developing children on comparisons of the 13 'prime-target' conditions and the seven combined conditions with the only exception being the 'Phonological Unrelated' condition, where children of Group 2 responded faster than the children of Group 1. The results largely indicate that such an implicit measure may not be a sensitive marker in differentiating the two groups. The results of this study are in consonance in part with some of the existing evidences. The current finding that the semantic primes do not distinguish the two groups is supported by the results of Jednorog, Marchewka, Tacikowski and Grabowska (2010) where they found no statistically significant difference in terms of the ERPs obtained for semantic primes between the dyslexic and control groups. Assink, Van Bergen, Van Teeseling and Knuijt's (2004) finding of no significant differences between poor

readers and chronological age-matched controls for categorically related and unrelated primes on a word naming task, support the current findings. The finding is not comparable with the 'Phonological Unrelated' condition of the present study as in the former; the primes were presented as visual words. The results are also in consonance with the findings of Nation and Snowling (1999), where they found that deciphering concrete semantic relations was not a difficulty for children with poor reading comprehension, and it was only when the abstract semantic relations had to be deciphered did they exhibit differences with the control group. The findings of the 'No Prime' condition across the two groups are in consonance with the findings of most of the studies referred to in the review barring Denckla and Rudel (1976) and Assink, Van Bergen, Van Teeseling and Knuijt's (2004) who found that children with Learning Disability exhibited slower reaction times for picture naming and neutral primes respectively.

The results of the present study are not in consonance with several studies reported in literature that have found differences between two such groups of participants (may not be exactly the same) on priming-based experiments. The findings of Betjemann and Keenan (2008), Stelmack and Miles (1994) and Stelmack and Miles (1990) who have all found significant differences between two such groups using semantic priming do not support the present findings. The difference between these studies and the present is that the earlier studies used synonyms as primes and the present study uses categorical coordinates. In terms of orthographic priming, the present findings are not in consonance with the findings of Savill and Thierry (2011), Betjemann and Keenan (2008) and Temple, Poldrack, Salidis, Deutsch, Tallal, Merzenich and Gabrieli (2001). The tasks/measures used in those studies however, were ERPs, visual lexical decision and matching letter pairs respectively.

Phonological priming of various types were found to disclose differences by Savill and Thierry (2011), Jednorog, Marchewka, Tacikowski and Grabowska (2010), Boada and Pennington (2006), Howard, Howard, Japikse and Eden (2006), Temple, Poldrack, Salidis, Deutsch, Tallal, Merzenich and Gabrieli (2001), Booth, Mac Whinney and Perfetti (1999), Stelmack and Miles (1994) and Stelmack and Miles (1990); but the current findings do not support these results in totality. The most significant factor that influenced the above studies was the duration of prime. In most of the investigations, it was found that only with very short durations of the prime, two such groups could be differentiated; while the current study had varying SOAs for the phonological condition in order to ensure that the entire prime word was presented. Also, the nature of the phonological primes is different from the ones used in the other studies. The presence of a difference in the 'Phonological Unrelated' condition however, indicates that the effect of a spoken word prime may well be present, if the relational factors are controlled.

The reason for the exception (based on the modified Logogen Model of Word Processing) however, may be that in the 'Phonological Unrelated' condition, the phonemic plan of the 'prime' would interfere with the phonemic plan of the target more than in the other 'Unrelated' conditions due to the mode of presentation in this case being auditory-phonological. It may be possible that the absence of any relation between the prime and target makes it more taxing for children with Learning Disability to resolve the confusion between the prime and target, particularly when presented through the auditory phonological channel. It may be indicative of the fact that children with Learning Disability have difficulty in activating the desired phonemic plan above threshold when preceded by an input that is totally unrelated in terms of either phonology or semantics, and is presented through the auditory channel.

5.2 Comparison of the 'No Prime' condition with 12 'prime-target' conditions in each group

The results of the comparison of the reaction times obtained on picture naming for the 'No Prime' condition and the rest of the 'prime-target' conditions reveal that only repetition priming has a facilitative effect on the task in both children with Learning Disability and typically developing children. This finding is well supported by Gonnerman, Seidenberg and Anderson (2007) who found the extent of overlap between the prime and target as a crucial indicator of the effect of priming. However, the difference between the two groups lies in the finding that the repetition relation elicits a considerably faster naming response irrespective of the modality of presentation of the prime, only in children with Learning Disability. In typically developing children, a repetition prime presented only through the pictorial or phonological modalities is facilitative. If the same is presented as a visual word, it does not facilitate the naming of the target. This may not however imply that children with Learning Disability are faster at analyzing the visual word than typically developing children. On the other hand, children with Learning Disability may take longer to inhibit the activation of the prime in the orthographic lexicon due to which the target may be facilitated as the relation is that of repetition (on the basis of the modified Logogen Model).

The present finding that children with 'Learning Disabilities' are not significantly different from the age-matched controls in most of the conditions, leads one to look for the patterns of responses across the various priming conditions incorporated in the study. The two groups have been compared independently for the same. The following discussion begins with the patterns observed in bilingual typically developing children as most studies in literature in these aspects have been

done on typical individuals. This is done with the purpose of facilitating subjective comparisons of the trends seen in bilingual children with Learning Disability with those of their typically developing counterparts.

5.3 Comparison of the effect of the 'prime-target' relations with in each modality of presentation in bilingual typically developing children

The findings of the comparison between the four 'prime-target' relations in each modality of presentation revealed the presence of varying effects of the 'prime-target' relations. It implies that if a prime is presented either pictorially, orthographically (visual word) or phonologically (spoken word), the facilitating or interfering effect is determined by the relation (repetition, semantic, phonological/orthographic and unrelated) it shares with the target in typically developing children. Further statistical analysis revealed that not all of the 'prime-target' relations elicited varied priming effects. When the pictorial modality was used for presentation of the prime, there were differences in priming effects of the repetition relation with the phonological/orthographic and unrelated relations. When the orthographic and phonological modalities were used for presentation of the prime, there were differences in priming effects of the repetition relation with all of the semantic, phonological/orthographic and unrelated relations. The findings thus largely pointed towards a difference between the repetition relation and the others, irrespective of the modality of presentation. The differences were such that in each of these comparisons, repetition priming effects were found to be most robust.

The findings of the present study are in total consonance with Gonnerman, Seidenberg and Anderson (2007) in that the magnitude of priming has been found be related to the extent of similarity between the prime and target. Repetition primes bear

the maximum similarity in terms of semantics, phonology and orthography and consequently exhibit greater facilitation. The finding that there exists no difference between the other relations (barring repetition) is not supported in the studies by Perraudin and Mounoud (2009; 2003) that followed the exact design of 'prime-target' presentation as in this study. They found significant differences between categorical semantic priming and unrelated priming in 7 and 9 year old typically developing children which was not the case here.

It may be crucial to note that although the effect of the repetition relation was significantly different from the others (semantic, phonological/orthographic, and unrelated) in the orthographic and phonological modalities of presentation, in the pictorial modality, the semantic and repetition relations did not exhibit differences. This may be indicative of effect of the direct access of the pictured-object (prime) to the semantic system and the strong implicit lexical relation it may have with its categorical coordinate (target), which may have resulted a similar amount of priming as in the repetition conditions. It is also found that the effect of the semantic relation does not differ with the other relations, which also may indicate that the effect of semantic priming may not be as robust as the effect of repetition priming (based on the modified Model of Word Processing).

5.4 Comparison of the effect of the modalities of presentation with in each 'prime-target' relation in bilingual typically developing children

The findings of the comparison between the three modalities of presentation in each 'prime-target' relation reveal the presence of varying effects of the modality of presentation only in the phonological/orthographic relation. It implies that if a prime is related to the target phonologically or orthographically, the facilitating or

interfering effect is determined by the modality through which it is presented in typically developing children. Specifically, the phonological (spoken word) presentation of the phonological/orthographic prime yields more robust priming than either the pictorial or orthographic (visual word) modalities of presentation. This is in consonance with the study by Ferrand, Grainger and Segui (1994) who found that spoken word primes yielded faster naming responses to pictures than visual word primes, when the primes were phonologically and orthographically related. The relation was however different from the present study in that they considered repetition and pseudohomophone similarities with the targets. In a study by Schiller (2008), it was found that when whole word primes were presented visually with the first or last segments' overlap, interference occurred in typical individuals. The present study also used a similar prime in the Phonological/Orthographic condition, but did not follow the above pattern of response in the orthographic modality of presentation. This may be due to the difference in the age of the participants in that the present study dealt with children and in Schiller's study, the participants were adults. The finding that none of the other 'prime-target' relations exhibited preferences for modality of prime presentation may indicate that the effects of semantic, repetition and unrelated priming may be independent of modality in typically developing children.

5.5 Comparison of the 7 'Combined' conditions and the 'No Prime' condition in bilingual typically developing children

The 'prime-target' pairs are grouped under specific 'prime-target' relations and specific modalities. Thus, data for the combined conditions is obtained. The findings of the comparison between the combined modalities and the 'no prime' conditions point towards the absence of priming effects in typically developing

children when all ‘prime-target’ relations are considered collectively for presentation through a modality. This may be due to the integrative effect of some ‘prime-target’ relations that may be facilitative and an almost equal number of ‘prime-target’ relations that may be interfering. Contrary to this finding, comparison between the combined relations and the ‘no prime’ condition pointed towards the presence of facilitatory priming effects in the repetition relation irrespective of the modality of presentation. More specifically, the repetition relation yields faster reaction times than the semantic, phonological/orthographic and unrelated relations and the ‘no prime’ condition. This implies that in typically developing children, if a word is pictured, read or heard prior to the naming of the same word on viewing a picture, it positively acts as a prime. The findings of the present study are supported by the studies that have found facilitatory effects of repetition priming (Gonnerman, Seidenberg & Anderson, 2007; Ferrand, Grainger & Segui, 1994), but are not in consonance with reference to the effects of the other types of priming (Ganesh & Subba Rao, 2009; Perraudin & Mounoud ,2009; Perraudin & Mounoud, 2003; Alario, Segui & Ferrand, 2000).

5.6 Comparison of the effect of the ‘prime-target’ relations with in each modality of presentation in bilingual children with Learning Disability

The findings of the comparison between the four ‘prime-target’ relations in each modality of presentation showed that the ‘prime-target’ relations did influence the effects of priming in the orthographic and phonological modalities of presentation. This is similar to the findings in typically developing children. However, the effects of the pictorial modality did not vary across the ‘prime-target’ relations; and this finding is not the same as in typically developing children. The reason may be speculated that children with Learning Disability may fail to recognize aspects of

phonology or orthography from the pictorial primes as this requires a deeper level of analytical extraction. This assumption is made on the basis of Howard, Howard, Japikse and Eden (2006) who reported that individuals with dyslexia may exhibit deficits in higher levels of implicit learning and Boada and Pennington (2006) who found that children with dyslexia had deficits in their implicit phonological representations. In the orthographic modality of presentation, the repetition prime is found to elicit significantly faster naming responses compared to the semantic and unrelated primes. Interestingly, they differ from the typically developing group in that there is no difference between the repetition relation and phonological/orthographic relation; and there is a significant difference between the phonological/orthographic relation and the semantic relation. The phonological/orthographic relation is found to elicit faster responses compared to the semantic relation. This implies that although children with Learning Disability are primed through repetition, the effect is not significantly more than that of a phonological/orthographic overlap between the prime and target. Also, there may be a possibility that the semantic prime presented through the orthographic modality may be interfering with the target and consequently, the response to the phonological/orthographic prime appears to be significantly different from that to the semantic prime. This differential effect of semantic and phonological/orthographic primes is supported by the findings of Jednorog, Marchewka, Tacikowski and Grabowska (2010). In the phonological modality of presentation, the children with Learning Disability follow the same pattern as typical children with repetition priming eliciting significantly faster responses than the rest.

5.7 Comparison of the effect of the modalities of presentation with in each 'prime-target' relation in bilingual children with Learning Disability

The findings of the comparison between the three modalities of presentation in each 'prime-target' relation in children with Learning Disability contrasts with the findings of typically developing children in that, only the effect of the repetition relation appears to be different across modalities. The typically developing children on the other hand exhibited differences between the modalities only for the phonological/orthographic 'prime-target' relation. The effects of priming caused by the semantic, phonological/orthographic and unrelated relations do not change depending on the modality of presentation in children with Learning Disability. With respect to the repetition relation, it is found that when the prime is presented through the auditory modality (phonological), the responses are significantly faster than when they are presented as visual words (orthographic). This implies that the children with Learning Disability who participated in the study may be better at implicit processing of phonological information than orthographic information. This is in contradiction to the findings of Bi, Xu and Caramazza (2009) in adults with dyslexia where they found that the orthographic primes led to greater facilitation. This may be indicative of a developmental trend. It however receives support from studies such as the one by Badian (1999) where reading comprehension was found to be poorer than listening comprehension. Thus, such an implicit measure may be considered as one that reflects explicit linguistic skills. The effects of the pictorial modality of presentation is however, not different from the effects of either the phonological or orthographic modalities for the repetition relation.

5.8 Comparison of the 7 'Combined' conditions and the 'No Prime' condition in bilingual children with Learning Disability

The findings of the comparison between the combined modalities and the 'no prime' conditions points towards the absence of priming effects in children with Learning Disability as in the age matched typically developing children when all 'prime-target' relations are considered collectively for presentation through a modality. On the other hand, the comparison between the combined relations and the 'no prime' conditions reveal the presence of positive effects of priming when the relation is repetition. This finding is also similar to the findings in typically developing children where the repetition relation elicits faster naming responses compared the semantic, phonological/orthographic, unrelated relations and the 'No Prime' condition. There is no difference in the effects of priming with semantic, phonological/orthographic and unrelated primes. The absence of semantic priming is in consonance with the findings of Jednorog, Marchewka, Tacikowski and Grabowska (2010); Assink, Van Bergen, Van Teeseling and Knuijt's (2004) etc. The present findings are not in consonance with Savill and Thierry (2011) and Temple, Poldrack, Salidis, Deutsch, Tallal, Merzenich and Gabrieli (2001) with reference to the absence of any difference between the 'no prime' and phonological/orthographic primes.

Thus, bilingual typically developing children and bilingual children with Learning Disability are found to exhibit patterns that differ subtly. In both the groups, repetition priming appears to be facilitative across the modalities of presentation. Children with Learning Disability and typically developing children appear to show a preference for the auditory phonological presentation of the prime over the visual orthographic presentation, based on the repetition and phonological/orthographic 'prime-target' comparisons, respectively.

5.9 Descriptive recording of the errors/corrections during the 'Naming' task

The responses of all the participants in the picture naming task include several erroneous responses in addition to the correct responses. The participants have also made attempts at correcting the error. Interestingly, the errors and corrections of the participants with in a group appear to be similar. Table 5.1 represents a summary of the types of errors and the corrections made by children with Learning Disability and typically developing children on picture naming.

Table 5.1

Naming errors and corrections in Groups 1 and 2

Error/Correction	Example	1	2
Semantic substitution	'bowl' for plate	+	+
Self correction after semantic substitution	'chair - table' for table	+	+
Self correction after partial semantic substitution	'/tom/ - potato' for potato	+	-
Super-ordinate substitution	'fruit' for mango	+	-
Self correction after associative substitution	'hair - comb' for comb	+	-
Self correction after associative super-ordinate substitution	'bird - butterfly' for butterfly	+	-
Visuo-perceptual error	'apple' for tomato	+	-
Self correction after language switch	'/hasu/ - cow' for cow	+	+
Voicing error	'/pas/' for bus	+	-
Part-word repetition (PWR)	'/pəpəpotaeto/' for potato	+	+
Prolongation	'/s----a:ri/' for saree	+	-
Audible fillers	'/ə---bas/' for bus	+	+
Incomplete response	'/bat/' for butterfly	-	+

Note: Group 1 – children with Learning Disability, Group 2 – typically developing children

Most of the errors are influenced by the primes presented prior to the targets, and a few others may have a distant connection with either the prime or target. These errors are suggestive of the difficulties in inhibiting the activation of the lexical, phonological and semantic neighbours of the 'prime-target' pairs. The effect of bilingual language representation can also be noticed in both the groups, where lexical items more familiar in the native language or less familiar in the second language lead

to incorrect access. In contrast to typically developing children, children with Learning Disability show a number of distant substitutions. It also appears that the difficulty with inhibition is more frequently observed in children with Learning Disability pointing towards the presence of implicit linguistic processing deficits.

5.10 Pair-wise comparison of each participant with Learning Disability and a chronological age-matched typically developing participant

Each participant with Learning Disability is paired with an age-matched typically developing participant in the present study. For further insights in to the data, a subjective comparison of each of the participants is made (as shown in *Figures 4.1 to 4.6*) considering their scores on International Second Language Proficiency Rating Scale (ISLPR) (Wylie & Ingram, 1999), Early Reading Skills (ERS) (Visual & Auditory Discrimination Sections) (from Rae & Potter, 1981) and Screening Checklist for Auditory Processing (SCAP) (Yathiraj & Mascarenhas, 2003).

5.10.1 LD 1 and TD 1 (Chronological Age: 7 years)

On visual inspection of *Figure 4.1*, the two age-matched children do not seem to perform differently. It is interesting to note that the second language proficiency of the child with Learning Disability is higher than the typically developing child. Also, the child does not score very poorly in the visual discrimination section. The child does exhibit some auditory processing deficits as per the auditory discrimination task, but does not score too poorly on SCAP. The greater proficiency of English combined with minimal deficits in input processing may have caused the two participants to perform similarly.

5.10.2 LD 2 and TD 2 (Chronological Age: 8 years)

On visual inspection of *Figure 4.2,* there appears to be a pattern that separates the two participants on most of the 'prime-target' conditions, pointing towards the presence of implicit deficits in the child with Learning Disability. However, this may be attributed largely to the difference in second language proficiency between the two participants and the presence of deficient visual discrimination skills. In other words, it may be possible that the proficiency and processing deficits account for the slower responses.

5.10.3 LD 3 and TD 3 (Chronological Age: 9 years)

On visual inspection of *Figure 4.3,* there is no apparent difference between the two age-matched participants. The proficiency of English is better for the child with Learning Disability compared to the typically developing child, as observed in LD 1 and TD 1. Also, the child with Learning Disability does not score very poorly on both ERS (auditory and visual discrimination sections) and SCAP. This may be indicative of the influence of language proficiency and input processing abilities on the reaction times.

5.10.4 LD 4 and TD 3 (Chronological Age: 9 years)

On visual inspection of *Figure 4.4,* it appears that no particular pattern is followed by the participants across the conditions. In some of the conditions, the child with Learning Disability exhibits faster naming, while in a few others, a reverse pattern is observed. Interestingly, the two participants function at a similar level of second language proficiency, which is not beyond survival proficiency. But, the child with LD, scores poorly on the visual discrimination section of ERS and more so on SCAP. This complicates the issue, as it points to a possibility of the presence of other

factors in addition to language proficiency and input processing deficits in influencing the reaction times.

5.10.5 LD 5 and TD 4 (Chronological Age: 11 years)

On visual inspection of *Figure 4.5*, large differences between the two participants are apparent, particularly for the reaction times of the no prime and pictorial conditions. As a support to this, the ISPLR score indicates better language proficiency of the typically developing child. In addition, the score on SCAP is certainly poor. Although, the scores on the sections of ERS are within the norms, the combined effects of poor auditory processing and limited linguistic knowledge appear to successfully differentiate the performances of the two participants.

5.10.6 LD 6 and TD 5 (Chronological Age: 12 years)

On visual inspection of *Figure 4.6*, very subtle differences may be observed; although they appear to function at a similar level. The speaking and listening levels of the two participants are similar. The child with LD is only marginally less proficient in terms of reading and writing. The scores on the sections of ERS and on SCAP do not indicate the presence of a greater degree of input processing deficits. Thus, the performance on reaction times appears to be influenced by these factors.

The individual comparisons have thus added additional dimensions to the understanding of implicit processing in children with Learning Disability and typically developing children by grossly appearing to follow the trends of language proficiency and input processing abilities. This however, need not be considered as a conclusive finding but as a question for future research. In addition, no substantial trend is noticed in terms of the change in the response patterns (on inspection of the Figures) with increasing age for children with Learning Disability. However, with

reference to typically developing children, the reaction times seem to fall below 1000 milliseconds at around 11 years of age. This may imply that the 13 'prime-target' pair stimulus can be a useful tool in tracking implicit linguistic processing abilities beyond 10 years of age.

The findings of the study have thus revealed some peculiarities between typically developing children and children with Learning Disability. The presentation of only an unrelated prime through the auditory channel has been found to be interfering in children with Learning Disability. The patterns followed by the two groups in terms of the effects of various 'prime-target' relations and presentation modalities are suggestive of the presence of subtle differences. Repetition priming has been convincingly found to be facilitative in both the groups although some differences in terms of the modalities of presentation exist. In addition, the specific findings of the study may have added to the understanding of the functioning of the modified Logogen Model.

CHAPTER VI

SUMMARY AND CONCLUSIONS

'Learning Disability', being a largely unobservable construct, implicit measures had been used in delineating the subtle and subtler deficits in linguistic processing. A few studies of implicit linguistic processing in children with Learning Disability reported reasonable differences in certain parameters with typically developing children, but no comprehensive conclusions were arrived at. Particularly in India, where there is a growing bilingual/multilingual population with Learning Disability it became imperative to have a holistic insight of the problem. These issues led to the beginning of the current investigation.

The study aimed at investigating the implicit linguistic processing abilities in Kannada-English bilingual children with Learning Disability and age-matched typically developing Kannada-English bilingual children. Six participants with Learning Disability aged between 7 and 12 years (Group 1) were compared with five age-matched typically developing children (Group 2) using a set of tools. They were:

1. International Second Language Proficiency Rating Scale (ISLPR) (Wylie & Ingram, 1999)
2. Early Reading Skills (ERS) (Visual & Auditory Discrimination Sections) (from Rae & Potter, 1981)
3. Screening Checklist for Auditory Processing (SCAP) (Yathiraj & Mascarenhas, 2003)
4. 13 sets of 'prime-target' pairs (10 pairs in each set = 130 items) – This was designed by the investigator based on the modified 'Logogen Model of Word Processing' (Patterson & Shewell, 1987). 13 'prime-target' combinations that

comprised three modalities of presentation (Pictorial, Orthographic and Phonological) and four relations between the prime and target (Repetition, Semantic, Phonological/Orthographic and Unrelated) were prepared.

All the participants were subjected to a picture naming task on the 13 sets of 'prime-target' pairs in the DMDX software. The reaction times obtained using the Check Vocal software were averaged and statistically analyzed in the SPSS software. The Mann Whitney, Wilcoxon Signed Ranks and Friedman tests were applied to compare and contrast between the two groups and to investigate the effects of the modalities of presentation and 'prime-target' relations on reaction time.

In addition, a description of the qualitative errors made by the participants of the two groups during the priming experiment was also made. The participants were compared pair-wise with subjective inspection of the diagrammatic representations of the mean values of reaction time for each of the 13 'prime-target' pairs and the scores obtained on the other tools. The results were discussed on the basis of the modified Logogen Model along with the findings in literature.

6.1 Conclusions

The following conclusions can be drawn from the findings of the study:

1. Bilingual children with Learning Disability do not differ from age-matched typically developing bilingual children in most of the 'prime-target' conditions.
2. Bilingual children with Learning Disability respond slower compared to age-matched typically developing bilingual children when an unrelated prime is presented through the auditory channel while naming a pictured object, indicating interference.

3. In bilingual children with Learning Disability, repetition priming is facilitative irrespective of the modality through which it is presented when compared with the 'No Prime' condition.
4. In typically developing bilingual children, repetition priming is facilitative when presented in the form of either a picture or through the auditory channel when compared with the 'No Prime' condition.
5. In bilingual children with Learning Disability, repetition priming yields faster naming responses compared to the other 'prime-target' relations when the modality of presentation is phonological (spoken word).
6. In bilingual children with Learning Disability, repetition priming presented as a visual word (orthographic) yields faster naming responses than the semantic and unrelated relations, but not the phonological/orthographic condition.
7. In bilingual children with Learning Disability, the orthographic presentation of a prime in the phonological/orthographic relation leads to faster naming response than a semantically related prime.
8. In typically developing bilingual children, repetition priming largely yields faster naming responses compared to most other 'prime-target' relations irrespective of the modality of presentation, barring the pictorial presentation of a semantically related prime.
9. In bilingual children with Learning Disability, the phonological modality of presentation yields faster naming responses compared to the orthographic modality, only when the 'prime-target' relation is repetition.
10. In typically developing bilingual children, the phonological modality of presentation yields faster naming responses compared to the orthographic and

pictorial modalities only when 'prime-target' relation is phonological/orthographic.

11. Both bilingual children with Learning Disability and typically developing bilingual children exhibit faster naming responses to repetition priming compared to the other 'prime-target' relations.
12. Bilingual children with Learning Disability differ in terms of the pattern observed with reference of the effects of 'prime-target' relations and modalities of presentation from age-matched typically developing bilingual children.
13. The nature and frequency of the errors made during the naming task under the influence of various primes are suggestive of greater implicit linguistic processing deficits in bilingual children with Learning Disability compared to typically developing bilingual children, particularly in terms of the difficulties in inhibiting the undesirable activations.
14. The performance on the priming paradigm may grossly be a reflection of the level of proficiency of the second language and the input processing deficits in bilingual children with Learning Disability.

Thus, the study effectively compares and contrasts the implicit linguistic processing abilities of the two groups.

6.2 Clinical Implications

The findings of the study may have several clinical implications, if cautiously incorporated.

1. The findings indicate that children with Learning Disability may do well on picture naming if sensitized towards various 'primes' through feature analysis.

2. ‘Repetition’ relation could be used as a cueing strategy presented through pictures, visual words or auditory-phonological routes in facilitating word retrieval in children with Learning Disability.
3. Improving language proficiency could be considered as an indirect approach to facilitate implicit linguistic processing.
4. Input processing deficits could be dealt with in therapeutic interventions to aid the improvement of implicit linguistic skills.
5. It is important to facilitate inhibition of responses to certain distracting stimuli in children with Learning Disability in order to create a balanced activation of lexical entities.

6.3 Limitations of the study

The study also has a few limitations, when viewed retrospectively.

1. Small sample size: The presence of a larger number of data points would have been extremely useful in charting the trends observed within and across the two groups more effectively.
2. Lack of sub-grouping: All children with Learning Disability were considered as belonging to a single group. The heterogeneity that is obvious in any group of children Learning Disability may have led to the varying patterns of responses observed. A greater control over participant selection would have been fruitful.

6.4 Options for future research

Although the findings of the present study could have been more valid if a larger sample was considered, the existing findings have opened several options for future research.

1. It may be worthwhile to study the effects of a similar comprehensive priming paradigm using lexical decision tasks and ERPs in children with Learning Disability.
2. A study on the effects of a similar paradigm using a shortened SOA may be helpful in differentiating the performance of children with Learning Disability and typically developing children.
3. This study could be replicated across bilingual children with Learning Disability of different first languages to investigate the effects of a native language on primed naming in English.
4. A similar paradigm could be administered on adults with Learning Disability to obtain more information on the developmental trends followed by implicit linguistic processing of this kind.
5. This stimulus set may be used to evaluate the effectiveness of therapeutic intervention by examining the effects of therapy on implicit linguistic processing in children with Learning Disability.
6. This stimulus set could be administered on individuals with input and output processing disorders such as Hearing Impairment and Childhood Apraxia of Speech, to get a broad view of the entire processing system of language.

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APPENDIX 1

The 130 'prime-target' stimuli grouped according to the 'prime-target' relations (Repetition, Semantic, Phonological/Orthographic and Unrelated) and modalities of presentation (Pictorial, Orthographic and Phonological).

REPETITION RELATION					
Pictorial		**Orthographic**		**Phonological**	
Prime	***Target***	***Prime***	***Target***	***Prime***	***Target***
apple	apple	MANGO	mango	/tomaeto/	tomato
bulb	bulb	TV	TV	/ku:mb/	comb
pants	pants	SHOES	shoes	/sa:ri:/	saree
table	table	CHAIR	chair	/ɔrɛndz/	orange
soap	soap	LIPS	lips	/lɛgs/	legs
butterfly	butterfly	MONKEY	monkey	/kau/	cow
potato	potato	CAR	car	/bas/	bus
idli	idli	MILK	milk	/ʧapa:t̲i/	chapati
sun	sun	FLOWER	flower	/pɛnsil/	pencil
book	book	PLATE	plate	/spu:n/	Spoon
SEMANTIC RELATION					
Pictorial		**Orthographic**		**Phonological**	
Prime	***Target***	***Prime***	***Target***	***Prime***	***Target***
grapes	apple	CAMERA	bulb	/ʃɚrt/	pants
remote	TV	CAP	shoes	/bɛntʃ/	chair
frock	saree	PINEAPPLE	orange	/ijɚ/	legs
sofa	table	BRUSH	soap	/aent/	butterfly
tongue	lips	ELEPHANT	monkey	/trein/	car
donkey	cow	AUTORICKSHAW	bus	/brɛd/	chapati
brinjal	potato	DOSA	idli	/mu:n/	sun
juice	milk	LEAF	flower	/kap/	plate
scale	pencil	BOWL	spoon	/ɔnijən/	tomato
pen	book	BANANA	mango	/tu:t̲ braʃ /	comb
PHONOLOGICAL/ORTHOGRAPHIC RELATION					
Pictorial		**Orthographic**		**Phonological**	
Prime	***Target***	***Prime***	***Target***	***Prime***	***Target***
pig	pants	BIRD	bulb	/aed/	apple
tiffin box	TV	MOBILE	mango	/tre/	table
tap	tomato	PAINT	plate	/ʃain/	shoes
balloon	butterfly	SWEETS	soap	/kɔtən/	comb
lotus	lips	CHEETAH	chair	/pa:rk/	potato
octopus	orange	SICK	saree	/mad/	monkey
snake	sun	INK	idli	/lebəl/	legs
mat	milk	COLD	car	/bɛl/	book
bag	bus	CANDY	cow	/faet/	flower
seven	spoon	PLUG	pencil	/ʧaild/	chapati

UNRELATED					
Pictorial		**Orthographic**		**Phonological**	
Prime	***Target***	***Prime***	***Target***	***Prime***	***Target***
parrot	saree	MOUNTAIN	comb	/tʃa:rt/	tomato
chain	mango	GRASS	plate	/bɔks/	flower
teeth	bulb	BIKE	apple	/drink/	book
tub	cow	RAT	legs	/dzamp/	orange
fish	chair	RAIN	shoes	/sli:p/	TV
lollipop	soap	NECK	table	/bɛd/	pants
giraffe	pencil	NINE	chapati	/ste:r/	bus
ball	car	SALT	monkey	/ga:rdən/	lips
pillow	idli	ROAD	potato	/king/	butterfly
zebra	spoon	NUTS	sun	/flo:r/	milk

NO PRIME – Target				
lips	mango	potato	TV	shoes
cow	flower	spoon	bus	milk