

**LINGUISTIC PATTERN OF WRITTEN LANGUAGE IN CHILDREN  
WITH LEARNING DISABILITY**

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Dissertation submitted in part fulfilment for the Degree of  
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May, 2014**

## **CERTIFICATE**

This is to certify that this dissertation entitled “**Linguistic Pattern of Written Language in 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.: 12SLP023). This has been carried out under the guidance of a faculty of this institute and has not been submitted earlier to any of the University for the award of any other Diploma or Degree.

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## DECLARATION

This is to certify that this dissertation entitled “**Linguistic Pattern of Written Language in Children with Learning Disability**” is the result of my own study under the guidance of Dr. Jayashree. C. Shanbal, Reader in Language Pathology, Department of Speech - Language Pathology, All India Institute of Speech and Hearing, Mysore, and has not been submitted earlier in other University for the award of any Diploma or Degree.

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*A big 'thankyou' to my loving parents for always being there for me.*

*To my sweet little sister... you are the apple of my eye.*

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*To my friends...you guys are the best... ☺ ☺*

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## **CHAPTER 1: Introduction**

Writing is an essential means of communication as well as a cognitive skill that helps children organize their thoughts in a structured manner. It is one of the most complex verbal behaviors and typically developing children of all ages have difficulties becoming proficient in writing. Some children with writing difficulties might have an associated disorder such as learning disability, dyslexia, whereas others do not.

Writing involves use of executive processing and self regulation throughout the activity which includes four stages: planning, organizing, generating and revising (Scott, 2005). These stages are followed one after the other smoothly, quickly and easily in proficient writers. In the early grades, text generation and writing quality are most constrained by child's handwriting fluency (Berninger & Swanson, 1994). By intermediate grades, handwriting becomes automatized for most of the children, the texts become longer as its constraint on text generation minimizes. Because children, who have not yet mastered handwriting, must direct attention to letter formation, they do not generate much text. With age, text length and quality becomes increasingly related (Berninger & Swanson, 1994; Shanbal & Prema, 2003; Yeshoda, 1994; Kiran, 1994).

Writing is a multi-faceted activity ranging from the production of legible handwriting to the production of organized discourse. Various pre requisites required for efficient writing are auditory processes, motor processes, visual processes and the inner language processes. These processes are the stepping stones for the prospective writers. Any difficulty with one of the pre requisites would lead to written language difficulties.

The components of writing are interwoven, and difficulty in one aspect of writing, such as spelling, often contributes to difficulty in another aspect of writing, such as taking notes or expressing ideas. The components of written language are handwriting, spelling, usage, vocabulary and text structure. These skills are interlinked to one another and thus help in forming a structured and organized written text (Mather, Wendling & Roberts, 2009).

Learning to spell transforms how children think about the sounds in their language (Nunes, Bryant, & Bindman, 2006). Children must recognize how the sounds and letters in words are related, which is not always an easy task. Regularities in letter-to-sound correspondences support accurate English spellings for nearly 50% percent of English words (Joshi, Treiman, Carreker, & Moats, 2008); nevertheless in reality English spelling is morphophonemic. Meaning relationships are often represented through spellings despite any changes that may occur in pronunciation or orthography (e.g., *sign* and *signal*, *nature* and *natural*; Green, et al., 2003).

Learning to spell is more difficult than learning to recognize words because spelling requires not only learning grapheme-phoneme correspondences but also developing orthographic and morphological knowledge (Ehri, 1980; Olson, Forsberg, & Wise, 1994), in which word specific spelling, pronunciations, and morphological structures and word meanings are stored and accessed. On the one hand, accessing this lexicon can often place distinctive “demands on the orthographic memory” (Moats, 2009) relative to grapheme position and sequences. On the other hand, the multi-format lexicon

may facilitate co-ordination of the interrelationships among orthography, phonology, and morphology.

Spelling errors are a rich source of information. Systematic spelling failures are thought to reveal aspects of the cognitive mechanisms of spelling and learning to spell. Moreover, spelling errors may be strongly dependent on the language-specific orthographic system and on the individual level of competence. By kindergarten, many children begin to apply their existing phonological knowledge of pronunciation, combined with emerging orthographic knowledge, to produce invented spellings. Hence, pack might be spelled as “pak” (Treiman & Bourassa, 2000), which then preserves the minimal phoneme representation known as the phonological skeleton (Bourassa & Treiman, 2003).

Given this framework, various theories of spelling development have been proposed to account for how children learn this complex linguistic skill. From past few years, research on writing aspects of language has geared up. Presently, many standardized tests are being used by Speech Language Pathologists which quantify the written language skills such as spellings, vocabulary usage, syntactic structures, and conceptual maturity. Written language can be assessed using standardized tests which test basic skills like spelling, handwriting, vocabulary, syntax qualitatively.

In the past, spelling development was characterized by linear stages in which children learn to use phonological, orthographic, and morphological knowledge bases in succession. A recent view challenges the linearity of this approach and proposes that spelling development is characterized by the simultaneous interaction of all three

linguistic factors from beginning itself. The “ Triple word form theory” (Bahr, Silliman, & Berninger, 2009; Garcia, Abbott, Berninger, 2010) predicts that spelling development depends on the learning to code into memory, analyze and coordinate the three word forms and their parts: a) phonological (coding and analyzing phonemes and other sound units in words), b) orthographic (coding and analyzing written words and the single letters, letter groups, and larger letter patterns in them), c) morphologic (coding and analyzing base words, prefixes, and inflectional and derivational suffixes in both spoken and written words).

Learning disability is conceptualized as an unexpected difficulty with one or more academic areas that occur among children of normal intelligence who have had adequate opportunity for learning and who do not have social disadvantages or behavior or emotional problems. The term learning disability (LD) refers to difficulties with academic abilities such as reading, writing, spelling and mathematics (American Psychiatric Association, 2000; Sarkees-Wircenski & Scott, 2003). The most widely used definition of LD can be found in the Individuals with Disabilities Education Act (IDEA). They defined LD as “ a disorder in one or more of the basic psychological processes involved in understanding or in using language, spoken or written, that may manifest itself in an imperfect ability to listen, think, speak, read, write, spell or do mathematical calculations including conditions such as perceptual disabilities, brain injury, minimal brain dysfunction, dyslexia and developmental aphasia.”

Thus, a more comprehensive investigation of written language pattern of children with Learning disability is of importance as it would not only facilitate SLPs to

understand the linguistic and non linguistic domains of writing, but may also help in quantifying and categorizing the spelling errors in order to understand the most affected linguistic domain of written language.

## CHAPTER 2: Review of Literature

The study of writing has intrigued scientists and scholars for thousands of years, dating back to the times of cave drawings, and this communication strategy has evolved over the centuries into a sophisticated linguistic system. Indeed, writing (auditory and visual) and speaking are the two basic mechanisms for verbal communication and, ultimately, for knowledge demonstration. Writing has become a critical life skill that is intimately linked to basic literacy.

Auditory language is acquired first, i.e., before a child begins to read and write. Language systems develop sequentially according to the pattern determined phylogenetically and ontogenetically, neurologically and psychologically. After the acquisition of auditory language and required additional maturity, the typically developing child acquires visual language forms; he learns to read and write. The relationship between the auditory and visual language form is hierarchical in nature, i.e., in course of normal development, the read form is dependent on the auditory or spoken language development, and the written language development is dependent on the integrity of both the auditory and the read form.

Writing is a challenging activity for most of the primary school going children as it is a complex process which requires the activation and co-ordination of orthographic, graphomotor and several linguistic skills including semantics, syntax, spelling and writing conventions ( Scott, 2005; Singer & Bashir, 2004).

Literature on written language skills has been reviewed and explained under the following sections:

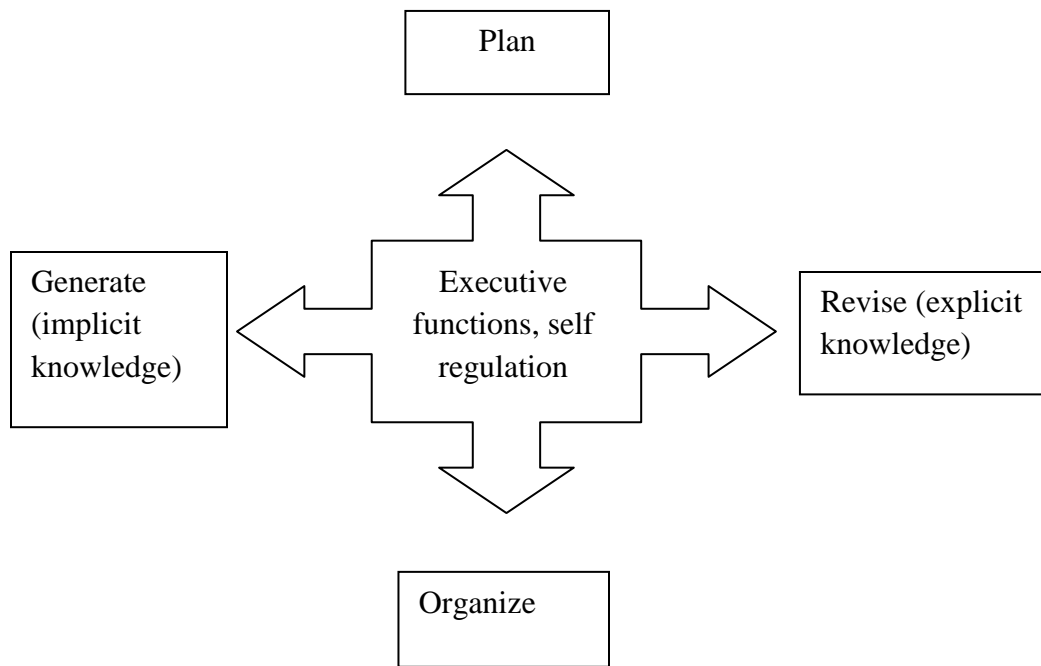
- Neurodevelopmental components
- Pre requisites for written language
- Components of written language
- Linguistic Basis of Spellings
- Models of Spelling Development
- Assessment of Written Language and Spelling
- Tests for Assessing Written Language and Spelling Skills
- Studies on Written Language in TDC and Special Populations
- Studies on Spelling Development in TDC and Special Populations

## **2.1 Neuro-developmental components of writing**

Writing may be one of our most complex human functions. A good written language sample could provide a multitude of information pertaining to an individual's academic, neurocognitive, and perhaps psychiatric functioning (Johnson, 1992). A variety of neurodevelopmental components have been implicated in written expression, and many of these components have been articulated in proposed theoretical models for

written expression. Because writing is an intentional action, it is under the control of executive and self regulatory processes.

Various models of written language have been proposed that have explained the variations and difficulties seen in the production of written language in children (Bereiter & Scaradmalia, 1987; Berninger & Swanson, 1994; Hayes, 2000; Hayes & Flower, 1980). One such model of written language production (Singer and Bashir, 2004) is described below.



*Figure 2.1.* A model of written language production (cited in Handbook of Literacy Development and Disorders, Singer & Bashir, 2004)



This model of written language production includes four processes i.e. planning, organizing, generating and revising. As writing is a deliberate self regulated task, it is controlled by executive functions. The first step in writing a text is generating the ideas and retrieval (plan), second is to structure the ideas to convey their meaning (organize), third step is encoding the ideas into linear strings of words, phrases and clauses to express those meanings (generate), and finally to reconsider and recast those linguistic structures to convey the intentions of the writer according to the written conventions of the culture (revise). Hence, these four processes primarily help in the process of composing. Each of these processes are described in the following sections,

*a. Planning:* The primary aim to write is to communicate. In this model, the process of planning is considered to involve the retrieval of preverbal representations (Collins & Gentner, 1980) i.e., conceptual information represented in non-linguistic form. In much simpler form, planning involves idea generation and retrieval. Children with LD failed to engage in advanced planning processes when they write both narrative and expository text. They use on an average less than 1 minute of time planning prior to writing, unless they are explicitly taught how to plan.

*b. Organizing:* According to this model, the process of organization takes place when the writer decides how to structure and sequence the ideational content of a text. Children enlist organizing processes when they implicitly and/or explicitly plan how to attain their goals for a text and generate language reflecting their knowledge. Children with LD struggle organizing ideas for writing. They string ideas together associatively instead of actively shaping them according to the text structure dictated by the genre

and/or writing task. Prior to writing, if children have brainstorming ideas, while composing text they do not apply logical and well defined schemas for organization of information. As a result, their writing is often poorly organized and incoherent.

*c. Generating:* Singer and Bashir (1999), reported that The process of generation encompasses two skills: firstly, text generation, which involves turning ideas that are generated in the planning process into language representations with working memory so that they can be expressed in writing. It involves implicit representation and encoding of ideas into written language. In the representational process, the writer draws knowledge of language meaning, structure, spelling, writing mechanisms and text structure.

Secondly, the skill of transcription, which involves encoding verbal mental representations into written symbols (Berninger & Swanson, 1994). The knowledge of spelling, writing mechanics and writing conventions is recruited by the writers to transcribe the formulated ideas onto paper.

*d. Revising:* The authors have explained revision as a process that taps the explicit linguistic knowledge. Changes to word choice, sentence structure, spelling, punctuation, and so on are brought about by one's explicit/meta-linguistic knowledge of language meaning, form and use. While producing text, writers use both implicit and explicit linguistic knowledge. They encode ideas implicitly, and then reflect on the degree to which they have accurately represented their intentions and when necessary, explicitly use their knowledge of language to reformulate, clarify or elaborate. Children with LD struggled not only to decode and to comprehend their own writing but also to

comprehend and evaluate what they read in terms of its meaning, form, style, clarity, organization and effect on the reader. Many children with LD have impaired working memory, which impedes their ability to hold goals for their text in mind, while they read to evaluate whether they achieved these goals (Swanson & Berninger, 1994).

## **2.2 Pre requisites for written language**

The skill of writing is last to be achieved in developmental process. Certain pre requisites should be achieved to attain proficiency in writing which are categorized as- a) Auditory processes, b) Visual processes, c) Motor processes, and d. Inner language processes (Myklebust, 1968, 1973).

*a. Auditory processes:* First language acquisition takes place through the auditory mode and second language acquisition via the visual mode. The second language is learnt by translating the content into its auditory equivalents. As long as the words are familiar, children can read using the visual form alone. But for comprehension of the unfamiliar words, comprehension takes place from the auditory mode. Any sort of disturbances and deprivation of auditory sensation results in a variety of behavioral modifications, including a profound alteration of learning itself (Mykelbust & Neyhus, 1970; Hughes, 1971).

*b. Visual processes:* Visual processes are considered as one of the most important and most related aspects to the acquisition of written language. The pre requisites for the written language development: are orientation (scanning), discrimination, recognition, visual memory and imagery.

c. *Motor processes:* These processes are the disturbances of fine motor coordination of the hands and fingers and arm, interfere with the development of motor ability which is an important pre requisite for writing. Writing is a motor act accomplished through use of the preferred hand. Though the association between handedness and development of writing is complex, it can be viewed in terms of motor behavior. So appraisal of laterality is an important aspect of motor maturity for writing. They also report that facility with the written output continues to mature for 7 years more.

d. *Inner Language Processes:* These processes refer to the manner in which words become associated with the meaning (Myklebust, 1954), for use of written language, as well as for use of the spoken and read forms. The inner language disturbance is called word-writing where the words are written but has no meaning to the writer.

### **2.3 Components of written language**

As children reach higher grades, their skills improvise, as do the aspects of writing. When learning to write, children may have trouble generating the content, organizing structures, formulating goals, executing the mechanical aspects of writing and revising texts and reformulating goals (Harris, Graham, Mason & Friedlander, 2008). Children might have problem in any of the above mentioned aspects which would hinder their abilities to formulate ideas into coherent messages. Thus, a need arises for basic understanding of the major components of written language which includes (a) handwriting, (b) spelling, (c) usage, (d) vocabulary, and (e) text structure (Harris, Graham, Mason & Friedlander, 2008).

a. *Handwriting:* According to Barbe, Wasylyk, Hackney and Barun (1984), handwriting is a fine motor skill that enables children to express their thoughts. A child who cannot produce legible script or write quickly and easily has restricted communication abilities. Handwriting requires numerous skills such as legibility and fluency. Legibility refers to the clarity and accuracy of the letter forms, whereas fluency refers to the ease and quickness of formation. Legible handwriting involves six interrelated characteristics which are as given below:

- Letter formation or the composition of the stroke.
- Size and proportion or the proportional size between the uppercase and the lowercase letters.
- Spacing or the amount of spacing between the letters and words.
- Slant or the consistency in the direction of writing.
- Alignment or the uniformity of size and consistency on the writing line.
- Line quality or the steadiness and thickness of the line.

Children who have severe problems with handwriting are diagnosed with dysgraphia or what is referred to as disturbance in visual motor integration. Children may have trouble executing the motor movements needed to write or copy letters or have trouble recalling the letter forms or letter sequences. Memory for letter forms and letter sequences is commonly referred to as orthographic memory. Children with poor handwriting, have difficulty paying attention to spelling, punctuation and ideation which results in an overwhelming task.

b. *Spelling*: Spelling is one of the most difficult skills to be acquired by children. The late models of spelling development indicate that beginning spellers use phonological and orthographic knowledge, and then begin representing morphological relationships after a year or more of spelling experience. However, recent research provides evidence that children appreciate morphology from an early age. For example, the previously mentioned study by Deacon and Bryant (2006) recognized that children in the age group of six to eight years were able to apply morphological knowledge in their spellings. Thus, from an early age, children integrate their available phonological, orthographic, and morphological knowledge in order to spell.

c. *Usage*: To communicate in writing with clarity, children must master rules involving capitalization, punctuation and syntax. Application of these rules requires knowledge of the language structure and mastery of these written language conventions. Knowledge of these rules becomes particularly important when children attempt to edit their own writings.

Syntax, frequently referred to as a component of grammar, and includes the rules for combining words into sentences and identifying the relationships among the various words. Syntax includes knowledge of (a) clause structure or noun phrases and verb phrases within clauses and (b) the rules of forming negatives, questions and complex sentences through embedding and conjoining (James, 1989). The selection and use of sentence structures are essential for clarity. Understanding of the sentence syntax enables one to construct a variety of sentence patterns that make one's writing more expressive. Knowledge of morphology is also important for understanding the sentence structure. As

morphological knowledge increases, a child's ability to produce more complex language structure evolves.

Children with writing disorders often have problems with using correct word order and applying capitalization and punctuation rules. Children who struggle with writing tend to write short sentences that lack complexity and variety. Also they tend to write run-on sentences and sentences with too many clauses that are joined using words such as 'and', 'but' or 'then'. They have trouble identifying where the main sentence ends and a clause begins. Some children experience delays in their ability to generate and use a variety of sentence patterns, and some have adequate oral syntactic development, but have trouble formulating written sentences.

*d. Vocabulary:* Another critical aspect of effective writing is selecting descriptive words. For children with language impairments, their written language mirrors the spoken language. For children with LD, however, a discrepancy often exists between their oral and written vocabularies, with their oral vocabulary being far superior to the words they use while writing. Different words available to writers are determined by their breadth and depth of word knowledge and their ability to retrieve words as and when needed. Children with limited vocabulary might have difficulty with (a) word-retrieval ability, (b) knowledge of morphology or (c) breadth and depth of word knowledge.

*e. Text Structure:* Written texts are designed and organized to convey and represent ideas for a particular purpose. The genres, or text structures, selected by writers

enhance organization and the presentation of information in different ways. Organization of text requires the abilities to plan, translate and review what has been written. In considering a writer's ability to organize and structure the text, firstly the cohesiveness and coherence of the child's writing should be examined. A writer must attend to the transitions from one sentence to the next, as well as to logical sequencing of ideas. Text organization requires attention to both cohesion and coherence. Cohesion involves the specific ways sentences are integrated and linked together and the transitions within and between sentences. Coherence refers to the overall form and organization of the ideas in a text.

Next, the child's knowledge of narrative and expository writing should be examined. Knowledge and understanding of the underlying framework or set of rules associated with narrative structure have been referred to as story schema and story grammar. Story schema refers to the mental representations an individual has of story parts and their relationships whereas story grammar describes the organizational rules, relationships and regularities found in text. Story grammar provides children with a framework that can help them produce narrative text.

Expository text explains or provides information about a topic to the reader. Expository writing is more complex than story writing because children must research the topic, determine ways to organize their findings and consider the reader's prior knowledge. A number of different expository text structures exist that can be applied to answer different text structure questions. Each structure is characterized by various semantic and syntactic techniques. Examples of text structure include descriptive,



sequential, temporal, compare-contrast, explanation, problem-solution and opinion. Failure to attend to text structure can result in writing that has irrelevancies, redundancies and poor organization.

In typically developing children, the processes required for writing develop in an orderly manner. By the time the child is approximately 6 years of age, he is ready to write when he has developed skills for visual and auditory discrimination required for reading and visuo-motor integration for forming a stage where he learns to organize words into simple sentences. However problems in the above mentioned skills may lead to difficulties in the writing process and may lead to varied forms of disorders of written expression (Spagna, Dennis, Cantwell & Baker, 2000). Hence, disorders of written expression may be defined as a significant impairment in written communication that fall substantially below those expected, given the individual age, measured intelligence, age appropriate education that significantly interferes with academic achievement (Spagna, Dennis, Cantwell & Baker, 2000).

Another skill which is very important for writing is the ability to recall the spelling of words. Researchers have given an outline for the abilities required to spell words in children. The ability to articulate the words correctly, to recall the spoken pattern (i.e., the auditory sequence of the phonemes or syllables) and to recall the visual letter sequences are necessary for learning to spell. Hence, knowledge about the development of spellings in TDC is essential to understand the interaction amongst the linguistic factors and written language development.

## 2.4 Linguistic basis of Spelling

Learning to spell requires integration of phonological, orthographic, and morphological knowledge. A recent view on spelling development proposed that from the beginning it is characterized by the simultaneous interaction of all three above mentioned linguistic factors. This line of research specifically highlights the importance of investigating how phonological, orthographic, and morphological knowledge provide the linguistic basis for spelling. This knowledge base has been investigated in populations of children who have typical development (Carslie, 2000), language learning disability (LLD) (Silliman, Bahr, & Peters, 2006; Windsor, Scott, & Street, 2000), and dyslexia, (Bourassa & Treiman, 2008; Tsismeli & Seymour, 2006), but not children on children with LD in Indian population. Various theories of spelling development have been proposed to account for how children learn this complex linguistic skill. In the past, spelling development was characterized by linear stages in which children learnt to use phonological, orthographic, and morphological knowledge bases in succession. The two popular theories supporting this view are discussed: the late model and the early model. They are so named for their predictions about the timing of children's acquisition of morphology. All of the late models advocate that children acquire morphological knowledge later on in their spelling development, which implies that the linguistic knowledge needed for spelling is acquired in phases. The early models assert that children demonstrate basic morphological knowledge even in early attempts to spell (Pacton & Deacon, 2008). A recent view challenges the linearity of this approach and proposes that spelling development is characterized by the simultaneous interaction of all three linguistic factors from beginning itself. The "Triple word form theory" (Bahr,

Silliman, & Berninger, 2009; Garcia, Abbott, Berninger, 2010) predicts that spelling development depends on the learning to code into memory, analyze and coordinate the three word forms (phonological, orthographic and morphological) and their parts.

## **2.5 Models of spelling development**

### ***The Early Model***

Cassar and Treiman (1997) found that children in kindergarten were demonstrating orthographic knowledge in their spellings, such as the allowable placement of doublet letters (i.e., doubled letters typically occur in the middle or at the end of a word). Deacon and Bryant (2006) found that 6- to 8-year-olds were demonstrating morphological knowledge in spelling the beginning letter patterns in inflected and derived words better than the words in control forms (e.g., *turn* in *turning* was spelled better than in *turnip*). In late models, morphological knowledge is the latest linguistic skill for children to master. The early model proposes that spelling development is characterized by the simultaneous interaction of all three linguistic factors. The early model view is that children use multiple strategies and various linguistic knowledge bases throughout spelling development (Treiman & Bourassa, 2000); this model emphasizes how children learn to coordinate phonological, orthographic, and morphological information over time (Bourassa & Treiman, 2003). Additionally, the early model maintains that spelling success is contingent upon the ability to access and apply each linguistic factor (Apel, Masterson, & Niessen, 2004).

### *The Late Model*

The late model; commonly known as phase theory, described the predominate strategies children use as they progress towards spelling mastery (Henderson , 1985). The commonalities in errors produced by children in certain phases of spelling development have been the primary basis for asserting the validity of the late model. Children progress through various levels of invented spellings before they are able to remember the correct spellings through the course of their spelling development. Analyses of spelling errors provide valuable information about which phase of spelling development the child is in (Masterson & Crede, 1999).

*Three phase theories.* The most popular phase theories have been proposed by Ehri (1986), and Henderson (1985). Ehri (1986) initially proposed three phases of spelling development: semiphonetic, phonetic, and morphemic. In the semiphonetic phase, children rely on their knowledge of letter sounds (phonology) to spell. During this phase children know very few correct spellings, so their spellings, while logical, often violate spelling conventions (e.g., *chicken* spelled as *hkn*; Ehri, 1986). In the phonetic phase, children begin to represent all or most of the sounds in the spelling (e.g., *doctor* spelled as *doktdr*; Ehri, 1986; Treiman, & Kessler, 2007). Children in this phase also remember visual properties of beginning and ending letters, as well as doubled letter patterns (Wright & Ehri, 2007). In the morphemic phase, children have learned word regularities, which leads to the use of conventional spellings. Essentially, children begin to recognize orthographic and morphological consistencies; such knowledge is said to be unavailable to early spellers (Treiman, 1998).

Henderson (1985) proposed five phases: preliterate, letter-name spelling, within-word patterns, syllable juncture, and derivational constancy. Children in the preliterate phase, pre-communicative phase, reflect their little knowledge of print's form and function through scribbling and random strings of letters (Henderson & Templeton, 1986). Semiphonetic phase is the letter-name spelling phase, in which children understand that each letter represents a sound, may spell letter names with the corresponding letter, and match letters to sounds (e.g., *kicked* spelled as *kekt*). In the within-word patterns phase, children are moving beyond the surface of speech sounds to more standard representations of sounds (e.g., *cream* spelled as *creme*; Henderson & Templeton, 1986). Then, in the syllable-juncture phase, like in the transitional phase, children build upon the basic knowledge from the previous phase to understand the rules for representing bisyllabic words (e.g., letter doubling; *robin* spelled as *robbin*). In the derivational constancy phase, children recognize that, regardless of changes in pronunciation and orthography, spelling is meaning. It is in this phase that children recognize the fact that semantically connected words share similar spellings through their roots (e.g., *sign*, *signal*, and *signature*).

In summary, the late (phase-based) models characterize the dominate strategies used in distinct periods of time and the errors produced as being consistent with a single phase. In general, the late models are not linguistic models in that their focus is primarily on orthography. On the other hand, the early (linguistic-based) models examine the strategies (e.g., phonological knowledge, orthographic knowledge, and morphological knowledge) used by children from the onset of spelling development to overcome the

linguistic complexities of spelling (Treiman & Bourassa, 2000). When compared to the TDC, children with LD perform significantly poor in most areas of written expression particularly in spelling. Spelling is difficult than reading because it requires recall and reproduction of the entire word correctly, not just recognition of the word. So, even as their reading skills improve, the spelling difficulties still persist. Thus, it is important to know the components that are involved in generating spellings for a word. Four aspects of oral language have particular relevance to spelling: Phonology, Orthography, Morphology and Semantics.

A more recent view to spelling development challenges the linearity of this approach and proposes that spelling development from the beginning is characterized by the simultaneous interaction of all three linguistic factors. The “Triple word form theory” (Bahr, Silliman, & Berninger, 2009; Garcia, Abbott, Berninger, 2010) predicts that spelling development depends on the learning to code into memory, analyze and coordinate the three word forms and their parts: a) phonological (coding and analyzing phonemes and other sound units in words), b) orthographic (coding and analyzing written words and the single letters, letter groups, and larger letter patterns in them), c) morphologic ( coding and analyzing base words, prefixes, and inflectional and derivational suffixes in both spoken and written words). Children must learn how to cross-map the interrelationships among these codes (Berninger et al., 2009; Nunes & Bryant, 2006) to learn to read and spell. Such crosscode interrelationships may also advance vocabulary development by connecting new meanings to their corresponding word forms (Verhoeven & Perfetti, 2011). Triple word-form theory provides viable

theoretical prism from which to investigate the variations in spelling patterns of typically developing child writers.

## **2.6 Developmental Overview of Phonological, Orthographic, and Morphological Patterns**

*Phonologically based spellings:* Early spellers often access their phonological knowledge to generate elephant as lefit or far as fr, which suggests emerging understanding of letter sequences (i.e., orthotactics) in the context of interactions with print. Many young children tend to spell a phoneme sequence with a single letter name, resulting in a phonologically based spelling pattern. Early phonologically based spelling attempts also frequently include word-initial consonant cluster reduction, which arises from children's inexperience in segmenting the cluster into separate phonemes (Treiman, 1991). Instead, clusters are analyzed as a unit interacting with the vowel. For example, in the word play (/ple/), it is difficult for young children to separate perceptually the / l / from the vowel, making it challenging for them to understand that the / l / is represented independently from the vowel.

*Orthography based spellings:* As beginning spellers learn sound-letter correspondences, particular patterns of orthographic features become evident (Cassar & Treiman, 1997). One such pattern involves consonant doubling, which occurs when children understand that a word contains a doubled consonant but do not recognize its positional constraints. In written English, doubled consonants occur in medial or final positions after a short vowel but cannot occur in the initial position (e.g., press). Another orthographic pattern involves the omission of silent –e. Beginning spellers may lack or

not consistently access the knowledge that, when adding a silent –e to the end of a word, the preceding vowel is long. For example, misspelling trade as trad indicates inadequate orthographic analysis of the long vowel silent –e relationship (Moats, 2000).

*Morphological spellings:* Morphological awareness encompasses both inflectional and derivational relations as well as compounding. On the one hand, inflectional morphology does not change meaning, pronunciation, or grammatical role. The original word root is maintained whereby tense agreement, aspect, number, or possession is suffixed via the past tense –ed, present progressive –ing, plural –s/es, and possessive ’s, respectively. In the oral domain, inflectional markers for tense agreement, an obligatory morphosyntactic aspect in finite clauses, are accurately produced by age 4 years (Rice, Wexler, & Hershberger, 1998). Derivational morphology, on the other hand, is central to new word formation and integral to the configuration of novel and more complex meanings.

### ***2.6.1 Role of Phonology and Orthography in spelling***

Phonology refers to the sounds of a language. Phonological awareness is the ability to identify, reflect on, and manipulate the sound structures of a language, including, but not limited to, the abilities to rhyme and segment syllables into increasingly smaller sub-syllabic units (e.g., onset and rime), followed by segmentation, blending, and manipulating the phoneme, which is the smallest unit (Apel et al., 2004; Apel, Masterson, & Hart, 2004). One aspect of phonological awareness is phonemic awareness, which is the ability to identify and manipulate phonemes (Apel et al., 2004). Furthermore, phonemic awareness (e.g., letter-sound knowledge and phoneme isolation



skills) has been shown to be highly predictive of children's spelling ability (Nation & Hulme, 1997; Treiman, Broderick, Tincoff, & Rodriguez, 1998).

While errors in phonological representations are prominent in beginning spellers, orthographic errors are also seen in early spelling development. Knowledge of the written language overlaps phonological knowledge to some extent since orthographic knowledge plays a role in letter choices when spelling (Cassar & Treiman, 1997). Orthographic knowledge involves two basic components: translating phonemes into their corresponding alphabetic forms and mastering orthographic patterns, such as acceptable letter combinations and language-specific constraints on spelling patterns (Bourassa & Treiman, 2000). As their spelling skills progress, children need more than just sound and letter knowledge to spell words accurately.

### ***2.6.2 Role of Morphology and Semantics in spelling***

Morphological knowledge is a critical factor for conventional spelling. Morphological knowledge is a strong predictor of children's ability to spell words that cannot be spelled by relying on phonological knowledge/orthographical knowledge alone (Nunes, Bryant, & Bindman, 1997). Morphological knowledge involves an awareness of the smallest meaningful units of language (root words, suffixes, and prefixes) and understanding the relationship between root words and the related derived or inflected forms (Kelman & Apel, 2004).

Nunes et al. (2006) posed four reasons why understanding morphology assists children in becoming proficient spellers. *First*, the representation of morphological units require disregarding letter-sound correspondences (e.g., all regular past tense verbs are

spelled with *ed*, but may be pronounced as /t/, like in *kissed*, or as /d/, like in *killed*). *Second*, when there is more than one way to represent a phonological sequence, morphological patterns can indicate the correct spelling (e.g., *conversation* and *compulsion* both represent the “shun” ending). *Third*, despite a change in phonology, the spelling of a stem may be maintained across words (e.g., when *magic* becomes *magician*, the *c* changes from /k/ to “sh”). *Lastly*, silent morphemes (Nunes et al., 2006) provide a link between morphology and spelling (e.g., ‘*the students*’ is pronounced the same as *the students*’ because apostrophe assignment is silent).

Kemp (2006) examined the ability of children in their first few years of school (5-9 years old) to accurately link morphological units in their written language. This was determined by analyzing the child’s spelling of the sound /z/ within control (e.g., *daisy* and *crazy*), base (e.g., *noise* and *breeze*), and derived (e.g., *noisy* and *breezy*) words. The author concluded that beginning spellers have a simple understanding of morphological links in writing, which is limited to the most transparent relationships (e.g., *noisy* and *noise*). Furthermore, as these skills develop and are used over time, children begin to use their knowledge of morphological relationships to guide their spellings, though initially not necessarily consistently or deliberately. However, by third or fourth grade, children demonstrate equally accurate spellings in derived and inflected words.

Semantics or vocabulary knowledge helps a writer in word choice and with the concepts like use of homophones or words that differ in meaning but sound alike. Typically, the content of the sentence, specially the words preceding or following the target helps the writer to determine the correct spelling. Children with LD often have

difficulties producing the correct spellings of homophones and require a considerable amount of practice to master these words.

## **2.7 Assessment of Written Language and Spellings**

The focus of research on written language is gradually been paid more attention in recent years. The multifaceted nature of written language makes objective and valid measurement a difficult task. The writing process can be broken down at the level of individual sub-skills, such as handwriting, punctuation, spelling and grammar usage. On the other hand, for some individuals, the breakdown occurs only when all these sub-skills must be integrated automatically within the broad process of composing. The first goal of assessment is to identify the most basic level at which writing breakdown occurs; followed by identification of intervention strategies that facilitates more effective written communication.

The standardized tests are one amongst the measurement options for speech language pathologists. Most of these tests measure the basic writing skills like punctuation, spelling, vocabulary etc. although these standardization measures are useful as screening measures, additional information is needed to provide a comprehensive picture of writing skill. At present, well named and reliable standardized tests are available that quantify handwriting legibility, dictation spelling skills, spontaneous spelling skills, vocabulary usage, syntactic accuracy, sentence combining ability, punctuation, capitalization usage and conceptual maturity. But, whether these measurements relate meaningfully to the performance of typical classroom writing assignments is less certain (Bain, 1991). However, numerous attempts have been made in

the past to develop comprehensive tests for assessing written language skills in children. There have been a number of tests developed ,revised in the past two decades providing SLPs, psychologists and educators a broad range of writing assessment instruments for identifying children in need of special language.

There are various tests available for assessing written language and spelling skills in children. A few have been enumerated in this section. Woodcock and Johnson (1977) developed the Woodcock – Johnson Psycho educational battery, Tests of Achievement (Written Language cluster). This test consists of a spelling dictation subtest and a proofreading sub-test. The dictation sub-test includes items requiring the subject to write letters, words, abbreviations and punctuation marks from dictation. Several items assess knowledge of regular and irregular plural forms. The proofreading sub-test requires the subject to read sentences and identify errors in word usage, spelling, punctuation and capitalization. However, the Woodcock – Johnson written language cluster provides only a preliminary screen of writing ability and should therefore prefer to be used in conjunction with the other writing tasks during the diagnostic process.

Jastak and Wilkinson (1984) developed and revised the Wide Range Achievement Test (WRAT-R). It includes measures of spelling, reading and mathematics for individual ages five to seventy five. It consists of two levels: level one for children in the age range 5 to 11 years, and level 2 for ages 12 through 75 years. For both levels, the spelling subtest follows a single word dictation format requiring written responses. Overall, the WRAT-R spelling subtest can be used for screening, educational placement, research and program evaluation. Larsen and Hamill (1986) developed the test of written spelling-2

(TWS-2), which is a revision of the Test of Written Spelling. It is a single word dictation test for individuals in the age range 6 years 6 months to 18 years 5 months. TWS-2 consists of two spelling subtests, on measuring 'predictable words and the other 'unpredictable' words and they are scored as correct or incorrect.

Kiran (1994) developed the Test of writing for children in Hindi (TOWCH) to assess writing skills in children in the range of 4-9 years of age. The test consisted of eight sections that are simple alphabets, syllables, words and non-words, sentences, sentence completion, questions and answers, and lastly the written test which comprises of picture description and spontaneous writing. The results indicated that all the writing tasks other than copying are developing with age and age of acquisitions vary for different tasks depending on whether the task is copying, dictation and spontaneous writing tasks. Yeshoda (1994) developed the Test of writing for children in Kannada (TOWCK) as a tool to assess the acquisition of writing in children in the age range of 3-8 years. This test also consisted of the same tasks as that of the TOWCH divided into eight sections. It was found that writing skills for copying begin to emerge at around 3-4 years of age. Later on the other skills like writing to dictation, sentence completion etc is gradually acquired with increasing age. The study also showed that writing is not fully developed even at around 7-8 years of age.

Shanbal (2003) developed a test "A Tool for Screening Children with Writing Difficulties" (ToSC-WD). This test can be used as a screening tool for linguistic and non linguistic domains of writing. The non-linguistic domain included mechanics of writing like abnormal pen grip, loose pencil grip, excessive pencil pressure, tremors while

writing, poor spacing etc. The linguistic parameters included spelling, punctuation and capitalization, vocabulary and syntax. Error analysis was done and they were scored as 1 for definite errors, 2 for occasional errors and 3 for no errors. This test was developed for the 3<sup>rd</sup> grade to 7<sup>th</sup> grade children. The results of this suggest that the acquisition of written skills has already begun by grade III; it continues and shows a developmental progression from Grade III to Grade VII. The results also suggest that the developmental progression for linguistic and non-linguistic skills are almost overlapping in the lower grades and become more distinct in the higher grades.

Spelling errors can also be assessed using a recently developed coding system, the Phonological, Orthographic, and Morphological Analysis of Spelling (POMAS; Silliman, Bahr, & Peters, 2006) which is a Qualitative analysis system that analyzes linguistic category (e.g., phonological, orthographic, morphological) and specific error features (e.g., letter-sound correspondences, consonant errors, vowel digraphs, etc.). This scoring system identifies the linguistic category of the spelling error as phonological, orthographic, morphological, or a combination of these categories and then describes the linguistic feature in error. An error was considered to be phonological in nature if the sound structure of the word was not fully represented or changed because of the deletion of phonemes. An orthographic error was considered if the sound structure of the word was fully represented with inappropriate graphemes. Errors that were considered to be morphological in nature consisted of two kinds: deletions or an incorrect grapheme representation of an inflection or a derivational suffix or roots that were misspelled in the process of adding derivational and/or inflectional suffixes. Hence, tools like these help in

detailed evaluation of spelling errors in TDC and special populations when used in combination with written language assessment tests.

## **2.8 Written language in typically developing children (TDC) and children with Learning disability (LD)**

Puranik, Lombardino and Altmann (2008) conducted a study to document the progression of the microstructural elements of written language in children at 4 grade levels. The secondary purpose was to ascertain whether the variables selected for examination could be classified into valid categories that reflect the multidimensional nature of writing. Written language samples were collected and transcribed from 120 children in grades 3 through 6 using an expository text retelling paradigm. Nine variables at various levels of language were analyzed. They were total number of words (TNW), total number of ideas expressed (IDEAS), number of T-units, mean length of t-unit (MLT-UNIT), number of clauses (CLAUSES), clause density (C-DENSITY), percentage of grammatical T-units (GRAM T-UNIT), percentage of spelling errors (SPELL) and writing conventions (CONVEN). Exploratory factor analysis suggested that writing can be represented by 3 factors: Productivity, Complexity and Accuracy. The results indicated that the measure of productivity (e.g., TNW, IDEAS) improved steadily with age, whereas measure of complexity (e.g., MLT-UNIT) did not. Results for measure of accuracy (e.g., SPELL & CONVEN) were mixed with some showing improvement across grades. Grade 3 children showed consistently poorer performance than children in grades 4, 5 and 6. Grade 4 children showed poorer performance than children in grades 5 and 6. They concluded that this empirically based framework for measuring

microstructural variables of writing provides clinicians with a 3 prong conceptual framework for determining children's strengths and weaknesses within the translational stage of writing.

Earlier research on written language in children includes studies which have compared typical and atypical language learners and have concluded that children with language based disabilities show reduced written productivity as measured by total number of words, total number of utterances or total number of ideas (Barenbaum, Newcomer & Nodine, 1987; Houck & Billingsley, 1989; Laughton & Morris, 1989; Puranik, Lombardino & Altmann, 2007; Scott and Windsor, 2000), difficulties in writing complexity as measured by average length of T-Units, number of different words, and percentage of complex sentences (Fey, Catts, Proctor-Williams, Tombling & Zhang, 2004; Gilliam & Johnston, 1992; Houck & Billingsley, 1989; Mackey & Dockrell, 2004; Morris & Crump, 1982, Puranik et al., 2007; Scott & Windsor, 2000) and accuracy as measured by number of spelling or mechanical errors and number of syntax errors (e.g., Altmann, Lombardino & Puranik, 2008; McArthur & Graham, 1987; Nelson & Van Meter, 2003; Puranik et al., 2007).

Many studies have compared written expression of children with LD with the typically developing children in the past. They report that in the area of syntactic maturity, children with LD are less proficient than their normally achieving peers (Myklebust, 1973; Poteet, 1978). They produce less mature compositions in several task conditions (Barenbaum et al., 1987; Nodine, Barenbaum & Newcomer, 1985) and display less sensitivity to text structure (Englert & Thomas, 1987). However, Barenbaum et al.,



1987 and Nodine et al., 1985 failed to find differences in the number of words per T-unit across ability groups. The lower productivity displayed by children with dyslexia is also a recurring finding (Barenbaum et al., 1987; Myklebust, 1973; Nodine et al., 1985; Poteet, 1978), as are significant spelling problems ( Poplin, Gray, Larsen & Banikowski, 1980). However the results related to vocabulary are mixed.

Poplin et al., (1980) reported no differences for grades 3 through 6, although significant differences were found for the subjects on other tasks. Barenbaum et al., (1987) failed to find a difference in the number of words used with seven letters or more. Capitalization and punctuation were found to be discriminating factor in some studies (Poteet, 1978), but differences were restricted to specific grade levels in other studies (Poplin et al., 1980). Moran, 1981 reported no significant differences between children with dyslexia and typically developing children on mechanics of writing.

Hauck and Billingsley, 1989 examined the written expression of children with LD and typically developing children (TDC) at three grade levels. Specifically, the investigation addressed the following research question as to how do the written samples of children with LD and the TDC compare at grades 4, 8 and 11 using measures of (a) productivity, (b) syntactic maturity, (c) vocabulary, (d) mechanics, and (e) use of conventions. Results indicated that, compared to the TDC, children with LD write fewer words and sentences, write more words per sentence, produce fewer words with seven letters or more and fewer sentence fragments, and have a higher percentage of capitalization and spelling errors. No group differences were found for the number of T-units produced or the number of morphemes per T-unit. Comparison of group differences

at each grade level and differences by groups across the grades reveals persistent written expression difficulties in children with LD. Sheetal and Sangeetha (2011) conducted a study on children with dyslexia from grade I to V using SALT analysis to assess their patterns of writing and concluded that children with dyslexia showed poorer score in all the variables ( total number of words, T- UNIT, CLAUSES, C- DENSITY, etc.) when compared to TDC except in MLT-UNIT. Children with dyslexia studying in higher grades (IV and V grades) performed better than the children with dyslexia in lower grades.

These above mentioned studies give a clear picture of how the written language skills shape with increasing age thus suggesting a developmental trend in written language acquisition.

Spelling development in typically developing children provides a reference to compare to population with disorders affecting spelling skills. However, when making comparisons between populations that have disorders affecting academic ability and typically developing children, it is important to make sure outside factors do not affect outcomes. For example, age can affect a child's skill level because as they progress in school, they will inevitably gain more knowledge. The degree to which students can integrate use of phonological, orthographic, and morphological domain is important in differentiating poor from proficient spellers. Therefore, it is important to know how development is affected in populations that have difficulty developing proficient spelling skills.

Bahr, Silliman, Berninger & Dow (2012) conducted a study on TDC from grade 1-9 evaluating triple word-form theory, to describe linguistic patterns of misspellings. Spelling errors were taken from narrative and expository writing samples provided by 888 typically developing students in Grades 1–9. Errors were coded by category (phonological, orthographic, and morphological) and specific linguistic feature affected. Grade-level effects were analyzed with trend analysis. Qualitative analyses determined frequent error types and how use of specific linguistic features varied across grades. The results revealed that Phonological, orthographic, and morphological errors were noted across all grades, but orthographic errors predominated.

Linear trends revealed developmental shifts in error proportions for the orthographic and morphological categories between Grades 4 and 5. Similar error types were noted across age groups, but the nature of linguistic feature error changed with age. Triple word-form theory was supported. By Grade 1, orthographic errors predominated, and phonological and morphological error patterns were evident. Morphological errors increased in relative frequency in older students, probably due to a combination of word-formation issues and vocabulary growth. These patterns suggest that normal spelling development reflects nonlinear growth and that it takes a long time to develop a robust orthographic lexicon that coordinates phonology, orthography, and morphology and supports word-specific, conventional spelling.

Cassar et. al, (2005) investigated the spelling abilities in children with dyslexia using the POMAS analysis (Silliman, Bahr, & Peters, 2006) coding system and reported that children with dyslexia had problems with consonant clusters, vowel letter names,

omission of final consonants, and overgeneralization of *-ed*, (Egan & Pring, 2004), as well as, issues with derivations (Tsesmeli & Seymour, 2006). In looking at the types of errors being made and the age of the individuals who seem to be making similar errors, it appeared that in children with dyslexia, spelling developed in a manner much like typical peers, only in a slower progression.

Roseberry-McKibbin, (2007) reported that children with LLD have difficulties similar to children with dyslexia in the area of written language, which are rooted in early difficulties in the comprehension and production of oral language. In the area of spelling, children with LLD were similar to those with dyslexia. Studies investigated the spelling abilities of children with LLD looked at their misspellings quantitatively. In a study by Silliman, Bahr, and Peters (2006), they included a qualitative analysis of misspellings, examined the spelling abilities of children with LLD, as well as age-matched and spelling level matched control groups. First, a dictated spelling task that targeted the spelling of specific linguistic features known to be difficult for young children, such as, letter doubling, short vowels, and suffixes was administered. They then analyzed the misspellings in terms of the categories and features listed on the Phonological, Orthographic, and Morphological Assessment of Spelling (POMAS), a qualitative measure. This method of qualitative analysis made it (POMAS), a qualitative measure. Frequency results indicated that the children with LLD made more errors than their age-matched peers, but were similar in error frequency to the group matched for spelling ability. The LLD group had considerably more trouble representing the basic

phonological structure of words when complexity increased. This group also showed more frequent omissions of inflected and derived morphological markers.

### **Need for the study**

India is a multi lingual country and majority of children are exposed to their mother tongue and have English as their medium of instruction in school. Very few studies have been reported for the assessment of written language and difficulties associated with it in the Indian context. Children with learning disability are one amongst the category of language disorders who have poor written language skills. They show reduced performance in spelling tasks, similar but delayed performance to spelling level matched peers (Windsor, 2000) and evidence of challenges with tasks that contain more complex morphology. Thus, the method of qualitative analysis will help in studying the specific linguistic feature patterns at various levels of language development that differ as compared to their age matched peers and further help in formulating intervention programmes for children with Learning disability (LD).

Most standardized tests check the narrative style of writing. Although this is appropriate in primary grades, children are expected to create expositions as they move onto higher grades. Expository text includes information about any topic where the writer must research the topic, determine ways to organize the text and consider the reader's prior knowledge. Expository writing requires employing skills such as familiarity with complex rhetorical structures, vocabulary, and knowledge of implementing grammatical rules and correct spelling of morphologically complex words that can be particularly challenging for children with learning disability. Thus, a more comprehensive research of

spelling patterns in written language of children in Indian population should be done which not only assesses the written language but also to quantify and categorizes the spelling errors in order to understand the most affected linguistic domain.

### **Aim of the study**

The primary aim of the present study is to investigate the linguistic pattern of written language in children with learning disability (LD).

The objectives of the study were:

- To analyze the spelling errors of typically developing children (TDC) and children with learning disability (LD) and to determine how knowledge about phonology, orthography, and morphology are integrated to proficiently encoded words.
- To investigate linguistic pattern analysis of misspellings in children with learning disability (LD) in comparison to typically developing children (TDC).

## CHAPTER 3: Method

The primary aim of the present study was to investigate the linguistic pattern of written language in children with learning disability (LD).

A counterbalance research design was used to compare the clinical group i.e. children with Learning Disability (N=10) and control group i.e. Typically Developing Children (N=10).

### 3.1 Participants

Participants were classified into two groups- The clinical group and the control group.

*Clinical group:* In the initial phase of the study a total of 10 children (diagnosed as Learning Disability) were considered for the study. A total of thirteen individuals were considered for the study. Three individuals could not pass ELTIC and thus were not eligible for the study. A total of ten children who were in grades VI and VII participated in the study.

*Control group:* Ten typically developing children (TDC) were selected for the study. Each of the clinical group children were age, gender, languages spoken, grade, and socio-economic status matched with children in the control group.

#### 3.1.1 Participant selection criteria

All participants selected were right handed children with no marked neurological or medical histories. Medium of instruction for both the groups was English and

syllabus followed in the schools was Karnataka State Syllabus. Kannada was the native language of all the participants.

*Clinical group-* The following participation criteria was considered for the selection of children in clinical group.

- 10 children identified as children with LD by a Speech-Language Pathologist and Clinical psychologists were considered for the present study.
- All the children were ruled out for any sensory, neurological or gross motor impairment using the ICF CY checklist (WHO Work group, 2004).
- English Language Test for Indian Children (ELTIC; Bhuvaneshvari, 2010) was administered on children to assure age adequate language skills. The children which did not pass the test were excluded from the study.
- Informed consent was taken from the participants and/or caretaker before the actual testing.

*Control group*

- 10 typically developing children participated in the present study.
- All the children were ruled out for any sensory, neurological or gross motor impairment using the ICF CY checklist (WHO Work group, 2004).
- English Language Test for Indian Children (ELTIC; Bhuvaneshvari, 2010) was administered on children to assure age adequate language skills. The children which did not pass the test were excluded from the study.



- Informed consent was taken from the participants and/or caretaker before the actual testing.

### **3.1.2 Test material and Procedure**

The topic 'My School' was given and the children were instructed to produce a written text in English. All compositions were marked after twenty minutes. The written sample was collected and read to the child for any clarifications in case of unclear spellings.

### **3.1.3 Scoring, coding and analysis**

The written samples were then transcribed and analyzed using Systematic Analysis of Language Transcripts (SALT; Miller & Chapman, 2001). The parameters assessed SALT software are:

1. *Total no. of words (TNW)*: It is the total number of words written in the text which will automatically be calculated by SALT. It measures productivity and word fluency.
2. *Number of T-units (T-Unit)*: A T-unit is a sentence. It is considered to be one main clause with all sub-ordinate clauses embedded in it (Hunt, 1965). It measures syntactic complexity.
3. *Mean length of T-unit (MLT-Unit)*: It is calculated by dividing TNW by T-Unit. It is a measure of syntactic complexity.
4. *Number of clauses (TNC)*: A clause is a group of words containing a subject and a predicate. It is a measure of productivity.

5. *Clause density (CD)*: This was calculated as ratio of TNC by T-Unit. It is a measure of syntactic complexity.
6. *Percentage of grammatical T-units (GRAM T-unit)*: It is the ratio of number of T-Units divided by the total number of T-units in the sample. It is a measure of accuracy.
7. *Percentage of spelling errors (SPELL)*: It is calculated by dividing the number of spelling errors by TNW. This is a measure of accuracy.
8. *Errors in writing conventions (CON)*: This measure checks the appropriate use of punctuation marks like initial capital letters, apostrophes, commas etc. in the text. This is a measure of accuracy.

The linguistic pattern analysis was carried out using Phonological, Orthographic and Morphological Assessment of Spelling (POMAS; Silliman, Bahr, & Peters, 2006) to analyze the spelling errors in children with LD and the TDC group.

It is an unconstrained, qualitative scoring system, the POMAS embodies triple word-form theory in that it identifies errors within three broad categories of development—phonological, orthographic, and morphological— and then allows for further classification into specific linguistic features derived from general American English. For instance, if the word *and* was misspelled as *ad*, the error would be classified initially as a phonological error because not all of the phonological skeleton elements were represented in the child's written production. This error would then be further classified as difficulty with a sonorant (nasal) cluster. However, if the child wrote *triped* for *tripped*, this would be coded as an orthographic error because the child was able to convey the

phonological structure. That is, the child marked the past tense of trip but did not demonstrate the appropriate orthographic notation. This error would be classified as difficulty with the linguistic feature of letter doubling. In a similar way, morphological errors were scored when the child demonstrated difficulty with inflections and derivations. For example, *kisst* for *kissed* is a morphological error that would be further analyzed as a difficulty with an inflected suffix. Derivations were similarly coded in terms of prefixes and suffixes. For instance, if *attention* was spelled as *attention*, it would be coded as a misspelled (derivational) suffix. Prefixed derivations were also included in the morphological code, as were homonym misspellings (e.g., *there* for *their*). The POMAS also allows for the possibility that an error might overlap between two areas of development, like *tis* for *its*, which the POMAS classifies as a phonological-orthographic reversal (i.e., metathesis).

The data was statistically analyzed using the following statistical procedures:

- Descriptive Statistics was done to calculate Mean and Standard Deviation (SD) values for the performance of children with LD and TDC on SALT analysis and POMAS analysis.
- The Mann-Whitney U test was done to compare the performance between children with LD and TDC on SALT and POMAS analysis.

## CHAPTER 4: Results

The primary aim of the present study was to analyze the spelling errors of typically developing children (TDC) and children with learning disability (LD) and to determine how knowledge about phonology, orthography, and morphology are integrated to proficiently encoded words. The present study also attempted to investigate the linguistic pattern analysis of misspellings in children with learning disability (LD) in comparison to typically developing children (TDC).

The data was analyzed for written language skills using SALT analysis and linguistic pattern analysis of mis-spellings using the POMAS analysis for the written sample obtained from the TDC and the LD group.

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

- 4.1 Performance of TDC for written language on SALT analysis
- 4.2 Comparison of performance of children with LD and TDC for written language on SALT analysis
- 4.3 Performance of TDC for errors of spelling in written language on POMAS analysis
- 4.4 Comparison of performance of children with LD and TDC for errors of spelling in written language on POMAS analysis

#### 4.1 Performance of TDC for written language on SALT analysis

The data was analyzed for TDC across grade 6 and grade 7 on written language skills using SALT analysis and overall mean and standard deviation (SD) of the eight variables – total number of words (TNW), total number of T- units (T- unit), total number of clauses (TNC), MLT- unit, clause density (CD), grammatical T- unit (GRAM T-unit), percentage of spelling errors (SPELL) and convention errors (CON) were extracted using Mann-Whitney test. Table 4.1 shows the performance of TDC group across grade 6 and grade 7.

Table 4.1

*Performance of TDC on written language between grade 6 and grade 7 on SALT analysis*

Variables	Grades (n=5)			
	Grade 6		Grade 7	
	Mean	SD	Mean	SD
<b>TNW</b>	235.80	80.63	249.60	51.64
<b>T-Units</b>	10.80	7.88	13.80	6.53
<b>TNC</b>	8.40	6.22	9.00	5.47
<b>MLT-Unit</b>	15.30	3.92	12.61	1.70
<b>CD</b>	0.59	0.52	0.42	0.20
<b>GRAM T-Unit</b>	0.56	0.27	0.67	0.17
<b>SPELL</b>	0.05	0.05	0.02	0.01
<b>CON</b>	6.40	4.39	4.60	2.70

*Note.* TNW- Total number of words, T-unit- total number of T- units, TNC- total number of clauses, MLT-unit- Mean length of T-unit, CD -clause density, GRAM T-unit-grammatical T- unit, SPELL-percentage of spelling errors and CON- convention errors.

Analysis of results on Mann-Whitney test in Table 4.1 revealed that the performance of TDC in grade 7 was better than that of grade 6. There was no significant difference between the variables amongst the two grades. For TNW, the results showed that children in grade 7 (Mean= 249.60; SD= 51.64) produced greater number of words grade 6 (Mean= 235.80; SD= 80.63). For T-Units, the results showed that children in grade 7 (Mean= 13.80; SD= 6.53) produced greater number of T-Units than grade 6 (Mean= 10.80; SD= 7.88). For TNC, the results showed that children in grade 7 (Mean= 9.00; SD= 5.43) produced greater number of clauses than grade 6 (Mean= 8.4; SD= 6.22). For CD, no significant difference was seen between children in grade 7 (Mean= 0.42; SD= 0.20); and grade 6 (Mean= 0.59; SD= 0.52). For GRAM T-Unit, no significant difference was seen between children in grade 7 (Mean= 0.67; SD= 0.17); and grade 6 (Mean= 0.56; SD= 0.05). For SPELL, no significant difference was seen for grade 7 ((Mean= 0.02; SD= 0.018); and grade 6 (Mean= 0.054; SD= 0.057). For MLT-Unit, the results showed that children in Grade 6 produced greater number of MLT-Unit (Mean= 15.30; SD= 3.92) than grade 7 (Mean= 12.61; SD= 1.70) and for CON errors, children in grade 6 produced greater CON grade 6 (Mean= 6.4; SD= 4.39) than grade 7 (Mean= 4.6; SD= 2.70).

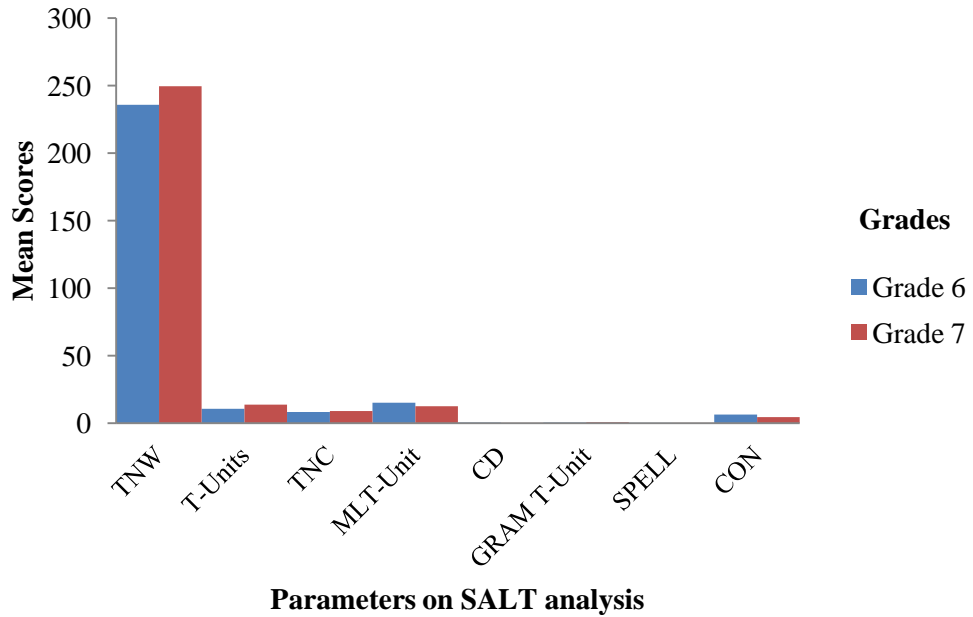


Figure 4.1. Performance of TDC for written language on SALT analysis between grade 6 and grade 7.

Note. TNW- Total number of words, T-unit- total number of T- units, TNC- total number of clauses, MLT-unit- Mean length of T-unit, CD -clause density, GRAM T-unit-grammatical T- unit, SPELL-percentage of spelling errors and CON- convention errors.

The results revealed that children in grade 7 produced greater number of words than children in grade 6. For T-Unit, TNC and MLT-Unit, children in grade 7 achieved greater scores than children in grade 6. For CON, children in grade 6 produced greater errors than children in grade 7.

## 4.2 Comparison of performance of children with LD and TDC for written language on SALT analysis

The data was analyzed for children with LD and TDC on written language skills using SALT analysis and overall mean and standard deviation (SD) of the eight variables – total number of words (TNW), total number of T- units (T- unit), total number of clauses (TNC), MLT- unit, clause density (CD), grammatical T- unit (GRAM T-unit), percentage of spelling errors (SPELL) and convention errors (CON) were extracted using Mann-Whitney test on SPSS version 16.0. Table 4.2 shows the comparison of performance of children with LD and TDC.

Table 4.2

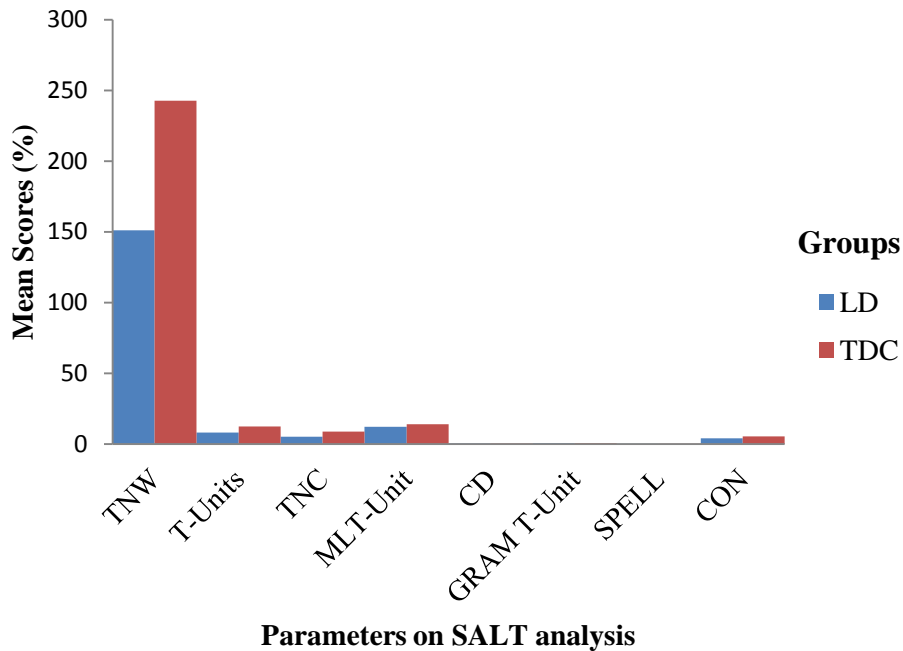
*Comparison of performance of children with LD (n=10) and TDC (n=10) for written language on SALT analysis*

	LD		TDC	
	Mean	SD	Mean	SD
<b>TNW</b>	151.00	71.40	242.70	64.24
<b>T-Units</b>	8.10	5.44	12.30	7.00
<b>TNC</b>	5.20	3.42	8.70	5.53
<b>MLT-Unit</b>	12.11	3.00	13.95	3.18
<b>CD</b>	0.38	0.18	0.50	0.38
<b>GRAM T-Unit</b>	0.58	0.18	0.61	0.22
<b>SPELL</b>	0.10	0.08	0.03	0.04
<b>CON</b>	4.00	2.70	5.50	3.56



*Note.* TNW- Total number of words, T-unit- total number of T- units, TNC- total number of clauses, MLT-unit- Mean length of T-unit, CD -clause density, GRAM T-unit-grammatical T- unit, SPELL-percentage of spelling errors and CON- convention errors.

Analysis of results on descriptive analysis in Table 4.2 revealed that performance of LD was significantly poorer than that of children in the TDC group. Significant difference using Mann-Whitney test was noticed for TNW and CON. Other parameters were showed relatively less variability in their values. For TNW, the results showed that children in TDC group (Mean= 242.7; SD= 64.24) produced greater number of words than children with LD (Mean= 151.00; SD= 71.40) with a significance of  $z=0.013$ ,  $p<0.05$ . For T-units, results showed that children in TDC (Mean= 12.30; SD= 7.00) produced greater number of T-units than children with LD (Mean= 8.10; SD= 5.44). For TNC, results showed that children in TDC (Mean= 8.70; SD= 5.53) produced greater number of clauses than children with LD (Mean= 5.20; SD= 3.42). For MLT-units, results showed that children in TDC (Mean=13.95; SD=3.18) produced greater number of MLT-units than children with LD (Mean=12.11; SD= 3.00). For CD, no significant difference was seen for children in TDC group (Mean= 0.50; SD= 0.38) than children with LD (Mean= 0.39; SD= 0.18). For GRAM T-unit, no significant difference was seen for children in TDC group (Mean= 0.61; SD= 0.22) than children with LD (Mean= 0.58; SD= 0.18). For SPELL, no significant difference was seen for children in TDC group (Mean= 0.03; SD= 0.04) than children with LD (Mean= 0.10; SD= 0.08) with a significance of  $z=0.019$ ,  $p<0.05$ . For CON, results showed that children in TDC group produced more convention errors (Mean= 5.50; SD= 3.5) than children with LD (Mean= 2.7; SD= 4.00).



*Figure 4.2.* Performance of children with LD and TDC for written language on SALT analysis

*Note.* TNW- Total number of words, T-unit- total number of T- units, TNC- total number of clauses, MLT-unit- Mean length of T-unit, CD -clause density, GRAM T-unit-grammatical T- unit, SPELL-percentage of spelling errors and CON- convention errors.

The results revealed that children in LD group produced lesser number of words than the TDC group. For T-Unit, TNC and MLT-Unit, children with LD scored lesser than the TDC group. For CON, children of TDC group produced more convention errors than children with LD.

#### **4.2.1 Comparison of performance of children with LD and TDC for written language between grades 6 and 7 on SALT analysis**

The data was analyzed for performance of children in grade 6 and grade 7 between children with LD and TDC group on written language skills using SALT

analysis. The analysis of results on descriptive analysis revealed overall mean and standard deviation (SD) of the eight variables – total number of words (TNW), total number of T- units (T- unit), total number of clauses (TNC), MLT- unit, clause density (CD), grammatical T- unit (GRAM T-unit), percentage of spelling errors (SPELL) and convention errors (CON). Table 4.2.1 shows the performance of children in grade 6 and 7 between children with LD and TDC group.

Table 4.2.1

*Comparison of performance of children with LD and TDC for written language between grade 6 and 7 on SALT analysis*

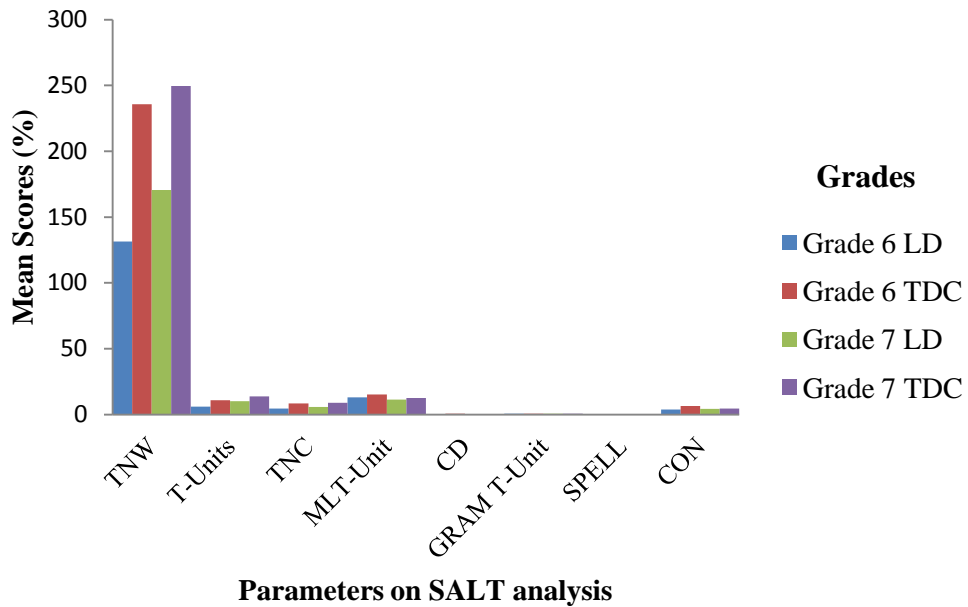
	<b>Grade 6</b>				<b>Grade 7</b>			
	<b>LD</b>		<b>TDC</b>		<b>LD</b>		<b>TDC</b>	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
<b>TNW</b>	131.40	91.43	235.80	80.63	170.60	46.38	249.60	51.64
<b>T-Units</b>	6.00	5.43	10.80	7.88	10.20	5.11	13.80	6.53
<b>TNC</b>	4.60	4.66	8.40	6.22	5.80	1.92	9.00	5.47
<b>MLT-Unit</b>	13.02	3.32	15.30	3.92	11.20	2.69	12.61	1.70
<b>CD</b>	0.38	0.26	0.59	0.52	0.37	0.10	0.42	0.20
<b>GRAM T-Unit</b>	0.54	0.22	0.56	0.27	0.62	0.15	0.67	0.17
<b>SPELL</b>	0.13	0.10	0.05	0.05	0.08	0.06	0.02	0.01
<b>CON</b>	3.80	3.11	6.40	4.39	4.20	2.58	4.60	2.70

*Note.* TNW- Total number of words, T-unit- total number of T- units, TNC- total number of clauses, MLT-unit- Mean length of T-unit, CD -clause density, GRAM T-unit-grammatical T- unit, SPELL-percentage of spelling errors and CON- convention errors.

Analysis of results on descriptive analysis in Table 4.2.1 revealed that performance of TDC was better than that of children with LD in grade 6 and 7. There was no significant difference between the variables amongst the two grades. For TNW, the results showed that children in grade 6 of TDC group (Mean= 235.80; SD= 80.63) produced greater number of words than children with LD (Mean= 131.40; SD= 91.43). For T-units, the results showed that children in grade 6 of TDC group (Mean= 10.80; SD= 6.22) produced greater number of T-units than children with LD (Mean= 6.00; SD= 5.43). For TNC, the results showed that children in grade 6 of TDC group (Mean= 8.40; SD= 6.22) produced greater number of clauses than children with LD (Mean= 4.6; SD= 4.66). For MLT-units, the results showed that children in grade 6 of the TDC group (Mean=15.30; SD=3.92) produced greater number of MLT-Units than children with LD (Mean=13.02; SD= 3.32). For CD, no significant difference was seen for children in grade 6 of the TDC group (Mean= 0.5908; SD= 0.524) and children with LD (Mean= 0.38; SD= 0.26). For GRAM T-unit, no significant difference was seen for children in grade 6 of the TDC group (Mean= 0.56; SD= 0.27) than children with LD (Mean= 0.54; SD= 0.10). For SPELL, no significant difference was seen for children in grade 6 of the TDC group (Mean= 0.05; SD= 0.05) than children with LD (Mean= 0.13; SD= 0.10). for CON, the results showed that children in grade 6 of the TDC group (Mean= 6.4; SD= 4.39) produced more convention errors than children with LD (Mean= 3.8; SD= 3.11).

For grade 7, the descriptive analysis revealed that performance of TDC was better than that of children with LD. For TNW, results showed that children in grade 7 of the TDC group (Mean= 249.6; SD= 51.64) produced greater number of words than children

with LD (Mean= 170.60; SD= 46.38). For T-units, results showed that children in TDC group (Mean= 13.80; SD= 6.53) produced greater number of T-units than for children with LD (Mean= 10.20; SD= 5.11). For TNC, the results showed that children in TDC group (Mean= 9.00; SD= 5.47) produced greater number of clauses than children with LD (Mean= 5.8; SD= 1.92). For MLT-units, results showed that children in TDC group (Mean=12.61; SD=1.70) produced greater number of MLT-Units than children with LD (Mean=11.20; SD= 2.69). For CD, no significant difference was seen between children in TDC group (Mean= 0.42; SD= 0.20) than children with LD (Mean= 0.37; SD= 0.10). For GRAM T-Unit, no significant difference was seen between children in TDC group (Mean= 0.67; SD= 0.17) and children with LD (Mean= 0.62; SD= 0.15). For SPELL, no significant difference was observed between children in TDC group (Mean= 0.02; SD= 0.018) than children with LD (Mean= 0.08; SD= 0.06). For CON, the results showed that children in TDC group produced more convention errors (Mean= 4.6; SD= 2.70) than children with LD (Mean= 4.2; SD= 2.58).



*Figure 4.2.1.* Performance of children with LD and TDC for written language within grade 6 and grade 7 on SALT analysis

*Note.* TNW- Total number of words, T-unit- total number of T- units, TNC- total number of clauses, MLT-unit- Mean length of T-unit, CD -clause density, GRAM T-unit-grammatical T- unit, SPELL-percentage of spelling errors and CON- convention errors.

The results revealed that children in grade 6 and 7 of the LD group performed poorer than children in grade 6 and 7 of the TDC group. For TNW, children in grade 6 and 7 of the LD group performed poorer than children of the TDC group in both grade 6 and 7. For T-Unit, TNC and MLT-Unit, the TDC group of both the grades 6 and 7 performed better than the LD group respectively. No significant difference was seen for CD, GRAM T-Unit and SPELL. For CON errors, the TDC group of grade 6 and grade 7 produced greater number of errors than children with LD.

### 4.3 Performance of TDC for errors of spelling in written language on POMAS analysis

The data was analyzed for TDC across grade 6 and 7 on spelling errors using POMAS analysis and overall mean and standard deviation (SD) for the five variables – phonological errors (P), orthographic errors (O), morphologic errors (M), phonologic-orthographic errors (PO) and morphologic-orthographic errors (MO) were extracted using descriptive analysis. Table 4.3 shows the performance of TDC group between grades 6 and 7.

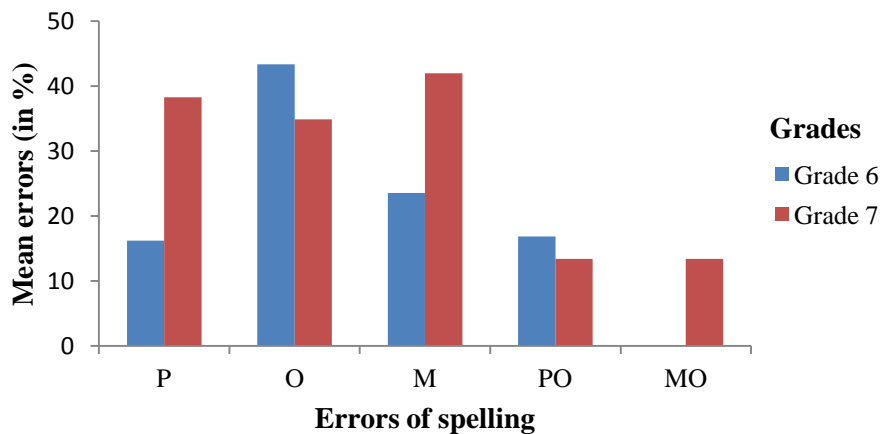
Table 4.3

*Performance of TDC on spellings between grade 6 and 7*

Errors (%)	TDC (n=5)			
	Grade 6		Grade 7	
	Mean	SD	Mean	SD
<b>Phonological (P)</b>	16.21	17.73	38.28	31.90
<b>Orthographic (O)</b>	43.35	39.72	34.86	30.89
<b>Morphological (M)</b>	23.57	34.21	41.96	63.39
<b>Phonological-orthographic (PO)</b>	16.85	10.40	13.40	29.96
<b>Morphological-orthographic (MO)</b>	0.00	0.00	13.40	29.96

Overall analysis of the data using Mann-Whitney test in Table 4.3 revealed that the performance of TDC in grade 6 and grade 7 did not show significant difference

amongst the five variables- P errors, O errors, M errors, PO errors and MO error. The results indicate that the performance of TDC in both the grades 6 and 7 of the TDC group did not show significant variations in the patterns of spelling errors produced. For Phonological errors, the results showed that grade 7 produced greater errors (Mean=38.28; SD=31.90) in comparison to grade 6 (Mean= 16.21; SD=17.73). For Orthographic errors, grade 7 produced less errors (Mean=34.86; SD=30.89) in comparison to grade 6 (Mean= 43.35; SD=39.72). For Morphological errors, grade 7 produced greater errors (Mean=41.96; SD=63.39) in comparison to grade 6 (Mean=23.57; SD=34.21). For Phonological-Orthographic errors, grade 7 produced lesser errors (Mean= 13.40; SD= 29.96) in comparison to grade 6 (Mean=16.85; SD=10.40). For Morphological-Orthographic errors, grade 7 produced greater (Mean=13.40; SD=29.96) in comparison to grade 6 (Mean=0.00; SD=0.00). Figure 4.3 shows the performance of TDC on spellings between grade 6 and 7.



*Figure 4.3.* Performance of TDC on spellings between grades 6 and 7

*Note:* P errors- phonological errors, O errors- orthographic errors, M errors- morphological errors, PO errors- Phonological-Orthographic errors, MO errors- Morphological-Orthographic errors.



The observations on the qualitative analysis also revealed that no trend was seen in the pattern of spelling errors between grade 6 and 7 of the TDC group. Children in grade 7 produced greater number of phonological, morphological and morphological-orthographic errors whereas children in grade 6 produced greater number of orthographic and phonological-orthographic errors as compared to children in grade 7 (Figure 4.3). Phonological errors such as ‘continously’ for ‘continuously’, ‘festivales’ for ‘festivals’ were produced by the TDC group. Greater numbers of morphological and Phonological-Orthographic errors were seen for grade 7 of the TDC group. It was observed that few morphological-orthographic errors were produced by grade 6 children.

#### **4.4 Comparison of performance of children with LD and TDC for errors of spelling in written language on POMAS analysis**

The data was analyzed for children with LD and TDC for spelling errors using POMAS analysis and overall mean and standard deviation (SD) for the five variables – phonological errors (P), orthographic errors (O), morphologic errors (M), phonologic-orthographic errors (PO) and morphologic-orthographic errors (MO) were extracted using Mann-Whitney test. Table 4.4 shows the comparison of performance of children with LD and TDC.

Table 4.4

*Comparison of performance of children with LD and TDC*

<b>Errors (%)</b>	<b>LD</b>		<b>TDC</b>	
	Mean	SD	Mean	SD
<b>Phonological (P)</b>	37.25	15.73	33.35	32.92
<b>Orthographic (O)</b>	39.10	18.49	38.90	33.84
<b>Morphological (M)</b>	22.35	18.35	13.88	25.34
<b>Phonological-orthographic (PO)</b>	90.98	7.93	73.88	10.90
<b>Morphological-orthographic (MO)</b>	3.70	1.17	6.70	2.11

Analysis of results on descriptive statistics for the performance of TDC and children with LD on POMAS analysis showed that greater P errors for in children with LD (Mean= 37.25; SD=15.73) than TDC (Mean=33.35; SD=32.92). For O errors, mean value of TDC was (Mean=38.90; SD=33.84) in comparison to children with LD (Mean= 39.10; SD=18.49). For M errors, mean value of TDC was (Mean=13.88; SD=25.34) in comparison to children with LD (Mean= 22.35; SD=18.35). For PO errors, mean value of TDC was (Mean= 73.88; SD= 10.90) in comparison to children with LD (Mean= 90.98; SD=7.93). For MO errors, mean value of TDC was (Mean= 6.70; SD= 21.11) in comparison to children with LD (Mean=3.70; SD=1.17). Further analysis of results on Mann-Whitney test in Table 4.4 revealed that performance of children with LD and TDC showed significant difference for percentage of P errors  $z=-2.42$ ;  $p<0.05$ , percentage of O errors  $z=-2.61$ ;  $p<0.05$  and percentage of M errors  $z=-2.26$ ;  $p<0.05$ . No

significant difference was noticed for percentage of PO errors  $z=-0.995$ ;  $p>0.05$  and percentage of MO errors  $z=-0.073$ ;  $p>0.05$ . The results indicated that on overall comparison of both the groups, children with LD produced greater number of phonological, orthographic and morphological errors than TDC.

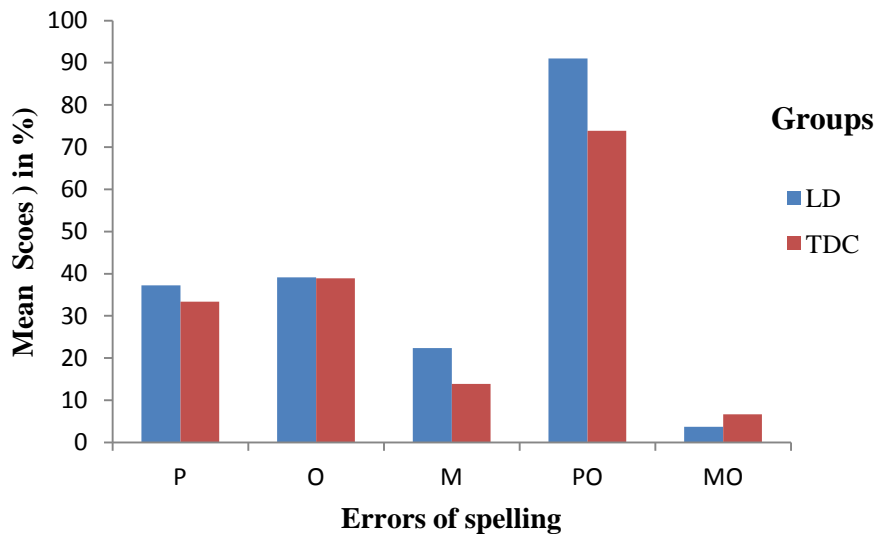


Figure 4.4. Comparison of performance of children with LD and TDC

Note: P - phonological errors, O - orthographic errors, M- morphological errors, PO -Phonological-Orthographic, MO-Morphological-Orthographic errors.

The observations on the qualitative analysis revealed that children with LD produced slightly greater number of Phonological, Orthographic, Morphological and Phonological-Orthographic errors than children with TDC. Children with LD produced greatest number of Phonological errors such as ‘tings’ for ‘things’, ‘tripes’ for ‘trips’, etc. The Orthographic errors seen in the written samples of children were ‘happle’ for ‘happy’, ‘live’ for ‘leave’, etc. The Morphological errors seen were ‘divison’ for ‘division’, ‘noleg’ for ‘knowledge’, etc. The Phonological-Orthographic errors included

errors such as ‘separte’ for ‘separate’, ‘thair’ for ‘there’, etc. These findings could be attributed to the fact that spelling ability is delayed in individuals with LD, mirroring the abilities of younger less proficient spellers.

#### 4.4.1 Comparison of performance of children with LD and TDC for errors of spelling in written language on POMAS analysis within grades 6 and grade 7

Table 4.4.1

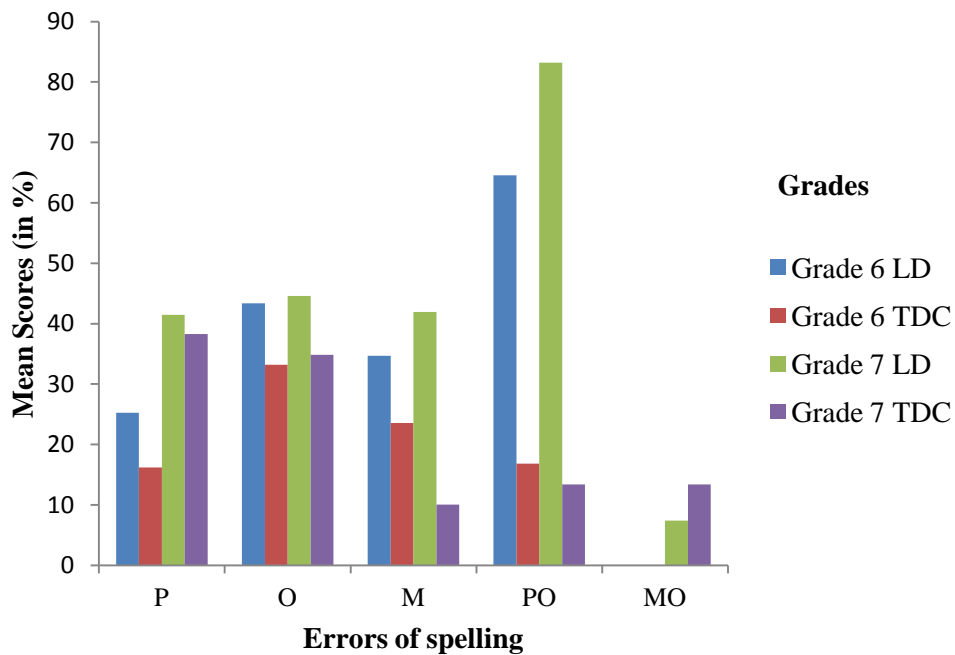
*Comparison of performance of children with LD (n=5) and TDC (n=5) for errors of spelling between grade 6 and 7*

Errors (%)	Grade 6				Grade 7			
	TDC		LD		TDC		LD	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
<b>Phonological (P)</b>	16.21	17.73	25.23	14.69	38.28	31.90	41.48	13.38
<b>Orthographic (O)</b>	33.20	39.72	43.35	13.89	34.86	30.89	44.60	22.26
<b>Morphological (M)</b>	23.57	34.21	34.66	17.06	10.03	9.38	41.96	63.39
<b>Phonological-orthographic (PO)</b>	16.85	10.40	64.56	6.27	13.40	29.96	83.20	10.00
<b>Morphological-orthographic (MO)</b>	0.00	0.00	0.00	0.00	13.40	29.96	7.40	1.65

Analysis of results on descriptive analysis in Table 4.4.1 revealed that for Phonological errors, children with LD produced greater number of errors (Mean= 25.23; SD=14.69) than the TDC group in grade 6 (Mean=16.21; SD=17.73). For Orthographic errors, children with LD in grade 6 produced greater number of errors (Mean= 43.35; SD=13.89 ) than the TDC group (Mean=33.30; SD=39.72). For Morphological errors, children with LD produced greater number of errors (Mean= 34.66; SD=17.06) than the TDC in grade 6 (Mean=23.57; SD=34.21) For PO errors, children with LD produced greater number of errors (Mean=64.56; SD=6.27) than the TDC in grade 6 (Mean= 16.85; SD= 10.40). For MO errors, TD (Mean= 0.00; SD= 0.00) and children with LD (Mean=0.00; SD=0.00) did not make any such errors in their written samples. Analysis of results on Mann-Whitney test revealed that performance of children with LD and TDC in grade 6 did not show significant difference amongst the five variables- percentage of P errors  $z=-1.798$ ;  $p> 0.05$ , percentage of O errors  $z=-1.892$ ;  $p>0.05$ , percentage of O errors  $z=-1.798$ ;  $p>0.05$ , percentage of PO errors  $z=-0.322$ ;  $p>0.05$  and percentage of MO errors  $z=0.00$ ;  $p>0.05$  which indicated that both the groups did not have much variations in the patterns of spelling errors produced.

For grade 7, results on descriptive analysis revealed that, for Phonological errors, TDC produced lesser number of errors (Mean=38.28; SD=31.90) in comparison to children with LD (Mean= 41.48; SD=13.38). For Orthographic errors, the TDC group produced lesser number of errors (Mean=34.86; SD=30.89) in comparison to children with LD (Mean= 44.60; SD=22.26). For Morphological errors, the TDC group produced lesser number of errors (Mean=10.03; SD=9.38) in comparison to children with LD (Mean= 41.96; SD=63.39). For PO errors, the TDC group produced lesser number of

errors (Mean= 13.40; SD= 29.96) in comparison to children with LD (Mean=83.20; SD=10.00). For MO errors, the TDC produced greater number of errors (Mean= 13.40; SD= 29.96) in comparison to children with LD (Mean=7.40; SD=1.65). Analysis of results on Mann-Whitney test revealed that the performance of children with LD and TDC did not show significant difference amongst the five variables- percentage of P errors  $z=-1.167$ ;  $p>0.05$ , percentage of O errors  $z=-1.567$ ;  $p>0.05$ , percentage of M errors  $z=-1.226$ ;  $p>0.05$ , percentage of PO errors  $z=-1.530$ ;  $p>0.05$  and percentage of MO errors  $z=-0.149$ ;  $p>0.05$  which indicated that both the groups did not have much variations in the patterns of spelling errors produced.



*Figure 4.4.1.* Comparison of performance of children with LD and TDC for errors of spelling between grade 6 and 7

*Note:* P errors- phonological errors, O errors- orthographic errors, M errors- morphological errors, PO errors- Phonological-Orthographic errors, MO errors- Morphological-Orthographic errors.

The observations on qualitative analysis revealed that children with LD in grade 6 and 7 produced greater number of Phonological, Orthographic, Morphological, and phonological-Orthographic than TDC group. For e.g., it was observed that the types of Phonological errors produced by children in LD group were ‘ier’ for ‘higher’, Orthographic errors like ‘ lik’ for ‘like’, M errors such as ‘aerobikes’ for ‘aerobics’, PO errors such as ‘permre’ for ‘primary’ were produced by children with LD. These errors signify that children with LD show reduced performance on spelling tasks, similar but delayed performance to spelling level matched peers (Windsor, et.al., 2000).

To summarize the results, on SALT analysis of written language samples the findings indicated that, TDC group produced greater number of words than children with LD. For T-Unit, TNC and MLT-Unit, results showed that TDC group scored greater scores than children with LD. For CON, children of TDC group produced more convention errors than children with LD. The observations on the qualitative analysis for spelling errors revealed that children with LD produced greater number of Phonological, Orthographic, Morphological and Phonological-Orthographic errors than children with TDC.

## CHAPTER 5: Discussion

The primary aim of the present study was to investigate the linguistic pattern of written language in children with learning disability (LD). Performance of individuals with LD was compared to the TDC group for written language skills using SALT analysis and for pattern of mis-spelling errors using POMAS analysis. The objectives of the present study were:

- To analyze the spelling errors of typically developing children (TDC) and children with learning disability (LD) and to determine how knowledge about phonology, orthography, and morphology are integrated to proficiently encoded words.
- To investigate linguistic pattern analysis of misspellings in children with learning disability (LD) in comparison to typically developing children (TDC).

The results of the present study are discussed in terms of:

- 5.1 Performance of TDC for written language on SALT analysis
- 5.2 Comparison of performance of children with LD and TDC for written language on SALT analysis
- 5.3 Performance of TDC for errors of spelling in written language on POMAS analysis



#### 5.4 Comparison of performance of children with LD and TDC for errors of spelling in written language on POMAS analysis

### 5.1 Performance of TDC for written language on SALT analysis

The results indicated that children in the TDC group in grade 7 showed better performance than grade 6 for total number of words (TNW), total number of T-units (T-Unit) and total number of clauses (TNC) (Figure 4.1). This finding suggests that an increase in number of words with increasing grade is indicative of an increase in productivity aspect of written language (Chall, 1983; Puranik et.al, 2008; Nelson & Van Meter, 2003). This could be attributed to increased vocabulary growth that is often observed with increasing age and the same could be reflected in their written language. Increase in the number of clauses is indicative of an increase in the productivity aspect of written language that was observed from the performance of children from grade 6 to grade 7 (Puranik et. al, 2008; Nelson & Van Meter, 2003). The possible reason could be that with developing age, spoken language skills improve, children tend to use more complex and longer sentences as they grow older and similar pattern was observed for written language development in the present study.

Relatively lesser variation was seen in the scores for clause density (CD), grammatical T-units (GRAM T-Unit) and percentage of spelling errors (SPELL) (Figure 4.1). The results of the current study did not show significant difference on clause density between grades 6 and 7. The possible reason could be that since the expository style of

written sample has been used, there is limited scope to use complex utterances (Loban, 1986). Children in the grade 6 scored higher for MLT-unit and showed greater number of convention errors. Unlike, various other researchers (Hunt, 1965; Puranik et.al, 2008) reported of an increment in length of MLT-unit with increase in grade. However, the results of the present study suggest that there is no significant difference between the adjacent grades 6 and 7. This can attributed to the fact that mean length of T-unit is a measure of complexity and children acquire competence in syntactic complexity gradually and steadily as a function of age and grade which could be indicative of continual growth which may be evident beyond grade 7 for written language skills.

## **5.2 Comparison of performance of children with LD and TDC for written language on SALT analysis**

The results indicated that TDC group produced greater number of words than children with LD (Figure 4.2.1). For T-Unit, TNC and MLT-Unit, results indicated that TDC group scored greater scores than children with LD. For CON, children of TDC group produced more conventional errors than children with LD. Children with LD had written fewer words compared to TDC group, hence their written sample consisted of simpler words and sentences. Whereas, for TDC group, in order to express ideas, they tried to use relatively complex language and thus make greater number of conventional errors such as errors with apostrophes, commas, etc.

Similar findings were observed in a study conducted by Houck and Billingsley 1989 who investigated written expression of children with LD and found that children

with learning disabilities write fewer words and sentences, and produce fewer words with seven letters or more and fewer sentence fragments. The possible reason could be because of word retrieval problems often found in children with LD (Mather et.al, 2009) due to which they have delay in producing words, produce more omission and substitutions of words than the conventional errors. The numbers of T-units produced were fewer in children with LD than children in the TDC group in the present study (Nodine et.al., 1985) which also reported similar results. This could be attributed to delay in producing words, thereby limiting children with LD to produce reduced number of T-units hence reducing overall productivity. For TNC, children with LD produced lesser number of clauses than children in TDC group in the present study (Figure 4.2.1). Total number of clauses is also a measure of productivity. There was an overall decrease in the measure of productivity as seen earlier in TNW and T-Unit which was also reflected in clauses (Sheetal & Sangeetha, 2011). The numbers of MLT-units produced were fewer for children with LD than children in TDC group in the present study. The possible reason could be that children with LD use short sentences with simpler constructions due to their limited knowledge of grammar (Mather, Wendling & Roberts, 2009). For CD and GRAM T-unit, children with LD did not show any significant difference as compared to TDC in the present study. This can be attributed to the fact that children in grade 6 and grade 7 lack the use of appropriate punctuations and write run on sentences with more clauses embedded in same T-unit.

Thus, children with LD showed poorer performance compared to TDC in almost all aspects of productivity, complexity and accuracy except for conventional errors. Children with LD exhibited lesser TNW, T-Unit, TNC, and MLT-Unit as compared to

children in the TDC group. Thus, from the above findings, it can be concluded that children with LD have limited vocabularies as compared to the TDC group which would further cause hindrance in development of word retrieval abilities, knowledge of morphology and breadth and depth of word knowledge.

### **5.3 Performance of TDC for errors of spelling in written language on POMAS analysis**

The results of the present study indicated that the performance of the TDC group in grade 6 and grade 7 did not show significant difference amongst the five variables- Phonological, Orthographic, Morphological, Phonological-Orthographic and Morphological-Orthographic errors which indicated that both the grades 6 and 7 of the TDC group did not have show a trend in the patterns of spelling errors produced. There was no significant difference between the pattern of phonological, orthographic, morphological, phonological-orthographic and morphological-orthographic errors amongst the grades 6 and 7. Children in grade 7 of the TDC group produced greater number of phonological, morphological and mophological-orthographic errors than children in grade 6 of the same group. Phonological errors such as ‘continously’ for ‘continuously’, ‘festivales’ for ‘festivals’ were produced by the TDC group. The error patterns between grades 6 and 7 showed that development of the three major linguistic codes i.e. phonology, orthography and morphology develop simultaneously as the vocabulary development takes place.

Earlier researchers supported the stage wise development of spelling which takes place in a hierarchical fashion as explained in the Late model of spelling development

proposed by a group of theorists (Ehri, 1986; Henderson, 1985). In this context Ehri (1986) described three overarching stages in which the child transitions from beginning to use phonological knowledge (semi-phonetic stage) to being able to represent most sounds in their spelling (phonetic stage) and finally to recognize the irregularities in spelling which leads to traditional spelling (morphophonemic stage). However, the findings of the present study do not support the notion that spelling development takes place as in the above said hierarchical fashion. The results of the present study indicated that children in grade 6 and 7 mainly resort to the phonological strategy for spelling the root (e.g. ‘practly’ for ‘practically’) which is either related to increased morphophonemic complexity or children in this age revert to the use of more stable phonotactic patterns when spelling root words of these types (Apel et. al., 2004). Results of the present study indicate that development of spelling does not take place linearly in stages but through all the three linguistic codes i.e., phonology, orthography and morphology are developed simultaneously.

The findings of the present study can be explained using a recent theory “The triple word form theory” (Bahr, Silliman, & Berninger, 2009; Berninger, Garcia, & Abbott, 2009; Garcia, Abbott, & Berninger, 2010) which challenges the linearity of the afore mentioned approach. According to this theory it is proposed that spelling development is characterized by the simultaneous interaction of all the three linguistic factors i.e. phonology, orthography and morphology from beginning itself. The TDC group has adequate vocabulary development which helps these children to cross-map the interrelationships among the codes- phonological (coding and analyzing phonemes and

other sound units in spoken words), orthographic (coding and analyzing the written words and single letters, letter groups and larger letter patterns in them) and morphological (coding and analyzing base words, prefixes, and inflectional and derivational suffixes in both spoken and written words).

Developmental trend could not be retrieved from the present study but main types of errors produced by the children of the TDC group of grade 6 and 7 under the phonological category were, *epenthesis* ‘tolid’ for ‘told’, *unstressed syllable reduction* ‘anmols’ for ‘animals’, *cluster reduction* ‘stuck’ for ‘struck’, *consonant deletion* ‘beame’ for ‘became’ were the common errors. No significant difference was seen amongst the Morphological, Orthographic, Phonological-Orthographic and Morphological-Orthographic errors. However, common morphological errors seen between grades 6 and 7 of the TDC group were *real word substitution* ‘edgeucation’ for ‘education’, orthographic errors seen mostly were *unstressed vowel error* ‘differant’ for ‘different’, *stressed short vowel error* ‘bisy’ for ‘busy’, *digraph omission* ‘sip’ for ‘ship’, Phonological-Orthographic errors seen were *vocalic /r/ omission* ‘wold’ for ‘world’, *voicing consonant reversal* ‘pusels’ for ‘puzzles’ and Morphological-Orthographic errors seen were very rare.

#### **5.4 Comparison of performance of children with LD and TDC for errors of spelling in written language on POMAS analysis**

The observations on the qualitative analysis indicated that children with LD produced greater number of Phonological, Orthographic, Morphological and

Phonological-Orthographic errors than children with TDC. Children with LD produced greatest number of Phonological errors such as ‘tings’ for ‘things’, ‘tripes’ for ‘trips’, etc. The Orthographic errors seen in the written samples of children were ‘happle’ for ‘happy’, ‘live’ for ‘leave’, etc. The Morphological errors seen were ‘divison’ for ‘division’, ‘noleg’ for ‘knowledge’, etc. The Phonological-Orthographic errors included errors such as ‘separte’ for ‘separate’, ‘thair’ for ‘there’, etc. (Figure 4.4.1). These findings could be attributed to the fact that spelling ability is delayed in individuals with LD, mirroring the abilities of younger less proficient spellers. Previous studies have reported that spelling abilities of children with LD have noted problems with consonant clusters, vowel letter names, (Cassar et.al, 2005) omission of final consonants (Egan & Pring, 2004). In looking at the types of errors being made and the age of the individuals who seem to be making similar errors, it appears that in children with LD, spelling develops in a manner much like typical peers, only in a slower progression. Children with LD mainly produced errors like ‘nais’ for ‘nice’, ‘butaful’ for ‘beautiful’, ‘stord’ for ‘stewart’, ‘premere’ for ‘primary’, ‘boll’ for ‘ball’. The LD group made maximum number of phonological errors (like epenthesis, unstressed syllable deletion, consonant deletion, cluster reduction, vocalic /r/ omission). The possible reason could be that they are in the phonetic stage of spelling development whereas the age matched peers of the TDC group are in the transitional stage of spelling development i.e. two stages ahead from the children with LD (Late model of spelling development, proposed by Ehri, 1986; Henderson, 1985).

According to the recently developed “triple word form theory”, the results of the present study could be explained in a way that due to delayed vocabulary development,

children with LD are unable to cross-map the interrelationships among the codes-phonological (coding and analyzing phonemes and other sound units in spoken words), orthographic (coding and analyzing the written words and single letters, letter groups and larger letter patterns in them) and morphological (coding and analyzing base words, prefixes, and inflectional and derivational suffixes in both spoken and written words).

Silliman, Bahr, and Peters (2006) also examined the spelling abilities of children with LD, as well as age-matched and spelling level matched control groups. Frequency results indicated that the children with LD made more errors than their age-matched peers, but were similar in error frequency to the group matched for spelling ability. The LD group had considerably more trouble representing the basic phonological structure of words (e.g. errors like epenthesis, cluster reduction were present) when complexity increased. This group also showed more frequent omissions of inflected and derived morphological markers (e.g. errors like ‘wantid’ for ‘wanted’, ‘detension’ for ‘detention’, etc.).

In the present study, on comparison of performance of children with LD and TDC for errors between grade 6 and grade 7, children with LD in both grades produced greater number of phonological, orthographic, morphological, phonological-orthographic and morphological-orthographic errors than children with TDC. Similar findings were reported in another study by Windsor, et.al, (2000) who reported that children with LD showed reduced performance on spelling tasks, similar but delayed performance to spelling level matched peers.



## Summary and Conclusion

Writing is an essential means of communication as well as a cognitive skill that helps children organize their thoughts in a structured manner. It is one of the most complex verbal behaviors and typically developing children of all ages have difficulties becoming proficient in writing. Spelling, one of the component of writing is a rich source of information. Systematic spelling failures are thought to reveal aspects of the cognitive mechanisms of spelling and learning to spell. Moreover, spelling errors may be strongly dependent on the language-specific orthographic system and on the individual level of competence. Very few studies have been reported for the assessment of written language and difficulties associated with it in the Indian context. Children with learning disability are one amongst the category of language disorders who have poor written language skills. They show reduced performance in spelling tasks, similar but delayed performance to spelling level matched peers (Windsor, 2000) and evidence of challenges with tasks that contain more complex morphology.

Thus the present study aimed at investigating the linguistic pattern of written language in children with learning disability (LD). Performance of individuals with LD was compared to the TDC group for written language skills using SALT analysis and for pattern of mis-spelling errors using POMAS analysis.

The objectives of the present study were: firstly, to analyze the spelling errors of typically developing children (TDC) and children with learning disability (LD) and to determine how knowledge about phonology, orthography, and morphology are integrated to proficiently encoded words. Secondly, to investigate linguistic pattern analysis of

misspellings in children with learning disability (LD) in comparison to typically developing children (TDC).

In the present study, children with LD (grade 6 and grade 7) and the TDC group (grade 6 and grade 7) participated for SALT analysis and POMAS analysis. For SALT analysis, the TDC group (grade 6 and 7) produced greater number of words, T-units, number of clauses and MLT-units as compared to children with LD (grade 6 and 7). Relatively lesser variation was seen in the scores for clause density (CD), grammatical T-units (GRAM T-Unit) and percentage of spelling errors (SPELL) between the TDC group and children with LD. It can be concluded that children with LD have limited vocabularies as compared to the TDC group which would further cause hindrance in development of word retrieval abilities, knowledge of morphology and breadth and depth of word knowledge. Overall, it may be understood that writing is a complex process that requires generation and integration of many levels of linguistic material. There might be difficulty at one or more levels of processing in persons with LD. Children with LD fail to engage in advanced planning processes when they write the expository text. Even when they have brainstormed ideas prior to writing, children with LD do not apply logical and well defined schemas for organizing the information when composing. As a result, their writing is poorly organized and incoherent

For POMAS analysis, children with LD (grade 6 and 7) produced greater number of phonological, orthographic, morphological, phonological-orthographic and morphological-orthographic errors as compared to the TDC group (grade 6 and 7). No developmental trend was noticed for the errors between grades 6 and 7 for the TDC

group. The findings of the present study could be attributed to the fact that spelling ability is delayed in individuals with LD, mirroring the abilities of younger less proficient spellers. ”, To summarize, results of the present study could be explained in a way that due to delayed vocabulary development, children with LD are unable to cross-map the interrelationships among the phonological, orthographic and morphological codes.

The present study highlights on the method of analysis for Speech-Language Pathologist (SLP) to view the linguistic errors and their contribution to writing text in children with LD. The method of qualitative analysis helps in studying the specific linguistic feature patterns at various levels of language development that differ in comparison to their age matched peers and will further help in formulating intervention programmes for LD population. The POMAS analysis provides a reference point for understanding the linguistic nature of spelling errors of child writers with learning disability in clinical practice and analyzes whether the linguistic patterns differ as a function of grade level.

The present study had limitations in terms of the small sample size and the results cannot be generalized due to small sample size. Further research is warranted in order to study the various linguistic mechanisms that may be crucial to understanding the basis of deficits in terms of written language deficits in children with Learning disability. Another interesting research could be in order to understand the possibility of different subtypes of written language deficits.

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