Learning Difficulty among Primary School Children in the District of Kalutara; Prevalence, Behavioural Comorbidities, Risk Factors and Maternal Concerns.

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Abstract

Learning Difficulty (LD) among primary school children has been identified as a global school health problem by health and educational authorities. Although, the problem has enormous social consequences at individual, family and society level, lack of research evidences has imposed a restriction in initiating strategic decisions for early identification and interventions in Sri Lanka. The present study was planned to gather basic research evidences which can be utilized to fill the existing gap in the field of LD in Sri Lanka.

The study was conducted among primary school children in grade three and grades four in the District of Kalutara to estimate the prevalence of LD, to identify behavioural comorbidities and risk factors of LD; and to describe maternal concerns towards parenting children with LD..

The study comprised four components. First component was development and validation of a screening instrument, Learning Difficulty Screening Questionnaire for Primary School Children [LDSQ (PSC)] in order to identify primary school children with LD. The second component included a descriptive cross sectional study to assess the prevalence of LD and to describe the behavioural comorbidities of LD among primary school children in grade three and grade four. The third was a case control study to identify selected risk factors of LD in a sample of children identified as cases and controls in the prevalence study, and the last was a qualitative study to describe maternal concerns towards parenting children with LD.

A 36 item teacher administered screening instrument, LDSQ (PSC) with three subscales, reading, writing and math was developed involving multiple steps during item generation and item selection. Judgmental validity of the tool was ensured during the process of development. Criterion validity was assessed against a gold standard which was the clinical judgment and separate cut off levels for each of the three subscales; reading (>45.5), writing (>41.5) and math (>50.0) were identified. Internal consistency reliability and the test retest reliability for subscales were found to be satisfactory.

model identified male sex (OR=6.1;95% CI=2.6-14.2), poor wealth quintile (OR=2.6; 95% CI=1.1-6.1), maternal age at delivery <20 & >35years (OR=11.9; 95% CI=3.6-39.7), Premature Baby Unit (PBU) stay >3days (OR=6.3; 95% CI=1.6-25.5), child needs special attention during infancy (OR=3.1; 95% CI=1.2-8.0), motor development delay (OR=2.8; 95% CI=1.01-7.8), Child with Special Health Care Needs (OR=5.2; 95% CI=2.1-13.3), family with >5 members (OR=4.3; 95% CI=1.7-10.8), family history of LD (OR=3.3; 95% CI=1.1-9.6) and home with violent disagreement pattern (OR=4.2; 95% CI=1.4-12.5) as risk factors of LD.

The qualitative component which included focus group discussions with mothers of children with LD revealed that most of these mothers were dissatisfied with the present life. Discussions identified four major thematic areas imposing psychological distress among mothers of these children. Uncertainty about future expectations, difficulties experienced in parenting children with LD and with superadded behavioural problems, stressful events experienced in family functioning and negative experiences gained during school involvement were the identified principal areas that were concerned by the mothers.

It was found that 18% of primary school children in Sinhala medium government schools in the District of Kalutara are having one or more type of LD. Often LD present as overlapping problems and significantly associated with behavioural problems. Risk factors of LD are multifactorial with biological as well as socioeconomic origin. Mothers of children with LD are concerned due to different reasons related to parenting of children with LD.

It was recommended that the Ministry of Health and Ministry of Education should work together to launch a comprehensive screening program at primary grade level and to identify high risk children at preschool level. Incorporation of teacher training programmes, mental health services, parent education programmes and multisensorial teaching methods would also help to minimize the social and psychological consequences at individual level as well as family level.

Key words: Learning Difficulty, Primary School Children, LDSQ (PSC).

The descriptive cross sectional study was carried out in a sample of 2020 grade three and grade four primary school children recruited using multi-stage cluster sampling method with probability proportionate to size of grade three and grade four children in the selected divisions. Altogether 101 clusters with a cluster size of 20 were included in the study. Of the 2020, 1864 primary care givers attended the interview thus making the response rate as 93%. Primary caregivers were interviewed on demographic and socioeconomic factors using demographic and socioeconomic Interviewer Administered Questionnaire.

Prevalence of LD in the study sample was estimated using the clinically validated cut off points of LDSQ (PSC) subscales. Prevalence of reading, writing and math learning difficulty was 12.6% (95% CI=11.1-14.1), 13.5% (95% CI=12-15.1) and 13.3% (95% CI=11.7-15.0), respectively. Prevalence of LD was 18% (n=336, 95% CI=16.3-19.8). The sample consisted of 4.4% (n=83) one type of LD, 5.8% (n=108) two types of LD and 7.8% all three types of LD.

Behavioural comorbidities of LD were assessed using teacher version of Strength and Difficulties Questionnaire (SDQ). It was found that 39.6% (n=133) of children with LD had emotional difficulties, 50.6% (n=170) had conduct problems, 68.8% (n=231) had hyperactivity and, 42.3% (n=142) had peer problems. All types of behavioral problems were significantly associated with LD ($p<.001$). It was also found that the presence of symptoms of mental health problems measured by Total Difficulty Score (TDS) was also significantly associated with LD ($p<.001$).

The case control study was conducted to determine the risk factors of LD. Children who had all three learning problems were recruited as cases and children without any learning problem were recruited as controls. The study was conducted among 137 clinically confirmed cases and 137 clinically confirmed controls. Maternal caregivers were interviewed using a Risk Factor Questionnaire to collect information on factors related to maternal perinatal period, infancy, development, early childhood, family and home physical environment. During the bivariate analysis, 26 variables were identified as having a significant relationship with LD. Of the 26 variables, 6 variables were excluded due to <10 events per variable and out of two variables measuring socioeconomic status one was excluded. Nineteen variables were included in the multiple logistic regression analysis. The

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LIST OF ABBREVIATIONS

ADHD	Attention Deficit Hyperactive Disorder
APA	American Psychiatric Association
AUC	Area Under the Curve
CD	Conduct disorders
CDC	Centers for Disease Control and Prevention
CFA	Confirmatory Factor Analysis
CHDR	Child Health Development Record
CPGC	Child Psychiatry and Guidance Clinic
CPI	Cognitive Processing Inventory
CSHCN	Children with Special Health Care Need
CVI	Content Validity Index
DSM IV	Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition
EFA	Exploratory Factor Analysis
ELBW	Extremely low birth weight
FGD	Focus Group Discussion
FI	Field Investigator
IAQ	Interviewer Administered Questionnaire
ICD	International Classification of Diseases
IDEA	Individual Disabilities Education Act
IEP	Individual Education Plan
IQ	Intelligent Quotient
LBW	Low birth weight
LD	Learning Difficulty
LDA	Learning Disability Association
LDDI	Learning Disability Diagnostic Inventory
LDES –R2	Learning Disability Evaluation Scale- Renormed
LDSQ-PSC	Learning Difficulty Screening Questionnaire- Primary School children
LR	Likelihood ratio

LRH	Lady Ridgeway Hospital
LRM	Logistic Regression Model
LSU	Learning Support Units
MBD	Minimal brain dysfunction
MDD	Major depressive disorder
MDG	Millennium Development Goal
MLD	Mathematical Learning Difficulty
MOIC	Medical Officer In charge
MOMH	Medical Officer Mental Health
NHIS	National Health Interview Survey
NHIS	National Health Interview Survey
NICU	Neonatal Intensive Care Unit
NIE	National Institute of Education
NJCLD	National Joint Committee on Learning Disabilities
NSCH	National Survey of Children's Health
ODD	Oppositional defiant disorders
PBU	Premature Baby Unit
PHI	Public Health Inspector
PI	Principal Investigator
PSC	Primary School Children
RD	Reading difficulty
RFQ	Risk Factor Questionnaire
ROC	Receiver Operating Characteristic Curves
RTI	Response to Intervention
SAQ	Self-Administered Questionnaire
SDQ	Strengths and Difficulties Questionnaire
SE	Special Education
SLCN	Speech, Language and Communication Needs
SLD	Specific Learning Difficulties
UK	United Kingdom
USA	United States of America

VLBW	Very Low birth weight
WIAT II	Wechsler Individual Achievement Test II
WJ III	Woodcock-Johnson III
WRAT III	Wide Range Achievement Test III

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CHAPTER ONE

INTRODUCTION

1.1 Concept of Learning

Learning can be simply defined as changing behavior through observations and experiences. In psychology and education learning is commonly defined as "a process that brings together cognitive, emotional, and environmental influences and experiences for acquiring, enhancing, or making changes in one's knowledge, skills, values, and world views" (Illeris, 2004). Gredler(2001) stated that learning is the way that human beings acquire new skills, knowledge, attitudes and values. The outcomes of learning are the new capabilities possessed by the learner. Neuroscientists define learning as two neurons communicating with each other (Sprenger, 1999).

From the day of conception up to the delivery, all the maternal contributions, the air she breathes, the food and drink she consumes, the chemicals she's exposed to, and even the emotions she feels are shared in some way with the fetus. These maternal contributions are treated as information by the fetus and the answers learnt to questions critical to the survival of the new born. Thus the process of learning starts in the womb even before the birth of a newborn (Paul, 2011). Human fetuses are able to memorize sound stimuli from the external world by the last trimester of pregnancy and this is how they learn their first language definitely long before their first cry (Mampe et al, 2009). The brain continues to grow from conception to birth and during this process the neurons develop networking or form synapses. This networking is enhanced by positive environmental stimulation such as good nutrition, less stress and tender care. Thus, provision of positive prenatal stimulation enables the baby to be born with full potential for learning and development (UNICEF, 2001).

Although the brain of a new born baby has already undergone an amazing amount of development, the process of development is still unfinished. The brain continues to develop and forms many more synapses during early childhood until five years. A newborn has tentative neuronal connections, which through the child's experiences will become the

hardwired connections responsible for the child's major cognitive and emotional functioning, including language and learning. With the environmental stimulation the learning accelerates rapidly and the kind of care a child receives plays a big role in how the brain chooses to wire itself. They should be provided appropriate stimulus, interactions, care, love and support, which in turn allow them to achieve their full genetic and intellectual potential. There is only a brief window of opportunity to provide the supportive, stimulating environment that will give a baby the best possible start in life (Bales, 1998).

Human development and learning critically and constantly depends on the interplay between an individual's genetic environment and the nutrition, surroundings, care, stimulation, and teaching that are provided or withheld. Thus the development and learning hinge on the interplay between nature and nurture (Shore, 1997). The unfortunates who miss this opportunity of growing in a nurturing environment at a point or throughout their early life would consistently lag behind the others during this journey of learning (McCain &Mustard, 1999).

1.2 Concept of Learning Difficulty

Either due to genetic predisposition or due to lack of environmental stimulation an individual's learning capacity may vary from person to person ranging from status of profound intellectual disability to giftedness. Education is being increasingly regarded as a fundamental right of every child, but a large number of children have difficulties that prevent them from taking full advantage of education and reaching their full educational and productive potential. They suffer from a group of disorder collectively known as learning disability or learning difficulty.

The term 'learning difficulty' (LD) has been applied to those children who have significantly greater difficulty in learning to read, write or doing mathematical calculation than the majority of their age and this difficulty is out of proportion to their intellectual capacity (Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition -DSM IV). They are unable to make use of the education facilities available in school. Mastery of basic academic skills, reading, writing and arithmetic is a necessary pre-requisite for success in

both schools and employment setting. Children who suffer from LD do not master or partially master these required academic skills. Failure to achieve an adequate standard of literacy is recognized as one of the social problems in most parts of the world as certain degree of literacy skill is absolutely necessary to survive in a technologically advanced society (Coltheart, 1983).

Different terminologies for LD have been used in the research and by the service providers. Pumfrey and Reason (1991) indicate that the term learning disabilities is used in the United States of America (USA) to refer to problems similar to those described in the United Kingdom (UK) as Specific Learning Difficulties (SLD). In the UK the term learning disability is used for children with intellectual disability. Educational specialists consider the term 'Learning Difficulty' as opposed to 'Learning Disability' as more appropriate due to the fact that it is unethical to label a child disabled in the context of current restricted educational framework that largely depends on the visual mode of learning. If the educational system were to incorporate widespread multi-sensorial teaching approaches and accept learning outcomes from students in modes other than visual, these children would have a greater chance to cope with the curriculum (Dilshad, 2006). The American Psychiatric Association uses the term "learning disorder" to describe the same condition instead of learning difficulty or learning disability (APA, 1994).

LD in children is not a new field. The enigma of the child who is unable to learn has been the concern of researchers, teachers and parents for many years. What is new is the rapidly growing movement of all responsible persons and authorities to offer service for these children. What is new is the increasing health concern of all professionals, educational as well as medical, to work together in diagnosing and managing LD.

Although the term "learning disabilities" has been in use since 1962, there is no single universally accepted definition of the condition. Several definitions came in to practice after the first definition which was developed by the federal government. Groups such as the Learning Disabilities Associations (LDA) and the National Joint Committee on Learning Disabilities (NJCLD) have put forward their own definitions. APA has its definition which is used more commonly in clinical practice. Although different definitions

are there, they are not consistent. This lack of consistency in the definitions created a major barrier in estimating the real burden of the problem. In 2004 the Individual Disability Education Act (IDEA) came in to practice and serves as the most acceptable definition in the field of special education (Rimrodt, 2011).

1.3 The historical background of LD

Reports of individuals who acquired a sudden inability to read, write or perform mathematical calculations after some type of neurological insult have been published since the 17th century. However, in the late 1800's an English physician, Morgan, published a report of a 14-year old boy who had a trouble in learning to read in spite of his bright cognitive abilities and visual skills. This report led another physician, Dr. James Hinshelwood to conclude that this difficulty was due to a problem in the visual memory system and the term congenital word blindness was coined in early 1900 (Jensen, 2005). Pioneer work in the field of LD is attributed to another physician, Orton, who examined the relationship between cerebral dominance and language disorder in the 1930's and Strauss, who examined the psychopathology of a brain injured child in the 1940's (Lerner, 1972). The credit of bringing the concept of LD in to practice goes to Dr. Samuel A Kirk, a pioneer in special education who introduced the term learning disability in 1963 in a gathering of parents who had children with LD which lead to the establishment of the Learning Disability Association and the beginning of service provision for children with LD (Grigorenko, 2008).

1.4 Classification of LD

LD can be categorized either by the type of information processing that is affected or by the specific difficulties caused by a processing deficit. The type of information processing is classified as input, integration, storage and output. Any deficiencies in the information processing such as visual perception, auditory perception, attention deficit, and working memory would give rise to difficulties in one or more basic academic skills (Kirk et al, 2000; NICHY, 2004).

Types of LD can also be classified by function impaired. Deficits in any area of information processing can manifest in a variety of specific LD. The most obvious broad categories are those that identify the specific skill area in which the individual is having problems such as reading disability (dyslexia), difficulty with arithmetic and mathematics (dyscalculia), problems with written expression and handwriting (dysgraphia), spelling difficulties (dysorthographia) and problems in recalling names, symbols and vocabulary (dysnomia) (Westwood, 2004). DSM IV classifies LD in to difficulty in reading (Dyslexia), writing (Dysgraphia) and doing mathematical calculation (Dyscalculia). It is stated that these types of LD are not mutually exclusive. They usually co-exist. Any individuals may have difficulties in more than one of the specified areas. For example dyslexia may impair all aspects of literacy development including reading, writing and spelling. It is found that dyslexic dysgraphia is commoner than motor dysgraphia and many dyslexic students may also have difficulties in mathematics (Westwood, 2004).

1.5 Etiology of LD

There is a consensus in the field of LD that intrinsic factors such as genetic factors have a greater predisposition to the problem of LD. Consensus had been achieved that it also has a neurobiological bases, specifically atypical brain maturation and functioning. The field assumes that these genetic factors influence development, maturation, functioning and structure of the brain and in turn affect the cognitive process associated with LD. It is further mentioned that so many external risk factors such as poverty, lack of educational opportunities, lack of environmental stimulation and prenatal insult affect patterns of brain development, maturation and functioning and worsen the prognosis of biological predisposition for LDs or act as a trigger in the manifestation of LD (Grigorenko, 2008).

1.6 Global and Local situation

Of the many factors that may combine to produce school problems, LD constitutes the most prevalent underlying condition. A variety of estimates of the prevalence of children who suffer from LD have been made, depending on the criteria used to determine the difficulty. It ranged from 1% to 30% of school population, (Lerner, 1972). Currently, 5-15% of school aged children in the United States is estimated to have LD, although the actual percentage

is controversial because of vague definition and different diagnosis criteria. Approximately 50% of all students receiving special educational services in the U.S.A have received them under the category of LD. Among these students, a majority, 80% - 90%, demonstrates substantial difficulties in reading (Grigeronko, 2008). Most of the research in the field of LD has been conducted in the field of reading and very little evidence has been established regarding the prevalence of math and writing.

In the local setting, studies have not been done to assess the prevalence of LD as such. But the prevalence of slow learners which was defined as poor academic performance in basic academic skills, reading, writing, and mathematics was assessed and found to be 15% among primary school children (Piyasena, 2002). In the national study which was conducted to assess the profile of achievement of grade four pupils, it was found that only 36% had necessary language skills and only 38% had achieved mastery in mathematics (NEREC, 2004).

1.7 Consequences of LD

The World Health Organization defined health as "a state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity". The child with LD faces failures one after the other in the class room, among peers and in the society. Therefore the impact of LD on a child's social and mental wellbeing is enormous (William, 1976).

Academic skills such as reading, writing and mathematics form the foundation, upon which a student's performance at school is assessed. Children with LD perform poorly during day to day curriculum related activities and they always lag behind their peers during the performance evaluation. Most of the children with LD are labeled as "dumb", "stupid" and "lazy" in the school. They are subjected to physical as well as psychological punishment by the parents and teachers without knowing the fact that these children are actually having a LD. Children with LD face rejection from peers and suffer from very low self-esteem because of their own perceived feelings of inadequacy and ignorance. The repeated psychological trauma and mental agony they experience push them towards frustration, irritability which ultimately leads to problems with conduct and behavior. LD is associated with demoralization, low self-esteem and deficits in social skills. All these has led to an

increasing trend of LD-associated emotional and behavioural disorders among school age children (Rock et al, 1997). These children would show symptoms of burnout as a reaction to school related stressors. At the same time depressive symptoms are also high among this group (Maag and Reid, 2006).

As these children grow older and reach teenage years there will be higher incidences of anti-social behaviours such as alcoholism, drug abuse, juvenile delinquency, gang affiliation and ultimately they may end up as school drop-outs. (Johnson, 2004; Gale, 1997).

In a study conducted in Sri Lanka it was found that 35% of school dropouts and 41% of school absenteeism were due to personal factors like disability and learning difficulties (Gunawardane, 2005). Adults with learning difficulties may have significant problems in employment or social adjustment. All above evidence indicate that LD leads to individual as well as social problems.

Stressful events related to parenthood are commonly related to family factors including factors related to children. Parental psychological stressors are related to the worries that parents have about the safety, growth and development of their children. Parents generally take pride in their children's accomplishments and are hurt by their children's failures. Many parents are very much concerned about their children's learning and educational achievement. Having a child with LD is considered as an extra burden to the family. LD not only affects the individual with the disability, but can also have a substantial impact on other members of the family and the family as a whole. Raising a child with LD would be an additional challenge for parents specially mothers and they undergo enormous amount of stressors in parenting these children (Raskind, 2006). They are concerned about the academic performance of the child, general behaviour of the child stigma and cultural issues and about the future of the child (Wai-Tong Chen, 2012). A study by Antshel & Joseph (2006) showed that mothers of children with LD reported higher levels of stress than mothers of children without LD. Another study showed that higher levels of stress are associated with LD children who are less socially competent and display more behavior problems (Dyson, 2003).

1.8 Justification

LD is an umbrella term that had been used to represent a group of disorders such as difficulty in reading, writing and mathematical calculation. This has been identified as a global health problem because of its massive impact on mental and social wellbeing of an individual as well as their family (Altarac, 2007). As a result of this, the topic had been researched in several countries during the last few decades and systematic diagnostic and management services had been launched with the participation of multidisciplinary teams. Although many studies have revealed information on school performance, lack of a reliable database on LD as such, has limited the service provision for these children in Sri Lanka. Therefore it is a timely need to initiate exploring the field of LD in our country.

Because of the identification problem of this group of children the diagnosis is delayed until they show behavioral manifestation. This is due to lack of awareness and understanding about the problem among teachers and parents. Presently children with severe learning problems are referred either to the National Institute of Education (NIE) or to Child Guidance Clinics in hospitals. Unavailability of a screening tool to screen suspected children in a class room setting would be a major limitation that hinders organization of proper referral system. As this study intends to develop a screening tool it could be used in routine screening programmes to identify children with LD at an early stage like primary school years.

According to Consultants Child Psychiatrists, information on LD in our country is limited to diagnosed children visiting health care units. Very few clinic based studies have been conducted among children already diagnosed to have LD. These are the children who manifest emotional and behavioral problems as co- morbidities of LD who are referred to child psychiatry and guidance clinics. This may be the tip of an "iceberg". Still, a greater proportion of children may be left undetected and untreated.

As no studies had been done to estimate the magnitude of the problem in the country, data on prevalence of LD is lacking. Findings of this study on prevalence of LD would enable educational and health policy makers to streamline diagnostic and supportive services for

children with LD by involving multidisciplinary teams representing Psychiatry, Pediatrics, Psychology, Public Health and Education.

As this is an era of competitive learning, LD has been considered as a neglected topic in the field of education. All efforts are being made to push forward the children who are able to learn. Attention, time allocation and development of strategies in order to address the problem of LD are not satisfactory in our country. Very few private and international schools have Learning Support Units (LSU) to take care of children with LD. Children with LD are being harassed and discriminated within the class room due to unawareness of the teachers about the problem (Verbal communication with officers at NIE) By dispersing the finding of this study, personnel in the field of education can be trained and motivated to overcome this problem at school and class room level.

It has been noticed that the difficulties of each child during the period of kindergarten and primary school are not being identified properly in the local setting (verbal communication with officers at NIE). Even though children progress in primary grades due to the non-detention policy, they may not show adequate learning skills. Studies have revealed that future LD can be predicted from risk factors identified during child health surveys in early childhood. As one of the objectives of the present study is to identify risk factors for LD, data on risk factors could be adopted to plan a LD identification system at the level of kindergarten. By means of this, children with LD can be identified early and an individual educational plan can be prepared according to their strengths and difficulties.

Parents of children with LD are psychologically disturbed and this would in turn affect family functioning. Affected children as well as the parents are under stress and both groups suffer a lot without knowing the exact reason for the problem. Evidence of this research could be used to educate parents about the causes, outcome and management of the problem of LD which would ultimately minimize health as well as social consequences at individual and family level.

1.9 Objectives

General objectives

1. To determine the prevalence of learning difficulty and to identify behavioral comorbidities and risk factors for learning difficulty among primary school children in grades three and four in the District of Kalutara and to describe maternal concerns towards parenting children with learning difficulty.

Specific objectives

1. To develop and validate an instrument to assess learning difficulty among primary school children in grades three and four.
2. To determine the prevalence of learning difficulty among primary school children in grades three and four in the District of Kalutara.
3. To describe the behavioral comorbidities of learning difficulty among these primary school children in grades three and four in the District of Kalutara.
4. To identify risk factors for learning difficulty among primary school children in grades three and four in the District of Kalutara.
5. To describe maternal concerns towards parenting children with Learning Difficulty.

CHAPTER TWO

REVIEW OF LITERATURE

2.1 Search Strategies

Relevant literature search was carried out manually as well as searching through the web using medical literature databases including Pub Med Central, Medline, Hinari and Cochrane. A range of key words such as Learning Difficulty, Learning Disability, Learning Disorder and Specific Learning Disability, Dyslexia, Dysgraphia, Dyscalculia, prevalence and risk factors of Learning Difficulty, screening instruments of Learning Difficulty had been utilized in order to get a comprehensive coverage of relevant literature. Manual search for relevant literature was done in text books, local journals and publications, dissertations and theses.

2.2 Definitions of LD

In the year of 1963, Dr Samuel Kirk addressed a gathering of very anxious parents and introduced the term "learning disability" to describe the group of children with a special type of learning problem (Hallahan and Cruickshank, 1973).

The concept included, "*children who could see and hear and who do not have marked intellectual deficits, but who show deviations in behaviour and in psychological development to such an extent that they are unable to adjust in home or to learn by ordinary methods in school*".

From this point onward, organizations that had been involved in the welfare of children with LD introduced different definitions by using criteria related to education, clinical medicine, and psychological medicine.

In 1967 the United States (U.S) National Advisory Committee on handicapped children defined LD, which is currently used in most part of the world. This definition was subsequently adopted by the U.S Office of Education in 1977 which presently drives the federal regulation. According to this definition,

"Specific learning disability means a disorder in one or more of the basic psychological processes involved in understanding or in using language, spoken or written, which may manifest itself in an imperfect ability to listen, think, speak, read, write, spell, or to do mathematical calculations. The term includes such conditions as perceptual handicaps, brain injury, minimal brain dysfunction, dyslexia, and developmental aphasia. The term does not include children who have learning problems which are primarily the result of visual, hearing, or motor handicaps, of mental retardation, or emotional disturbance, or of environmental, cultural, or economic disadvantage" (U.S office of Education, 1977).

However, interpretation of the federal definition has resulted in a series of problems that have affected theoretical and service-delivery issues in LD. The NJCLD stated that "learning disabilities" should be recognized as a general term referring to a heterogeneous group of disorders and not as a homogenous group of disorders that was recognized under federal definition.

These disorders are realized as significant difficulties in the acquisition and use of one or more of the following functions: listening, speaking, reading, writing, reasoning, and mathematical abilities. Further it was stated that the comorbidities of social, emotional and behavioural problems of LD should also be emphasized within the definition.

The use of "children" in the federal definition limits the applicability of the term "learning disabilities" to school years, but it was stated that this problem should be viewed as a problem of early childhood which continue into adult life. It is, therefore, a problem that may occur across the life span. Inclusion of all these clarification led to the recommendation of a definition by NJCLD in 1981.

"Learning disability is a general term that refers to a heterogeneous group of disorders manifested by significant difficulties in the acquisition and use of listening, speaking, reading, writing, reasoning, or mathematical abilities. These disorders are intrinsic to the individual, presumed to be due to a central nervous system dysfunction, and may occur across the life span. Problems in self-regulatory behaviors, social perception, and social interactions may exist with learning disabilities but do not by themselves constitute a learning disability. Although learning disabilities may occur concomitantly with other handicapping conditions (for example, sensory impairment, mental retardation, serious

emotional disturbance) or with extrinsic influences (such as cultural differences, insufficient or inappropriate instruction), they are not the result of those conditions or influences" (American Speech, Language Hearing Association, 1991).

Procedural guidelines for LD identification were not described under this definition. In fact, the definition was criticized by several experts stating that it is primarily exclusive in nature, describing what LD is not rather than identifying what LD is.

When theory came in to practice, it was noted that identification of these children was not feasible as proposed. Consequently, operational definitions necessary for practice have been emphasized by the personal involved in identification of LD.

The concept of intra- individual differences or discrepancy was introduced as a new concept. This included "the possibility of sub average functioning in only a few areas of learning with average or above functioning in other areas of learning". One of the first such discrepancies investigated was "cognitive achievement discrepancy". In this scenario, subtest scores from cognitive assessments was compared with achievement of the same child during the assessment of LD, and from this point onward the ability achievement discrepancy model came in to practice (Kavale. and Forness, 1995; Hallahan, 2001).

The American Psychiatric Association uses the term learning disorder instead of learning disability and incorporated the ability achievement discrepancy model in to the definition. It states,

"Learning Disorders are diagnosed when the individual's achievement on individually administered, standardized tests in reading, mathematics, or written expression is substantially below that expected for age, schooling, and level of intelligence. The learning problems significantly interfere with academic achievement or activities of daily living that require reading, mathematical, or writing skills" (APA, 1994).

"The Individuals with Disabilities Education Act (IDEA) is a United States Federal Law that governs how states and public agencies provide early intervention, special education, and related services to children with disabilities.

It addresses the educational needs of children with disabilities from birth to age 18 or 21 for selected categories of disability". In its 2004 amendment IDEA recognized 13 categories

under which a child can be identified as having a disability; autism, deaf-blindness, deafness, emotional disturbances, hearing impairment, mental retardation, multiple disabilities, orthopedic impairment, other health impairment, specific Learning Disability (SLD), speech or language impairment, traumatic brain injury and visual impairment including blindness.

IDEA describes LD as SLD in order to differentiate it from mental retardation which has a global learning disability. The federal definition of LD has been adopted by IDEA and in 2004 amendment, retained the definition of specific learning disability as included in previous versions of IDEA since 1975.

"The term 'specific learning disability' means a disorder in one or more of the basic psychological processes involved in understanding or in using language, spoken or written, which disorder may manifest itself in the imperfect ability to listen, think, speak, read, write, spell, or do mathematical calculations." (NICHCHY, 2011; U.S office of Special Education, 2002).

The category of LD replaced a variety of 'loose' definitional references previously used such as 'Slow learners', 'backward learners' (Franklin, 1987) and "minimal brain dysfunction" (Fletcher, 2002).

2.3 Critique regarding definitions of learning difficulty

Many definitions on LD exclude sociocultural factors that may affect child's learning (Kavale, 1995). All these definitions explain learning disability theory based on a medical model, where disability is perceived as an individual deficit which is mainly biological in origin (Reid, 2004).

Researchers working within a social model of disability emphasize that there are social or structural causes that lead to LD, and even some time that disability is entirely socially constructed (James, 1986; Curt, 2004). Therefore medical as well as social correlates are important when defining learning disability.

Poor socio-economic conditions are associated with malnutrition, limited prenatal and postnatal care, and exposure to teratogens and maternal substance abuse which can lead to

subtle neuropsychiatric disturbances giving rise to the problem of LD (Hallahan, 1996). Recent studies have shown that characteristics of child's immediate environment have an impact on his maturation and indirectly on learning as well (Theodore, 2001).

Secondly, many definitions including DSM IV defines LD by Intelligent Quotient (IQ) discrepancy and this IQ achievement discrepancy model has dominated the school system and the field of research for several decades in identifying children with LD. There has been substantial criticism of this approach among researchers. Recent researches have provided little evidence that a discrepancy between formally measured IQ and achievement is a clear indicator of diagnosing LD (Restori, 2009).

Most importantly, use of the IQ achievement discrepancy model has made early identification of children with suspected LD difficult thereby delaying the intervention. Young children who experience academic problems in the early elementary grades do not demonstrate the IQ-achievement discrepancy that is needed to meet eligibility criteria of LD (Speece, 2002). This will lead to unnecessary delay in diagnosing and managing these children.

It was stated that because of IQ achievement discrepancy a group of children will not fall to any category of special education, neither to the category of mental retarded children nor to the category of learning difficulty. Students who experience long-term academic achievement problems due to their below average intellectual ability, slow learners will not receive any educational intervention if diagnosticians are adhered to IQ achievement discrepancy (Restori, 2009).

Furthermore, diagnosing on the basis of a discrepancy does not predict the effectiveness of treatment. Low academic achievers who do not have a discrepancy with IQ (i.e. their IQ scores are also low) appear to benefit from treatment just as much as low academic achievers who do have a discrepancy with IQ (i.e. their IQ scores are higher than their academic performance). Both groups respond to RTI (Response to Intervention) which is a treatment method of learning difficulty (Marcia, 2007).

2.4 Brain, memory and learning

Understanding a child's brain and the way it develops is very important in understanding "learning" and "Learning difficulty". Meade (2001) stated that learning is possible because of the brain's ability to process information. Brain is organized in a way to capture, store and retrieve records of information in circuits of connected brain cells. Sousa (2001) explains "Learning occurs when the synapses make physical and chemical changes so that the influence of one neuron on another also changes.

Neuroimaging studies revealed that there are specific areas of the brain that involved when a person performs various activities such as reading single words, giving meanings of words, or reading continuous text (Grigorenko, 2001; Krasuski, Horwitz & Rumsey, 1996). Neuro-imaging studies are now being extended into the brain activity of individuals when carrying out mathematical calculations. It is found that the right Hemisphere of the brain controls essentially non-verbal and abstract functions, art and music, imagination and intuition. The Left hemisphere controls reasoning, logical, judgmental or mathematical thinking and verbal skills. The left brain is also responsible for understanding language through hearing and reading and expressing language through talking and writing. Broca's area which is situated in the front of the left brain is the specific area in charge of expressing language while Wernicke's area located at the back of left hemisphere in charge of understanding of speech that we hear. There is a very small language area in the right hemisphere as well (Jensen &Breiger, 2005).

Structural and functional neuroimaging studies have demonstrated difference in brain structure and activation in dyslexic children and adults compared to normal readers. Structural studies revealed difference in left hemispheric region that supports language in individuals with reading problems. Skilled readers generally demonstrate an asymmetry of brain structure favoring left hemisphere while dyslexic demonstrate no asymmetry or asymmetry favoring right brain. Functioning neuroimaging studies revealed that skilled readers show increased activation in left temporo-parietal region while dyslexic show increased activation in anterior portion of the brain and right temporo-parietal region (Jensen &Breiger, 2005).

One particularly important brain-based human attribute is memory. Memory can be defined as the persistence of learning in a state that can be retrieved at a later time (Silver & Hagin, 2002). Learning and memory are very closely related and most of the learning problems are connected with poor memory. Baddeley (1999) stated that memory does not contain a single system, but it consist of a range of interacting systems, which is capable of encoding or registering information, storing information and making it available for retrieval. These systems are described as short-term memory, working memory and long-term memory.

Short term memory defines our immediate consciousness. It can be hypothesized as the system that allows information to be held in mind for only a few seconds. Short-term storage is represented as a necessary first step toward long-term storage. The stored information under the short term memory process would not undergo any manipulation or transformation during the brief time. Sprenger (1999) reports that short-term memory processes seem to be located in the frontal lobes and do not reach capacity until approximately the age of 15 years.

Working memory which functions mainly in the prefrontal cortex of the brain goes well beyond short term memory and allows active processing and modification to the information (Leahey and Harris, 2001). Working memory enable a person to hold visual and verbal information in an active state while processing it for a particular purpose or integrating it with other information (Demetriou et al 2002). Working memory, where all conscious cognitive processing occurs, is involved in all acts of thinking, reasoning and problem solving (Paas et al, 2003). It is a key factor involved in reading comprehension and in understanding and communicating through spoken language. Ratey (2001) suggests that working memory also enables us to maintain continuity in our attention and thoughts from one moment to the next.

Storage of information for a considerable period of time is done under long-term memory. Long term memory can be episodic memory, where information on time, place and events are stored as images and can be recalled easily (Bauer et al, 2000). This type of memory usually exists even at the age of two years. Further, long term memory can be Procedural memory which consists of ability to recall the steps in a particular process, skill or strategy or Semantic memory which refers to memories of meaningful facts, rules, definitions,

concepts and principles. Most learning within the school curriculum involves semantic and procedural memory (Baddeley, 1999).

2.5 Types of LD

2.5.1 Types of LD by stage of information processing

Learning is highly connected with information processing. LD fall into broad categories based on the four stages of information processing used in learning: input, integration, storage, and output (NICHY, 2004).

2.5.1.1 Input:

This is the information perceived through the senses, such as visual, auditory and tactile perception. Visual Processing involves the ability to understand, remember and utilize visual information even when it becomes abstract or complex. When there is a difficulty in visual perception it can cause problems with recognizing the shape, position and size of items seen. These children may experience difficulty in coping with visual information such as charts, graphs, or cluttered worksheets. They often confuse or misunderstand simple symbols like +, -,x ,/ while doing math problems, students with learning disabilities find difficult to align numbers or have a problem in staying within the lines or margins while writing (McDevitt & Ormrod, 2004). These students often struggle with the visualization required for math and spelling but may also experience some difficulty with reading comprehension.

Auditory processing involves the general ability to understand, remember, and utilize auditory information. In this case, the ears hear what information is said but is not processed correctly. These children may have problems in discriminating background noise from meaningful sounds that they are supposed to concentrate (Özel, 2009). Therefore difficulties with auditory perception make it difficult to screen out competing sounds in order to focus on one of them, such as the sound of the teacher's voice. These children may learn better when visual information (such as charts, graphs, maps, demonstration, etc.) is supported with verbal clarification.

2.5.1.2 Integration:

There are certain tasks that must be carried out in the brain in order to make sense of information brought in to the brain via visual and hearing modes. How the information is perceived can affect one's understanding of it. This is the stage during which perceived input is interpreted, categorized, placed in a sequence, or related to previous learning. Depending on the individual's specific learning disability, they may have difficulty in interpreting and organizing the information from the different sensory channels (Suthers, 1996). In order to organize the information the individual needs to be able to sequence the information.

There can be problems with sequencing, which can relate to deficits with processing time intervals or temporal perception. It involves the ability to learn, memorize, organize, and express detailed. The students with weak sequential processing may struggle with reading speed, experience difficulty in remembering specific facts like steps or formula during math or mechanics of writing and organizing thoughts. These students may learn best when first presented overviews, summaries, and underlying concepts rather than detailed facts.

Students with problems in these areas may be unable to tell a story in the correct sequence, unable to memorize sequences of information such as alphabet, months of the year, the days of the week and time table, able to understand a new concept but unable to generalize it to other areas of learning, or able to learn facts but unable to put the facts together to see the "big picture." A poor vocabulary may contribute to problems with comprehension.

2.5.1.3 Storage:

Learning difficulties have been associated with ineffective use of memory process. Memory is a key component in the information processing theory. Problems with memory can occur with short-term memory, working memory, or with long-term memory. Once the information is perceived, it enters the short-term memory and individuals with learning disabilities may have trouble with either their short-term or their long term memory processing. Working memory can become overloaded when too much information is presented. Most memory difficulties occur in the area of short-term memory, which can make it difficult to learn new material without many more repetitions than is usual. Difficulties with visual memory can impede learning to spell (McDevitt & Ormrod et al, 2004).

2.5.1.4 Output:

Whatever the information learnt should be retrieved and communicated. This way of communication can be done by using words through language output or by using muscles through motor activities such as writing, drawing or gesturing. Individuals may have either language or motor disabilities making it hard for information to be communicated (Swanson, 1987). Difficulties with language output can create problems with spoken language, for example, answering a question on demand, in which one must retrieve information from storage, organize our thoughts, and put the thoughts into words before we speak. It can also cause trouble with written language for the same reasons. Difficulties with motor abilities can cause problems with gross and fine motor skills. People with gross motor difficulties may be clumsy, that is, they may be prone to stumbling, falling, or bumping into things. They may also have trouble running, climbing, or learning to ride a bicycle. People with fine motor difficulties may have trouble buttoning shirts, tying shoelaces, or with hand writing. (NICHY, 2004).

2.5.2 Types of LD by function impaired

2.5.2.1 Reading difficulty / disorder / disability (RD)

Reading difficulty was first recognized in the late nineteenth century, when it was called pure word blindness, then developmental alexia. Starting in the 1960s, educators commonly referred to reading disorder as dyslexia, from the Greek word "dys" (poor or inadequate) and the word *lexis* (words or language) (Jensen, & Breiger 2005).

APA (1994) defines reading disorder as "reading achievement (i.e. reading accuracy, speed or comprehension) that falls substantially below the expected level for that individual's chronological age, measured intelligence and age appropriate education. Reading disorder can cause severe problems in reading, and consequently in academic work.

In order to become an effective reader, a child must first be able to hear and identify individual sounds in a spoken word. These are called "phonemes" and are the basic building blocks of language. Therefore any deficits in phonological processing skills will lead to reading difficulty (Jensen, & Breiger 2005). Phonological processing problems can occur at many level, phonological awareness (understanding that words are composed of

individual sounds), phonological retrieval (the ability to quickly and automatically name latters, objects, colours or numbers), and phonological memory (the ability to code phonological information in to working or short term memory). Apart from these, theories of auditory processing deficits, difficulty in processing auditory tones when they are presented in quick manner rather than at a slower rate has also been proposed as a cause of reading difficulty. Deficits in visual processing have also been hypothesized as a cause of reading disorder (Molfese, 2006).

These children would show deficits in related skills such as word recognition, oral reading and reading comprehension. They would exhibit slow reading speed, poor comprehension when reading either aloud or silently, omission of words, reversal of words or letters while reading, difficulty in word vocabulary, speech characterized by long pauses, fillers ("um") and nonspecific language ("that thing") (Jensen, & Breiger 2005). Children with reading disorder often have other delays or learning problems and these include confusion with directions, or right/left-handedness, confusion with opposites (up/down, early/late), mathematics disorder and disorder of written expression (Hales, 2000).

2.5.2.2 Writing difficulty

Proficiency of written expression skills is identified as a major pre- requisite of a child's education. Along with reading, expressing oneself in writing is an essential accomplishment of childhood that facilitates the necessary and rewarding tasks of adult life. Writing difficulty is also named as "dysgraphia". "Dysgraphia is a Greek word, where "graph" refers both to the hand's function in writing and to the letters formed by the hand. The prefix "dys" indicates that there is impairment. The suffix "ia" refers to having a condition. Thus, dysgraphia is the condition of impaired letter writing by hand" (International Dyslexia Association, 2012).

This difficulty would present from childhood and is manifested in both spelling and motor coordination difficulties, which produce slow, irregular and illegible hand writing (Molfese, 2006). The APA describe dysgraphia as "disorder of written expression" and defines as impairment of writing skill compared to the age, level of intelligence and education. These children frequently fail to complete writing when compared to other children, make mistakes in spellings, write different sizes of letters and make grammatical error (APA, 1994). Writing skills of children with dysgraphia would lag three to six years

behind an individual without learning disorders. A 12 year old child with learning disorder may write similar to a six or nine year old child without any learning difficulty. These children will find difficulties in capitalization, punctuation, word usage, sentence formation and paragraph structure. Letter formation, quality, size, spacing, rate and overall legibility of hand writing should be assessed when assessing writing difficulty. As it is associated with difficulty in motor coordination, it is also important to assess child's posture, pencil grip, paper position and issues related to hand dominance when assessing writing difficulty. Anyway, it is stated that dyslexic dysgraphia, that is dysgraphia associated with dyslexia is more common than motor dysgraphia. Disorder of written expression is often accompanied by reading disorder, mathematic disorder, or both (Jensen & Breiger 2005).

2.5.2.3 Difficulty in mathematical calculation

Specific learning difficulty (or disability) in mathematics was originally defined by the Czechoslovakia researcher Kosc in1971, " difficulty in mathematics as a result of impairment to particular parts of the brain involved in mathematical cognition, but without a general difficulty in cognitive function" (Kosc, 1974). In day to day life most of the mathematical concepts are being used. Understanding of these concepts enables us to comprehend number concepts and perform calculations. Budgeting our time and monetary resources, reading calendars, locating an address, and even following a recipe are examples of our dependence on elementary arithmetic skills.

The term "Dyscalculia" has also been used to describe this condition. The word dyscalculia comes from Greek and Latin, it means: "counting badly". The prefix "dys" comes from Greek and means "badly". "Calculia" comes from the Latin "calculare," which means "to count". Dyscalculia is a specific learning disability affecting the normal achievement of arithmetic skills. Although Genetic, neurobiological, and epidemiological evidence indicate that dyscalculia, like other learning disabilities, is a brain-based disorder, socioeconomic and environmental deprivation have also been implicated in its etiology. Because the neural networks of both hemispheres are involved in normal arithmetic skills, dyscalculia can result from dysfunction of either hemisphere. Any way it has been found that left parieto temporal area is significantly involved in arithmetic skill (Shalev, 2004).

Mathematical learning disorder (Math LD) is defined in DSM-IV as substantially below mathematical ability (calculation and reasoning) when compared to chronological age,

measured literacy and age appropriate education. In early years these children usually present with problems in retrieval of basic arithmetic facts and in computing arithmetic exercises. They specifically show immature counting skills. They also show deficiency in understanding or naming mathematical symbols, clustering objects in to groups, copying numbers and figures correctly. When they grow older (8–10 years) demonstrate severe difficulties in learning arithmetic tables and comprehending algorithms of addition, subtraction, multiplication, and division, difficulties in learning math concepts (such as quantity, place value, and time), difficulty in memorizing math facts, organizing numbers, and understanding how problems are organized on the page. (Shalve 2004; Jensen & Breiger, 2005).

2.6 Primary School Children (PSC)

Entering primary school is one of the main milestones in a child's education. The primary school years are an important phase, as they lay the foundation for the child's learning. During these formative years, it is very important to build every child's confidence and desire to learn, and expose him or her to the different aspects of learning in both academic and non-academic areas, so that the child will have a well-rounded primary education. Primary school year which is a transitional period between early childhood and adolescence is named as elementary school years or middle childhood. This period is responsible for enormous amount of child development. Continuous development in physical, social, emotional and cognitive aspects of the child can be seen during this period. The blend of basic language, awareness, and concepts allows the child to read, write, and communicate which will become more complex and creative with time. Dramatic progress in all developmental areas is noted from one school year to the next school year.

By the age of six years almost 90% of reading skill is developed as the child gained phonemic awareness and letter sound knowledge during preschool period. During the age of seven to ten years children become more fluent and expressive in their reading, and gain full reading potential. It is stated that this stage is a critical one and students whose reading skills are below average at the end of third grade are at risk for school failure in the future.

Writing, like reading, is a complex skill that continues to develop during middle childhood period. Writing which starts from drawing and scribbling in early childhood advanced in to letter writing and proper spelling in middle childhood. By grade two or three most children settle into conventional spelling, where most words are spelled correctly.

Even before formal schooling begins, children have a good knowledge on how counting works. Children learn a lot more about math during elementary school. Their counting become more advanced, throughout the elementary school years, children learn facts about addition, subtraction, multiplication, and division. When they reach age eight they are thorough with most of the basic math concepts (Galotti, 2011).

2.7 PSC – Sri Lankan context

Sri Lanka's education structure is divided into five parts, primary, junior secondary, senior secondary, collegiate and tertiary. Preprimary education which is entirely voluntary has been conducted as private and non-governmental institutions. Education from primary up to the level of collegiate in the government sector is provided free of charge. Primary education lasts five to six years (Grades one to five) and includes children aged five to ten years. Sri Lanka has enrolled nearly all primary aged children in schools leading to net enrolment rate of 96% and primary completion rate of 95% (2006). These achievements reflect several policies like introducing free education and making primary education compulsory by law since 1997. Secondly achievement of universal primary education being the Millennium Development Goal (MDG) by the year of 2015 would have contributed to this. Finally, high demand for education among Sri Lankan parents would have led to higher enrolment rate. (MoE, 2006).

Schools are expected to follow the national curriculum prepared by the NIE. However there is an adequate provision for local variation especially for lower grades. According to accepted national policy, at primary level the key subjects are taught separately while other areas are integrated around environmental studies. Accordingly, Mother tongue, Mathematics, Religion and Environment related activities are identified as key subjects. In addition oral English is promoted through different mechanisms. The span of five years in the primary stage is further divided to three key stages.

Grade one & two – Key stage one

Grade three & four – Key stage two

Grade five - Key stage three

At the key stage one, the mode of learning is primarily play and activities. In key stage two there is a mix of play, activities and desk work. In key stage there is a greater emphasis on desk work. The competencies that each child should attain at the end of each key stage have been identified and grouped in to two categories, the essential learning competencies and desirable learning competencies (MoE, 2004).

2.8 Learning problems among PSC

Some children acquire cognitive difficulty from birth that makes learning more difficult than in normal children. This is the global deficiency in the cognitive, motor, language and social skills development, and this will give rise to "general learning disability", "intellectual disability" or "mental retardation" which is defined according to general intellectual functioning..

DSM IV categorizes intellectual disability based on IQ measurement by a standard IQ test as profound (IQ level<20 or 25), severe (IQ level 20-25 to 35-40), moderate (IQ level 25-40 to 50-55) and mild intellectual disability (IQ level 50-55 to approximately 70). As majority of these children show morphological abnormalities, delay in developmental milestones and problems with communication, speech, feeding and behavior, early detection is done during infancy and early childhood. These children are sent to special schools accordingly. Any way children with mild mental retardation may be sent to normal schools as they move by imitating and modeling normal kids (Kuruppuarachchi, 2008). According to DSM IV any individual whose IQ level 50-55 to 70 by a standard IQ test would fall in to the category of mild mental retardation.

The second category which was defined in literature in early days was children who exhibit slow learning due to borderline intellectual functioning, defined as IQ level 71-84 (DSM IV). This category of children find difficult to cope with most aspects of learning and lag behind the other children. With the advancement of research evidence in the field of LD, the above definition was replaced by the term learning disability (Franklin, 1987). Once the

concept of LD was introduced to the field it included all children whose IQ ranged beyond the level of intellectual impairment to consider the diagnosis of LD.

Children with disabilities and various other handicapped conditions struggle in learning due to their own disability. These children are usually out of regular school and are eligible for special education facilities. Their education programmes are arranged in special schools and special classes in regular schools. These programmes are developed in such a way to facilitate their learning which lags behind due to their handicapped conditions (Piyasena, 2002).

Starting primary school is a huge transition in a young child's life. It is expected that when a child starts primary school, they will be able to understand much of what is said, express themselves clearly, share their feelings and make their needs known. This level of proficiency in speech, language and communication is critical to the development of a child's cognitive, social and emotional well-being (Rose, 2006). Children starting school with speech, language and communication needs (SLCN) may struggle with any aspect of communication and they can become withdrawn or present with challenging behavior within the primary school environment (Hart et al, 2004).

Completing primary school does not ensure that these children have attained basic literacy and numeracy skills. Indeed, there is simple evidence that some of the PSC are not learning these skills despite years of school attendance. They show poor skills especially in reading, writing and mathematics and identified to have LD. Although children who attend regular school would show poor school performance due to several reasons, LD makes the highest contribution. LD is not diagnosable prior to child's engagement with schooling and the opportunity to master key academic competencies. It is when the child's performance consistently falls out of the acceptable range in one or more academic subjects these children are evaluated for LD (Grigorenko, 2008).

2.9 Screening of children with LD

Screening is usually done to shortlist the children with difficulties prior to the detail assessment. A screening process may be needed to determine whether a diagnostic assessment, conducted by a trained specialist, should be provided or not. Screening for

identifying children with LD can be done at preschool as well as at primary school level. Identification of LD at preschool level is not easy as most of the time general performance of these children in non-academic area seem to be normal. However careful observation of child's age appropriate behavior in the specific areas of listening, speaking, motor coordination, attention and concentration would help to suspect learning difficulties at preschool stage (NIMH, 2003). Identification at primary school level is rather easy as assessment in the academic areas can be done.

Following techniques are being used to identify the students with LD.

1. Teacher rating scales or checklists
2. Achievement tests
3. Parent report

It has been reported that teacher rating scales or checklists are the better predictors of learning difficulty than using achievement test scores or parent reports (NIMH, 2003) usually screening checklists and questionnaire list out common learning behavior exhibit by children with LD. Some teacher rating questionnaires are incorporated with parent questionnaire to get more valid results. There are several screening instruments that have been used in research and in the field of special education

The Learning Disability Diagnostic Inventory (LDDI) was developed by Donald D. Hammill and Brian R. Bryant. It is a norm-referenced rating scale designed to help psychologists, diagnosticians, LD specialists, speech-language pathologists, and others who work closely with children to identify intrinsic processing disorders and learning disabilities in students between the ages of 8 – 17 years. The LDDI is composed of six independent scales: Listening, Speaking, Reading, Writing, Mathematics, and Reasoning. Each scale contains 15 easy-to-rate items and can be completed in approximately 20 minutes. LDDI is not an ability or achievement measure, instead, the LDDI states the extent to which students' skill patterns in a particular area (e.g., reading, writing) are consistent with those individuals known to have LD in that area.

The instrument was normed on 2,152 students with Learning Disabilities residing in 43 states and the District of Columbia. Reliability coefficients exceed 0.90 for all scales. In

addition, evidence for stability and iterator reliability is also provided and coefficients are in the 0.80s and .90s. Numerous validity studies were conducted to ensure that the LDDI scores have content-description, criterion-prediction, and construct-identification validity. These studies involved extensive item selection and differentiation examinations, which included confirmatory factor analysis; as well as studies that examined the LDDI's relationship to academic achievement (Hammil, 1998).

The Learning Disability Evaluation Scale- Renormed (LDES-R2) was developed by McCarney (1996) for educators to identify students with learning disability using observations. The purpose of the tool is to provide information contributing to the educational diagnosis of LD. The LDES was designed to provide a norm referenced measure of performance observation by trained professionals (teachers) in the class room. It is a standardized educational assessment tool used with children from ages five to 18 years. The instrument consists of 88 items arranged on seven subscales based on federal government's definition of LD. The items represent behaviours reflecting seven characteristics of LD observed by the educators in the class room environment. The seven subscales representing the characteristics of LD are difficulties in performance in listening, thinking, speaking, reading, writing, spelling and doing mathematical calculation.

LDES was standardized among 6,160 students from 26 estates, representing four major regions of U.S in 1995. The content validity was established through the input and review of educators. The LDES was correlated with Wechsler Intelligent Scale for Children (WISC), the Peabody Individual Achievement test, and the Woodcock Reading mastery test as measures of criterion related concurrent validity. The internal consistency values of the subscales were all above 0.8. Test retest reliability was 0.9 (Mathew, 2001).

The Cognitive Processing Inventory (CPI) has been developed over the past twenty years to assist in the process of non-biased differential diagnosis of learning disabled students. It is based upon a thorough review of current neuropsychological research in addition to formal cognitive assessment of over 2000 students, hundreds of parent and student interviews, and direct behavioral observation of the learning disabled population. The CPI is a non-biased, standardized behavior rating scale which can be completed by parents, teachers and students to evaluate information processing characteristics as part of formal or informal learning style and/or learning disability. The CPI provides scores in the processing

areas of Auditory Processing, Visual Processing, Sequential/Rational Processing, Conceptual/Holistic Processing, Processing Speed, and Executive Functioning. The CPI consists of a two-page, 60-item checklist which includes 10 items pertaining to background information and 50 items which are used to provide scores in the various cognitive processing domains. There are different forms to be completed by parents, teachers and students. Children more than 12 years can be assessed by using self-assessment tool.

An evaluation of test-retest reliability was performed which compared initial and follow-up parent CPI ratings of 150 students at approximate one-year intervals. This suggests an overall stability correlation of approximately .92. Correlations across specific processing areas range from .85 to .92 with overall Global Processing Index (GPI) correlations ranging from .94 to .96 (Crouse, 2012).

2.10 Diagnosis of children with LD

IQ-Achievement Discrepancy

Diagnosis of learning disabilities is often made by educational psychologist, clinical psychologist, psychiatrists and other experts through a combination of IQ testing, academic achievement testing, classroom performance, and social interaction and aptitude. Other areas of assessment may include perception, cognition, memory, attention, and language abilities. The resulting information is used to determine whether a child's academic performance is appropriate with his or her cognitive ability. If a child's cognitive ability is much higher than his or her academic performance, the student is often diagnosed with a learning disability. Though this method has been practicing several years it is currently being replaced by other more appropriate methods (Restori, 2009).

To fulfill this purpose with the initial IQ testing and achievement test should also be carried out. Comprehensive achievement tests can be used to evaluate skills in the primary academic domains such as reading, writing and mathematics. Almost all psychological instruments that assess LD are based on ability-achievement discrepancy. These instruments have been widely used by experts in the field of psychology to diagnose LD. The most commonly used comprehensive achievement tests include the Woodcock-Johnson III (WJ III), Wechsler Individual Achievement Test II (WIAT II), the Wide Range

Achievement Test III (WRAT III), and the Stanford Achievement Test. These tests include measures of many academic domains that are reliable in identifying areas of difficulty (Marcia, 2007). Apart from these, individual batteries have been used to assess difficulties in reading and mathematics. These academic instruments are very comprehensive and need time and expertise to apply. There are teacher rating and parent rating tools that have been used during the diagnosis of LD (Overton, 2000).

- **Response to Intervention (RTI)**

RTI is a treatment oriented diagnostic process that require and educational intervention process. This method composes of early screening of students and placing those students with identified difficulties into a research based intervention programme. Once they are absorbed in to intervention programme their performances are closely monitored to determine whether they need increasingly intense programme to improve their progress. Those who respond will not require further intervention. Those who do not respond adequately to regular classroom instruction (tier I) and to more intensive interventions (tier II) are considered to be "non responders." These students can then be referred for further assistance through special education. RTI design takes considerably longer duration, may take many months to find an appropriate tier of intervention. A strong intervention program is also needed before students are identified as learning disabled. RTI is considered as a regular education initiative and is not usually practiced by clinical specialists (Restori,2009).

2.11 Management of children with LD

Management of a child with LD requires multidisciplinary team work with the participation of the parents, teachers, psychologists and health care professionals. LD affects all individuals associated with the child and impacts the dynamics of family life. Management of the disorder requires guidance for the family by providing necessary information and options available. Parents should be educated about different educational plans that are available to improve their present situation. Training of parents on coping strategies would reduce family stress that encounter when handling a child with LD.

Academic remediation can be delivered through special education services at school. There are different modes of special education services which can be delivered according to the child's level of achievement. The individual child can be placed in a resource room for few hours or throughout the entire class time. They can even be enrolled in a special school if these facilities are available. Provision of an individual education plan (IEP) which sets goals for improving specific skills of the difficult child is another option. The plan may include a *specifically designed curriculum, special instructional methods and evaluation* methods in order to improve identified difficulties at individual level. Educational therapy is another intervention that could minimize long term effects of LD.

Accommodation to the learning environment is a helpful addition that enables the child to overcome LD. Depending on the individual need these may include quiet environment, preferential seating arrangements, classroom assistants as note takers and readers and special equipment used as spell checkers and computer based activities.

Mental health services play an important role in managing children with LD. These services may range from counseling services to prescription of medications. Medications are recommended when there is a comorbid condition like Attention Deficit Hyperactive Disorder (ADHD) or oppositional defiant disorder or severe anxiety problems. Counseling services may be needed when handling children with learning disorders with comorbid condition like frustration, anxiety related to school performance, poor peer relationship and depression. The mental health professional who works with the child needs to coordinate well with the family and school to address the issues in a holistic manner (Susan, 2006).

2.12 Prevalence of LD

Estimates of the prevalence of LD range from 2% to 10% depending on the way that determine the disease and the definitions applied (APA, 1994). It has been reported that 30-50% of US population has undiagnosed learning difficulty. 2.9 million school-age children (ages 6 through 21) in the U.S. (5% of all school-aged children in public schools) are classified as having specific learning disabilities (SLD) and receive some kind of special education support (Kenyon, 2003).

The National Health Interview Survey (NHIS) is an ongoing annual survey, conducted by the Centers for Disease Control and Prevention (CDC) that uses a multistage probability sample to estimate the prevalence of a number of health conditions in population of the United States. Children from age 3 to 17 were included in the study. During the interview parents were asked whether any school health professional has ever told that particular child is having a learning difficulty. By analyzing these data for all developmental disorders, it was found that prevalence of learning disability from 1997 to 2008 was 7.66% and it was the highest compared to all developmental disorders. Prevalence was significantly high among the age group 11-17 years (9.27%) compared to 3-10 years (5.07%). Although there was a difference between maternal education less than high school (8.05%) compared to High school (7.50%) or college graduate (4.85%) and poverty level <200% (8.57%) compared to ≥200% (6.03%) it as not significant. When the age group of 11-17 years is considered significantly higher ($p<.05$) proportion of boys had LD (8.97%) compared to girls (5.01%) (Boyle et al, 2008).

Historically, LD has been diagnosed up to two times more in boys than in girls. However the recent research evidence shows that prevalence rates among boys and girls are more or less similar than once thought (Encyclopedia of Neurological Science, 2005). Jensen & Breiger (2005) stated that the higher prevalence rates among boys were due to referral bias towards boys that led to increased diagnosis as they are presented with comorbid more disruptive externalizing behavior while girls are presented with internalizing behavioral problems.

Altarac (2007) assessed the life time prevalence of LD among US children using data of National Survey of Children's Health (NSCH). The data on diagnosis of LD by school health professionals from parent interviews was used to assess the prevalence. Life time prevalence of LD was 9.7%. Significantly ($p<.001$) higher proportion of LD was found among boys (12.2%) compared to girls (7.1%). At the same time there was a significant difference ($p<.001$) among the groups highest education in the household less than high school (13.4%), high school (12.3%) and more than high school(8.3%). It also differ significantly ($p<.001$) between the groups of poverty <100% (14.8%) and >100% (68.1%).

According to Statistics Canada, more children have a learning disability than all other types of disabilities combined. Out of all children with disabilities, more than half (59.8%) have a

learning disability. It has been reported that 3.2% of Canadian children have a learning disability. LD increased considerably between 2001 and 2006 among Canadians aged 15 and over by almost 40 per cent (PALS, 2006).

In India it has been estimated that about 12.5 million children with disabilities are to be provided education in the school system. Out of which 3.6 million are children with learning disabilities in the age group of 5-14. It has been reported that 13-14 per cent of Indian school children are learning disabled. (Sakhuja, 2004).

A multi-staged stratified randomized cluster sampling study was conducted among children aged 8–11 years from third and fourth standard in a South Indian city. A six level screening approach that commenced with identification of scholastic backwardness followed by stepwise exclusion of impaired vision and hearing, chronic medical conditions and subnormal intelligence was carried out among these children. In the final step, the remaining children were subjected to specific tests for reading comprehension, writing and mathematical calculation. It was found that the prevalence of specific learning disabilities was 15.17%, whereas 12.5%, 11.2% and 10.5% had dysgraphia, dyslexia and dyscalculia respectively (Mogasale et al, 2012).

A cross sectional study was conducted in a sample of primary school students from the first to the 6th grade in public elementary schools (n=423) in Jakarta, Indonesia to assess the prevalence of learning difficulties. The sample was obtained by proportional random sampling from 27 primary schools. Children with learning difficulty were defined as children with a discrepancy between their intellectual functioning and academic achievement which could not be explained otherwise by physical or sensory impairments. Children who had below average academic achievement compared to their classmate's average academic achievement (based on their last semester report card which showed the average academic class achievement) was obtained. It was found that 13.7% of children (n=58) had learning difficulty. The mean age of students with a learning difficulty was 9.58 (Wiguna et al, 2012).

A study was conducted to investigate prevalence rate of learning disabilities (LD) in Chinese children. One thousand and one hundred fifty one children were randomly selected from primary schools. The study instruments included PRS (The pupil rating scale

revised screening for learning disabilities). According to criteria set by ICD-10, 118 children diagnosed as LD were classified into the study group. The prevalence rate of LD in Chinese children was found as 10.3% (Yao and Wu, 2003).

It is worth to note that most of the research in the field of LD has been conducted with reading and there is little established evidence on writing and mathematics. Reading disorder (RD) is the most common form of LD accounting for 50% to 80% of all diagnosed LDs. Prevalence in DSM IV is estimated at three to ten percent of the population with a male to female ratio of approximately 4:1. However other studies suggest that the prevalence rate is closer to 17% to 20% with a more equal rate between girls and boys (Jensen, 2005). In another study it was found that RD was the commonest accounting for 80% to 90% of all LD (Molfese, 2006)

The prevalence of mathematical learning difficulty (MLD) has been estimated to be five to six percent among school aged children. No consistent evidence of gender difference in math achievement has been found (Jensen & Breiger 2005).

On the basis of several population-based prospective studies and many smaller-scale studies, 7% of children and adolescents have been diagnosed as MLD in at least one area of mathematics before graduating from high school, and an additional 10% of children and adolescents have been identified as low achievers in mathematics. An analysis of 340,000 eleven year old children between 1998 and 2007 identified that 5% to 7% of children in each academic year was three to four grade levels behind in mathematics compared to other children (Geary, 2010).

Most children with learning difficulty have difficulty in at least one aspect of writing namely, hand writing, spelling, content or form. Epidemiological data on prevalence of written language are lacking, it is estimated that writing difficulty is likely to affect 15% to 25% of school aged children (Jensen & Breiger 2005). Lyon (1996) estimated that 8% to 15% of school children have writing disorders. Most of these disorders overlap to produce a child with LDs.

In a study done in Child Psychiatry and Guidance Clinic (CPGC) at Lady Ridgeway Hospital (LRH) among already diagnosed children with LD, it was found that 70% of

children had difficulties in reading, 60% mathematics and 55% writing (Wijerathne et al, 2003).

2.13 Behavioural comorbidities of LD

Children with LD perform poorly during day to day curriculum related activities and they always lag behind their peers during the performance evaluation. This will create a feeling of anxiety, inadequacy and shame leading to behavioral disturbances. Therefore children and adolescents with LD often have behavioral problems as comorbid conditions (Johnson, 2004).

Behavioral problems in children can be classified in to two major domains of dysfunction, externalizing and internalizing behaviors (Achenbach & Eldebrock, 1978). The externalizing behaviors are marked by defiance, impulsivity, hyperactivity, aggression and antisocial features while the internalizing behaviors are evidenced by withdrawal, depression and anxiety. Several studies have been consistently shown a significant association between learning disabilities and behavioral problems (Rutter, 1974; Willcutt &Pennington, 2000).

Several population surveys had found that the prevalence of comorbid behavioral problems among learning disabled children was between 24% to 54% (Mc Gee et al, 1984; Schachter, 1991). Jorm (1986) did a follow up among 453 Australian children during the first three years of schooling and found that children with reading difficulty having more behavioral problems at school entry.

In a retrospective study at Child and Adolescent unit at National Institute of Mental Health and Neurosciences, Bangalore; it was found that 79% of children with learning disabilities had comorbid psychological disorders, in which 32% had internalizing disorders, 28% had externalizing disorders and 19% had other disorders Muthukumar et al (1999).

Dilshad (2006) found that the proportion of emotional problems (internalizing and externalizing) among children with LD was higher compared to children without LD.

A study was conducted from the data derived from a national survey of child mental health by the UK Office for National Statistics in 1999. The sample was selected to be representative of the UK population of children aged 5 to 15 years in England, Scotland, and Wales. Specific learning difficulties were measured by using specific scales and emotional and behavioural problems were collected through parent and teacher ratings on the Strengths and Difficulties Questionnaire (SDQ). These showed significant associations between the presence of learning difficulties and scores on all of the SDQ sub-scales hyperactivity (OR= 3.82, CI=2.37- 6.14), conduct disorder (OR=2.40, CI=1.63-3.52) and emotional problems (OR= 2.74, CI= 1.75-4.28) except parent and teacher ratings of prosocial behaviour (Caroll et al 2004).

A study was conducted to determine the causal nature of co-occurring reading and behavior problems. Children with reading difficulty at first grade were assessed for behavioural problems at third grade and the children who exhibit behavioural problems in first grade were assessed for learning problems at third grade. Multilevel logistic regression modeling was used to analyze data from the Early Childhood Longitudinal Study–Kindergarten Class (ECLS-K). After statistically controlling for a wide range of potential confounds, they found that children with reading problems in first grade were significantly more likely to display poor task engagement, poor self-control (OR=1.33, $p<.05$), externalizing behavior problems (OR=1.39,$p<.05$), and internalizing behavior problems (OR=1.66, $p<.001$) in third grade. They also found that children displaying poor task engagement in first grade were more likely to experience reading problems in third grade (OR=2.17, $p<.001$) (Morgan et al, 2008).

Rutter (1976) found that around one quarter of children with reading disability showed antisocial behavior. He also noted that higher rates of externalizing behaviors such as conduct disorders, restlessness, and poor concentration and over activity among retarded readers in the middle childhood.

Proportion of comorbid ADHD in learning disabled children would vary from 10% to as high as 60% depending on the specific sample examined (Halperin et al 1984; Holborrow &Berry, 1986).

In a study conducted on diagnosed LD children in Lady Ridgeway Hospital, it was found that, out of all children 60% had symptoms suggestive of ADHD (Wijerathne et al 2003). Kariyawasam et al (2002) found that learning disorder was a common neuropsychiatric manifestation among children diagnosed to have ADHD.

Mc Gee et al (1986), in his study among New Zealand children found that externalizing behavioural problems were three times higher among boys with RD compared to boys without learning disability. And also found that ADHD, conduct disorders (CD) and oppositional defiant disorders (ODD) were the leading problems among these children.

Stein and Hoover (1989) conducted a comparison study between children with and without LD to assess the level of anxiety. It was found that children with LD had a higher total anxiety score compared to non LD children. Children with dyscalculia were found to be socially withdrawn while children with reading difficulty were found to have anxious-withdrawn behaviour.

Thirty percent of children with dyscalculia had phobic or anxious behaviour while 24% of children with both writing and math difficulties had phobic or anxious behaviour (Prior, 1999).

Kashani (1982) found that co- occurrence of major depressive disorder (MDD) was three times higher among children with LD compared to children without learning disability. In his follow up study among children aged nine to 12 years, the proportion of MDD was 62% among LD children while it was only 22% among non LD children.

Nelson et al (2010) reported the results of a meta-analysis of the empirical literature on anxiety among school- aged students with LD compared to their non-LD peers. Fifty-eight studies met inclusion criteria and a total of 3,336 students with LD were included in the studies. Results indicated that students with LD had higher mean scores on measures of anxiety than the non-LD students. The overall effect size was statistically significant ($p<.001$) and medium in magnitude ($d=.61$). This finding indicated that approximately 70% of students with LD experience higher anxious symptoms than the non-LD students. The results of meta-analysis confirmed the common assumption that students with LD experience higher anxiety symptoms than their non-LD peers.

2.14 Risk factors of LD

There is a consensus in the field that LD arises from intrinsic factors and has neurobiological bases, specifically atypical brain maturation and function. Any insult that affects the developing brain would produce this condition and there are substantial numbers of literature to prove this consensus (Grigeronko, 2008). Maternal and perinatal factors have a great contribution in this regard. With emerging evidences, indices like social and psychosocial stressors were also taken in to account (Aagard, 1986). Psychosocial deprivation such as poor nutrition and housing, lack of psychosocial stimulation, abuse and neglect are some of the factors that have been considered as risk factors (Eapen, 1998). It is aware that these extrinsic risk factors affect pattern of brain development and function and correspondingly, might worsen the prognosis of biological predisposition for LD or act as a trigger in LD manifestation. Therefore biological as well as socio economic and environmental risk factors should be studied during the assessment of risk factors for LD (Grigeronko, 2008). The risk factors for LD can be classified as follows.

2.14.1. Demographic and socioeconomic factors

- **Sex of the child**

There is a gender difference with more boys being learning disabled (Coutinho & Oswald, 2005) than girls. Corrigan (1996) has done a case control study to assess predictive value of preschool surveillance in detecting learning difficulties. The study population was children born between 1st of July 1983 and 30th June 1983. The sample was drawn when these children were 7 to 8 years to ensure minimum 2 years of primary school education in order to facilitate detection of significant learning difficulties by their teachers. Cases were the group of children named by the teachers to have mild to moderate learning difficulty and controls were age and sex matched group of children from the same class felt by the teachers not to have such difficulties. It was found that male sex (OR 1.6; 95% CI=1.3-2.0) is a risk factors when predicting LD from preschool surveillance data.

Jennifer et al (2001) who studied the boy/girl difference in risk for RD found that male children had 2.5 times higher risk for RD compared to girls. In the study conducted among diagnosed children of LD at LRH, Wijerathne et al (2003) found that 85% of LD children were boys.

Among 122 children (80 boys, 42 girls) who showed behavioral markers of dyslexia in family genetics studies, the gender difference in mean level of reading and writing was examined. During the assessment of gender difference in severity of writing and reading disabilities it was found that boys were more impaired in writing skills as well as accuracy and rate of reading compared to girls (Berninger, 2007).

- **Parental education**

Altarac (2007) in his study to assess life time prevalence of LD in US children found that parental education <high school ((OR 1.4; 95% CI=1.13-1.8) and high school (OR 1.37; 95% CI=1.21-1.55) were significant predictors of LD (compared to high school).

Having parents with higher level of education positively influenced the academic performance (Chulasiri, 2010). Samarasinghe (1989) reported that 32% of overseas workers children had poor academic performance.

It was found that maternal (p=.001) and paternal (p=.001) education less than 12 years was significantly associated with RD among school children.

- **Poverty**

Altarac (2007) reported that poverty <100% (poverty was expressed as a percentage of federal poverty level) (OR 1.88, 95% CI: 1.55-2.29) and highest education in the house hold less than high school (OR1.42, 95% CI: 1.13-1.80) was significantly associated with life time prevalence of LD.

Research has consistently shown that poverty affects child development independent of other factors related to poverty and that family income is a powerful predictor of academic achievement regardless of other factors (McLoyd, 1998). Not only does the duration of poverty affect children, the age at which a child first experiences poverty also influences the child's academic difficulties. Poverty at a young age especially during first five years of life inhibits school-readiness skills and lead to later academic failure (McLoyd, 1998).

Corrigan (1996) found that lower social class (social class iv and above) (OR 3.9) is a risk factor when predicting LD from preschool surveillance data.

2.14.2 Maternal and perinatal factors

When human neurological development is considered, the perinatal period has been shown to be very important and crucial. Complications during the perinatal period exist in as many as 8% of live births (Behrman, 1981). These complications, which can occur during pregnancy, labor, delivery, and the neonatal period, have been shown to place the child at risk for future developmental abnormalities such as LD (Kopp and Parmelee, 1979). Further, it was noted that advance in medical technology has led to the reduction in perinatal mortality and proportionately survival rate of infants with adverse perinatal outcome has increased. This has led to a stage where more children are surviving with neurodevelopmental disorders including learning and other developmental disorders (Rosetti, 1986).

i. Factors related to antenatal period

- **Maternal age**

It has been reported consistently that teenage pregnancy negatively affect long term cognitive and learning (Kinard, 1987). Ralitza (2001) reported that after controlling the confounding effect of low maternal education and poor socioeconomic status, effect of teenage pregnancy on LD disappeared (OR 0.69, 95%CI=.56-.85) and effect of high maternal age (>36 yrs.) was increased (OR=1.2; 95%CI= 0.96-1.5). It was found that mothers under the age of 17 are more likely than older mothers to have children that fall in the impaired range on preschool intellectual assessments and suffer from learning problems (Broman, 1978).

- **Maternal education, marital status and prenatal care**

Chapman (2001) investigated birth risk factors for school identified LD by using a retrospective cohort study. Sample consisted of (n=244,619) 6 to 8 years children from public schools in Florida. There were 6715 children with LD. Independent variables were obtained from birth certificates records which included child and family information at birth, maternal medical history, age at delivery, education and marital status, prenatal care, tobacco and alcohol use. It was found that low maternal education (RR= 1.8, 95% CI= 1.7-1.9) and late or no prenatal care (RR= 1.5, 95% CI= 1.4-1.6) were significantly associated with LD.

Hill et al (1998) found that high pre pregnancy weight (RR 2.7), stress during pregnancy(RR 2.8) are some of the indicators in maternal perinatal scale that was significantly associated with long term learning educational disability in off springs.

Corrigon (1996) used perinatal data, secondary data obtained during child health survey. After logistic regression it was found born to an unmarried mother (OR= 0.6) were significantly associated with LD (Corrigon, 1996).

- **Smoking**

Hill et al (1998) found that cigarette smoking (RR 2.8) and medication use (RR.1.7) were significantly associated with long term learning educational disability in off springs.

Chapman et al (1996) found that tobacco use (RR=1.5, 95% CI= 1.4-1.6) was significantly associated with LD.

- **Alcohol exposure**

A study was conducted to assess the relationships between the dose, pattern, and timing of prenatal alcohol exposure and achievement in reading, writing, spelling, and numeracy in children aged 8 to 9 years. Midwives' Notification System and the Western Australian Literacy and Numeracy Assessment statewide education testing program were used to extract relevant data. The records for 86% (n = 4056) of the cohort were successfully linked with education records when the children were aged 8 to 9 years. It was found that Children were twice as likely not to achieve the benchmark for reading after heavy prenatal alcohol exposure during the first trimester (OR 2.26; 95% CI 1.10–4.65) and for writing when exposed to occasional binge drinking in late pregnancy (OR 2.35; 95% CI 1.04–5.43).

ii. Factors related to delivery and neonatal period

- **Presentation during delivery**

Infants presenting in the breech position during labor have been shown to have learning difficulties requiring treatment later in life (Muller *et al.*, 1971).

The influence of delivery in breech presentation on the occurrence of minimal brain dysfunction (MBD) defined as hyperkinesia and learning disability was studied. Parents of

8--15 year old children were asked to account for behavioral and educational deficits and needs of their children from birth until the date of investigation. The average frequency of hyperkinesia and learning disability was 8%. Among children born in breech presentation it was 14 per cent, while in those born in vertex presentation the corresponding figure was 2 per cent (Fianu, & Joelsson 1979).

- **Hypoxia**

Hill et al (1998) stated that hypoxia during delivery (RR 1.7) was significantly associated with long term learning educational disability in off springs.

Chapman et al (2001) found that hypoxia during labor and delivery measured by low 5min Apgar <3 (RR= 2.2, 95% CI= 1.5-3.4) was significantly associated with LD.

- **Birth weight**

Children with very low birth weight and very premature birth find difficulty in learning during the school age (Lynn et al, 2011).

A study was conducted to examine the achievement and neuropsychological outcomes at a mean age of 11 years in children who born with low birth weight (VLBW, < 1,500 g) compared with a term-born control group. The sample included 68 children with birth weight <750g born between 1st July 1982 and 31st December 1986. Next group included 65 children with a weight of 750g-1499g and 61 term controls with >1500g. These groups were matched by sex, age (born within six month period), ethnicity and socioeconomic status. During follow up children with low average IQ (<80), with sensory or neurological disorders were excluded in order to examine specific LD. The study examined the outcomes at a follow-up assessment at a mean age of 11 years by means of IQ achievement discrepancy. The < 750 g group obtained lower scores in math, IQ, and perceptual–organizational skills than the term-born group. Logistic regression revealed that the rate of any LD (Math/ Reading) was higher in the <750g group than in control, (OR= 5.43, 95% CI = 1.43- 20.67, p<.05) (Litt, 2005).

Children (N = 1868) in four birth weight categories [extremely low birth weight (ELBW; weighed < or = 1000 g at birth, n = 247), very low birth weight (VLBW; 1001 - 1500 g, n = 364) and low birth weight (LBW; 1501 through 2500 g, n = 724), and normal birth weight (NBW > 2500 g, n = 533)] were compared on indicators of school achievement. It was

found that ELBW children exhibited a fivefold (OR 5.56) risk of being classed as disabled in learning than those born at normal weight. VLBW children had a threefold risk, and LBW had had a risk of 1.53. ELBW children score lower than all other birth weight groups on math and reading achievement tests. Even among children with IQ scores above 85, ELBW children still obtain lower math scores than NBW children, suggesting the potential for future educational needs (Klebanov, 1994).

A population based cohort study was conducted to assess the relationship between birth weight and school aged disabilities. The participants in this study represented a population-based cohort of Florida children who were born between 1982 and 1984 and who were receiving a public school education in 1996–1997. Linkage methodology was used to establish a cohort of 267,213 children aged 12–15 years with both birth certificate and school records. Birth weights were stratified. Some sort of school problems were reported in 17% of population. Out of this, majority, 56% had LD. It was found that LBW (1500g-2500g) is a significant predictor for LD (RR= 1.36, 95% CI; 1.25-1.5) (Avchen, 2001).

Chapman et al (2001) found that VLBW (Very Low Birth Weight) (RR=2.5, 95%CI= 2, 1-3, 0) was significantly associated with LD.

- **Gestational age**

Survival rates are increasing for children born extremely preterm, although the majority of these children have IQ scores within the average range, 50-70% of these children have later school difficulties (Lynn, 2011).

It is estimated that children born prematurely exhibit a 50% increased probability of requiring special education when compared with children born full-term. Specific learning disabilities are one of such primary causes of special education needs (de Rodrigues et al, 2006).

A longitudinal study was done between mildly pre-term children and full-term children, a higher-than-expected proportion of learning disabilities were found among pre-term children (Julkowski, 1998).

A case control study was conducted among children (n=408) with mild to moderate learning difficulties born between 1st of July 1983 and 30th of June 1984 and resident in

North and West Belfast, Poland. Selection of cases was done after two years of primary schooling to facilitate detection of significant learning difficulties by their teachers. The controls were the children attending the same schools, within the same age range, and felt by their teachers not to have significant learning difficulties. Univariate and multivariate analysis of perinatal and preschool variables derived from Child Health Survey (CHS) reports was done. After multiple logistic regression it was found that prematurity less than 35 weeks (OR 3.0, 95%CI=1.4-5.5) was significantly associated with LD (Corrigon, 1996).

- **Neonatal sepsis**

Several clinical neonatal factors including neonatal sepsis and length of time on oxygen were associated with lower mean scores in all areas of academic achievement or specifically mathematics (de Rodrigues et al, 2006).

- **Neonatal encephalopathy**

A comparative study was done between children who had had neonatal encephalopathy associated with birth asphyxia as term infants (n=145) and a peer group of 155 children. Identified clinical categories of encephalopathy for the neonates were 56 mild (hyper alertness, hyper excitability), 84 moderate (lethargy, hypotonia, suppressed primitive reflexes), and 5 severe (stupor, flaccidity, absent primitive reflexes). School performance was assessed at the age of 8 years. Grade level intellectual, visual-motor integration, receptive vocabulary scores, as well as reading, spelling, and arithmetic scores for those with moderate or severe encephalopathy were significantly below ($p<0.05$) than those in the mild encephalopathy or peer comparison groups. Non impaired survivors of moderate encephalopathy were more likely to be more than one grade level delayed than were children from the peer group (reading 35% vs 15%, spelling 18% vs 8%, and arithmetic 20% vs 12%, $p < 0.01$) (Robertson, 1989).

- **NICU care**

Children (n= 9943) born between 1980 and 1987 and had stayed in Neonatal Intensive Care Unit (NICU) were located in Florida elementary schools (kindergarten through third grade) during academic year 1992–1993. Educational disability was operationalized as placement into eight mutually exclusive types of Special Education (SE) classifications including Specific Learning Difficulty (SLD). It was found that presence of a medical condition was significantly associated with SLD (OR; 1.28, 95% CI; 1.03-1.59) (Resnick et al, 1998).

2.14.3 Infancy related factors (Post neonatal)

- **Meningitis**

A case–control study was conducted in England and Wales among 461 teenagers who had bacterial meningitis in infancy and 289 matched controls. Cases and controls were recruited at the age of 5. Comparison of index cases and controls in outcome measures such as type of school attended; number of General Certificate examinations attempted; the number of examinations passed (grades A*–C) and achievement in five key subjects was done at the age of 16 years. During their secondary education 56 (12.1%) index cases, including all those in special schools, and 10 (3.5%) controls had been identified as children with special educational needs ($\chi^2=16.7$; $p<0.0001$; OR=3.9; 95% CI 1.9 to 7.7). Highly significant difference in the mean number of examinations taken by index cases (mean (SD) 8.43 (3.5); n=385) compared to controls was found (mean (SD) 9.20 (2.1); n=232) (p=0.0002). When pupils from all schools were considered, more index cases (117/461 (25.4%)) than controls (19/289 (6.6%)) failed to gain any GCE passes at grade C or above (χ^2 = 42.3; $p<0.0001$; OR=4.8; 95% CI 2.9 to 8.0). The proportion of index cases attending comprehensive schools who failed to achieve five passes at grade C or above (184/385 (47.8%)) is significantly higher than that for controls (59/232 (25.4%)) ($p<0.0001$; OR=2.7; 95% CI 1.9 to 3.8) (Louvois, 2006).

- **Anesthesia exposure**

Association between general anesthetic exposure before age 4 years and the development of learning disabilities (LD) was assessed in a population-based cohort consisting of children born in Olmstead County, MN, between 1976 and 1982. Using educational records children were classified as having LD (>1.75 SD below the predicted standard score) in reading, written language, or math. The children's academic records were followed until a diagnosis of LD was made. Study revealed a dose-response relationship between anesthesia exposure before age 4 and LD, but a cause-and-effect relationship as not proven (Wilder et al, 2009).

It was found that exposure to general anesthesia during infancy was significantly associated with LD at age 12 compared to peer who had never been exposed to anesthesia (OR; 4.5, 95% CI, 1.44–14.1) (Bong, 2013).

2.14.4 Developmental factors

When assessing learning difficulties during the kindergarten age, inquiry on developmental milestone was as important as perinatal factors. It has been reported in several studies the delay in some of the developmental milestones were highly associated with LD during school age. Clumsiness, coordination difficulties, delayed establishment of laterality (confusion in handedness), delayed speech, articulation disorders and delayed motor development are highly suggestive that the child will eventually experience LD (Ferinden, 1972).

- **Gross motor development**

During comparison of case histories of 1000 children exhibiting LD, Hoffman (1971) reported that late or abnormal creeping(50%), late walking (26%), prolonged tiptoe walking(14%), late or abnormal speech (70%) and ambidexterity after age seven (33%) were the abnormalities occurring most frequently in the early developmental period.

In a study which included a representative sample of 5,362 children born in the United Kingdom in 1946 found that delay in infant developmental milestones was significantly associated with future LD. Developmental data were obtained at age 2 in the National Survey of Health and Development, Data on intellectual function and educational attainment at ages 8, 26, and 53 years were also obtained. Regression analysis found that the associations between age at first standing and talking and IQ at age 8 remained statistically significant (standing: $p = 0.02$, speech: $p = 0.001$). The associations between speech development and reading comprehension at age 26 ($p = 0.005$) and verbal fluency at age 53 ($p = 0.017$) also remained significant (Murray et al, 2006).

- **Speech and language development**

Corrigan et al found that speech delay (OR 3.3) was significantly associated with LD after multiple logistic regressions (Corrigan, 1996).

It was reported that specific learning difficulties associated with early speech and language impairment included difficulties with spelling (Holm, 2008), reading comprehension and accuracy (Fletcher, 2004), writing (Sices, 2007) and mathematical calculation (Fazio, 1999).

A prospective cohort study was conducted among a nationally representative sample of 3632 children to examine the predictive ability of early speech and language impairment on children's achievement and performance at school. These children were followed up from early childhood through to primary school, using data from the Longitudinal Study of Australian Children (LSAC). Independent variables were parent-rated expressive language concern; parent-rated receptive language concern and use of speech language pathology services around 4 to 5 years. Outcomes were assessed at the age of 6 to 7 years by teachers' ratings of language/literacy ability, numeracy/mathematical thinking and approaches to learning. Comparison of means and Analyses of Variance (ANOVA, $p<.05$) tests were used to examine differences in achievement measures (6–7 years) for children identified at aged 4–5 years as having or not having speech and language impairment. ANOVA, provided clear evidence that children who were identified as having speech and language impairment in their early childhood years did not perform as well at school, two years later, as their non-impaired peers on all three outcomes (Harrison et al, 2009).

2.14.5 Early childhood related factors

- **Children with special health care need**

General health condition of the child specially during infancy and early childhood has a greater impact on LD. Children with chronic diseases are at major risk of subsequent learning difficulties due to the condition itself, treatment prescribed and frequent absence because of illness (Oberklaid, 1984).

Altarac (2007) defined children with special health care need (CSHCN) according to Maternal and Child Health Bureau criteria in USA. The screening questions were grouped on five definitional criteria for CSHCN; prescription medication use, above average service use, functional limitation, use of mental health services, and use or need of specialized therapies. Life time prevalence of LD was found to be significantly associated with single criteria (OR 2.97), two criteria (OR 5.64), three criteria (OR 9.53), four (OR 24.57) and all five criteria (OR 75.0) after multiple logistic regression.

Recurrent hospitalization due to frequent spells of illnesses, failure to thrive or poor nutrition during early childhood were also associated with LD during school age.(Jorgen, 1986).

- **Recurrent otitis media**

Corrigan et al (1996) found that otitis media with effusion during early childhood was a risk factor for LD (OR1.4). Several retrospective studies reported a significant association between early middle ear effusion and reading problem, lower general academic performance, learning disabilities, need for special education services and mathematical difficulties.

- **Epilepsy**

Fastenau et al (2008) assessed rates of learning disabilities (LD) by several psychometric definitions in children with epilepsy and identified risk factors. Participants (N = 173, ages 8–15 years) completed IQ screening and academic achievement testing and structured interviews. A significant association was found between Math LD and absence seizure (OR; 1.96, 95% CI; 0.57- 6.67), partial without generalization (OR; 5.56, 95% CI; 1.64-20.00) and partial with generalization (OR; 3.85, 95% CI; 1.02- 14.29) compared to children with generalized seizure. He further stated that age of seizure onset was a risk factor for reading and math LD. Out of all LD, writing was the most common domain affected in majority of children with epilepsy.

- **Sleep disorders**

Corrrigan (1996) reported that enuresis (OR 2.4) during early childhood was significantly associated with LD after controlling for confounding factors.

There are evidence that sleep disordered breathing has an impacts on school performance Gozal et al assessed the association between frequent loud snoring in the pre-school years and school performance at 7th and 8th grade. This was significantly among children in the bottom 25th centile compared to matched peers who were in the top 25th centile for school performance (Gozal & Pope, 2001).

A case control study was conducted to assess effect of mouth breathing on LD. Cases were (n=48) children indented to have school failure for two consecutive due to LD and controls were (n=24) children with normal learning. The children were submitted to ENT

examination and found that students with learning disabilities have a higher prevalence of pharyngeal tonsil hypertrophy: $p < 0.001$, and palatine tonsil hypertrophy: $p < 0.001$. children with adenotonsillar hypertrophy have more learning difficulties when compared to children without such problem (Fensterseifer et al, 2013).

In a study of 1,129 children in whom information on snoring was available, 410 (36.3%) never snored, 605 (53.6%) snored occasionally, 89 (7.9%) snored frequently and 25 (2.2%) children always snored. The "always snorers" had poorer academic performance in mathematics (OR: 3.6, 95% CI: 1.3-10.1), and spelling (OR: 3.5, 95% CI: 1.2-10.3). "Frequent snorers" also had poorer academic performance in mathematics (OR: 2.4, 95% CI: 1.3-4.7) and spelling (OR: 2.0, 95% CI: 1.04-3.8) (Urschitz et al, 2003).

- **Anesthesia exposure**

A retrospective study was conducted to assess the anesthesia exposure before the age of 4 years and later LD. Educational records were used to identify children classified as having LD (reading, written language, or math).All children who had anesthesia exposure before the age of 4 was identified and frequency and age of anesthesia exposure were recorded. From the total cohort 5,357, 593 received general anesthetics before age 4 (449 once, 100 twice, and 44 three or more times) and 4,464 were not exposed to anesthetics. The cumulative incidence of LD before age 19 in all cohorts was 20.5%; the incidence was 20% in children with no exposure. It was 20.4% with one exposure, and 35.1% with multiple exposures. A single exposure to anesthesia was not associated with an increased risk of LD. The hazard ratio for LD was 1.59 among children receiving two anesthetics and 2.6 among those receiving three or more. The risk for LD increased with longer cumulative duration of anesthesia exposure (Wilder, 2009).

Sprung (2009) found that Children exposed to general or regional anesthesia during cesarean delivery are not more likely to develop LD compared to children delivered vaginally, suggesting that brief perinatal exposure to anesthetic drugs does not adversely affect long-term neurodevelopmental outcomes. The risk of LD may be lower in children delivered by CD whose mothers received regional anesthesia.

- Early childhood life event

Stressful life events during early childhood like parents death, unemployment, divorce, change of residence, child care service contact, frequent hospitalization of child or parent, marital disharmony among parents, would lead to academic skill deficiency during school age (Jorgen, 1986).

2.14.6. Family related factors

- **Family history of LD**

Recent research has confirmed that dyslexia has a hereditary basis (Cardon, 1994; Fisher, 1999). The first prospective study of children at family risk of dyslexia was reported by Scarborough (1990) who followed the progress of 30 two year old children from families with a history of reading disability during the early school years comparing them with children from families of similar socio-economic backgrounds who did not report a positive history of dyslexia. At 8 years, 65 per cent of the high-risk sample (20 children) was classified as reading-disabled.

Snowling et al (2003) studied the development of 56 children at family risk of dyslexia. The children with and without family risk of dyslexia were followed up from the age of three years to eight years. It was noted that in exposed group, 66% had reading disabilities at 8 years compared to 13% in the non-exposed group from similar, middle class backgrounds.

- **Family structure and functioning**

Family functioning is a critical component of children's wellbeing and development and it was reported poorer family functioning was found in families that have children with LD. Altarac (2007) found that two parent step family structure (OR1.32), adopted children (OR 1.54), poor parent child relationship measured by not sharing ideas with the child (OR 1.38) and aggravation in parenting scale (OR 1.32) were family risk factors for LD.

The parents estimated that one-third (33.4%) of the internationally adopted children had some, and 12.7% had severe learning difficulties, i.e. three and six times more than in normal population, respectively. Reactive attachment disorder symptoms at the time of

adoption were associated with learning difficulties at school age (OR 4.57, 95% CI 2.57–8.13) (Ref).

Several studies reveal that directly or indirectly, birth order and family size can be indicators of academic achievement in children. Esping (2003) stated that children from larger families obtained lower scores on measures of intelligence as well as educational measures, even when measures of social class were controlled.

2.14.7. Factors related to home physical environment

Home environment plays a major role in deciding children's learning. Environment can be classified in to physical and psychosocial. Positive stimulation and better learning opportunities since early childhood would minimize LD to a greater extent. Werner (1948) explained that environmental causalities ranked at a higher level in predicting LD compared to reproductive causalities. He noted that deprived environment like institutionalization affect academic achievement ten times more common than perinatal factors.

A significant association was observed between current intimate partner violence and their children performing poorly at examinations obtaining less than 40% marks (Jayasinghe, 2007). Dissanayake (2006) found that household possessions and problems at home negatively influenced academic performance.

Chronic stressors that influence poor children's development often include poor housing conditions such as overcrowding and poor and dangerous neighborhoods. These individuals are also exposed to life-threatening environmental stressors such as violence, drugs, homelessness, and negative role models (McLoyd, 1998).

Apart from psychosocial environment, physical environment also plays a major role in deciding children's developmental problems including LD. Exposure of developing brain to chemicals and toxins in the environment can lead to various problems like LD and ADHD. Research evidences are available to show exposure of the father to various chemical compounds during the 65 days prior to conception (the time required to complete sperm development in the testicles) can increase the risk symptoms common in learning

disability students. Exposure to pesticides, smoking, alcohol and drugs during pregnancy has been proven to affect learning.

2.15 Maternal concerns towards parenting children with LD

Parents often concerned about the safety growth and development of their children. Parents generally take pride in their children's accomplishments and are hurt by their children's failures. LD can also be identified as one of the failures in a child's life and parents' expectations. Therefore, when the parents fail to cope up with all the stressors they experienced when parenting children with LD they would end up in a frustrated situation.

Although both parents experience these worries when facing life events, eepidemiological research has found consistently that women have higher rates of psychological distress than men (Al-Issa, 1982) in relation to parenthood. Stress researchers often attribute the differential distribution and etiology of mental illness to women's greater exposure to role-related stress, the greater emotional costs of parenthood for mothers, especially those with dependent children when parental role demands are greatest (Aneshensel, 1981). Women's emotional involvement in the parental role, and their psychological investment in the parental identity, may lead them to experience parental role strains as more distressing.

Wai-Tong Chien (2012) has carried out a qualitative study among 25 pairs of Chinese parents who were caring for a child with LD. He found that Chinese parents of children with LD experienced various types of difficult life situations, which were also experienced by their Western counterparts. Physical and emotional disturbances are often reported by these parents due to demands for time and effort in caregiving and improving their child's academic performance. They feel disappointed and give up at times when they experience repeated failures in managing their child's problematic behaviors, as well as very poor concentration on homework and frequent complaints by school teachers. In addition, taking care of these children also affected parents' social life, such as regular family activities and hobbies.

A study by Antshel & Joseph (2006) showed that mothers of children with LD report higher levels of stress than mothers of children without LD. Another study showed that higher levels of stress are associated with children with LD who are less socially competent

and display more behavior problems (Dyson, 2003). These studies illustrate that many factors intertwine and potentially contribute to the stress of raising a child with LD.

Dyson (1996) carried out a comparative study to assess the parental stress and family functioning in families having children with LD and without LD. The study was conducted as quantitative and qualitative components. Parents and siblings were enrolled. In 84% of families mothers responded. Total of 19 families with a child having LD and non LD was compared with 55 families having normal children. When parental stress was compared a significance difference ($p<.01$) was noticed between both groups. But sibling relationship in both groups was positive. Parents reported that 46% of siblings had a good understanding and tolerate their sibling with LD.

Karande (2009) conducted a study to assess the anxiety level and causes for anxiety among mothers whose children were diagnosed to have specific learning difficulty. Levels of anxiety were absent in 24%, mild in 75%, and moderate in 1% of mothers. The most common worries, in 95% of mothers, were related to their "child's chronic poor school performance", namely, getting poor marks in spite of working hard, illegible handwriting, repeated spelling mistakes, slow writing, poor reading skills, difficulty in calculations, incomplete school work, and poor memory. The second common worries, in 90% of mothers, were related to the "child's future", namely, whether child will be able to continue education, become a graduate, cope with higher education and have a career as a professional, and stand on his/her own feet. Almost half of the mothers (51%) were worried about their "child's behavior", namely, aggressive behavior, temper tantrums, stubbornness, hyperactivity, or inattentiveness. Almost a third (31%) of the mothers was worried about the multiple visits to our clinic for their child's assessment, namely, the tests that will be conducted on their child, and that the time-consuming procedure of assessment. A few mothers (16%) were worried about their home situation; either marital conflicts with their husbands or relationships with other family members at home.

CHAPTER THREE

METHODS

The study was conducted under four components (figure: 3.1).

Component 1

Development and validation of a screening instrument (LDSQ-PSC) to assess LD among primary school children in grades three and four in the district of Kalutara.

Component 2

A school baesd descriptive cross sectional study to assess the prevalence of LD using LDSQ (PSC) and to describe the behavioural comorbidities of LD among primary school children in grades three and four in the district of Kalutara.

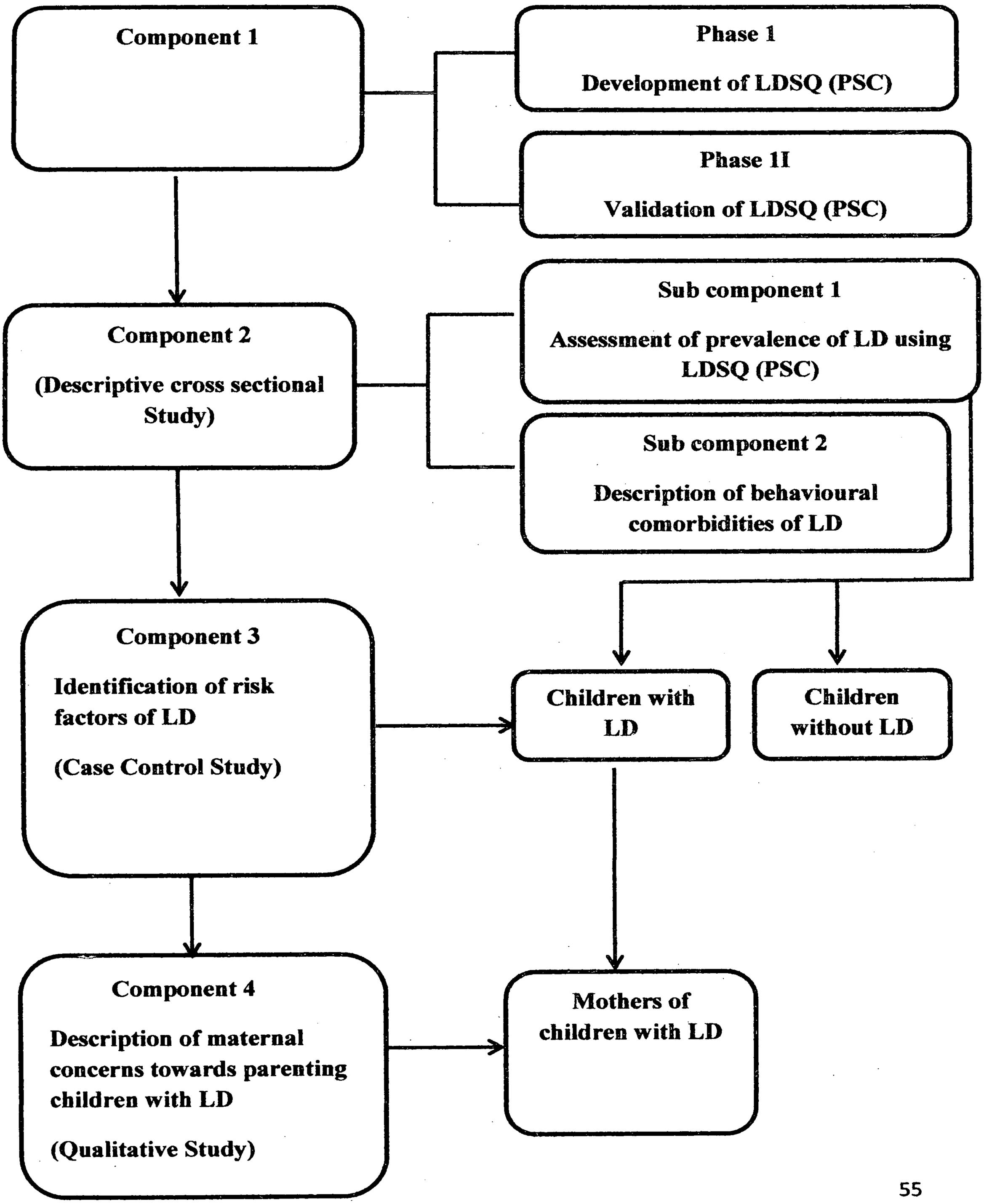
Component 3

A case control study to identify risk factors of LD among primary school children in grades three and four in the district of Kalutara

Component 4

A qualitative study to describe maternal concerns towards parenting children with LD

Figure: 3.1 Schematic presentation of methodological flow of the study



3.1. Component 1: Development and validation of screening instrument LDSQ (PSC) to assess LD among primary school children in grades three and four

Component 1 was conducted in two phases.

3.1.1 Phase 1: Development of an instrument to assess LD among primary school children

3.1.2 Phase2: Validation of the developed instrument to assess LD among primary school children

An extensive literature survey was conducted by the principal investigator (PI) using standard bibliographic reference system such as Medline and psycInfo to locate appropriate instruments that measure LD among primary school children. In addition experts in the field of education and psychiatry were consulted to identify instruments that have been used in the local setting. Most of the available instruments for the diagnosis of LD were psychometric tools and all such tools should be administered by an expert in the field of psychology such as clinical or educational psychologists.

During the search of teacher and or parent rating screening tools, PI was able to trace the following instruments.

1. Learning Disability Evaluation Scale – Renormed, (LDES-R2) (McCarney, 1996)
2. Special Need Assessment Profile (SNAP- Spld) (Weedon & Reid,2008)
3. Cognitive Processing Inventory (CPI) (Crouse,2012)
4. Learning Disability Diagnostic Inventory (LDDI) (Hammil,1995)

1. **Learning Disability Evaluation Scale – Renormed, (LDES-R2)** (Annex 1).

This is a teacher rating scale needing cultural modification. It was developed according to IDEA definition and comprised of subscales for listening, speech, thinking and spelling in addition to the domains that the present study intended to measure; reading, writing and mathematics. During discussions with the authors more conditions were applied as the PI planned to validate the tool for the local setting. The revised cost of the tool was very high and it was beyond the affordability of PI.

2. Special Need Assessment Profile (SNAP- Spld)

Special Need Assessment Profile for specific learning disability is a software that requires computer based assessment and does not contain a manual rating scale. It also measures social and personal difficulties and seems to be more advanced to be used as a screening instrument in the school setting.

3. Cognitive Processing Inventory (CPI) (Annex II)

This instrument is available in teacher and parent forms but it did not serve the purpose of present study. It measures the strengths and weaknesses of each processing skill that would give rise to LD rather than the type of LD (Annex II).

4. Learning Disability Diagnostic Inventory (LDDI)

This tool is developed under IDEA definition. It has subscales for listening, speaking and reasoning other than reading, writing and mathematics. As this tool was not developed under a clinical definition assessment of criterion validity by a psychiatric assessment would be a difficult procedure. Administration of the tool by the class teacher would also be difficult as it is a 90 item questionnaire that needs different types of assessment.

It was therefore decided to develop a more culture specific tool that is suitable for Sri Lankan context after considering above facts and the experts' opinion. In order to achieve this, preparation of a teacher administered questionnaire was proposed by the experts. Feasibility of administration with the current work load of the teachers was also considered. Although including a parent form together with teacher questionnaire was suggested, this was not implemented as all the parents would not be able to complete a self-administered questionnaire due to different level of education and including this part would make the study more extensive. Personal communication with teachers revealed that most of the parents are not ready to accept that their children are having a problem, therefore, the class teacher was proposed as a better person compared to parents for an independent assessment regarding children's learning. As the class teachers could continuously monitor the children's behavior in learning for a period of time before completing the questionnaire,

this would produce better results compared to achievement tests. Therefore development of a simple culture specific teacher administered tool to asses LD among primary school children was recommended. As the purpose of the instrument was to screen primary school children for LD the instrument was named as Learning Difficulty Screening Questionnaire for Primary School Children (LDSQ (PSC)).

3.1.1. Phase 1: Development of the screening instrument – LDSQ (PSC)

The development of the new instrument to screen LD, [LDSQ (PSC)] was carried out in four stages (Figure: 3.2).

Stage I: Devising an item pool suitable for the initial draft of the LDSQ (PSC)

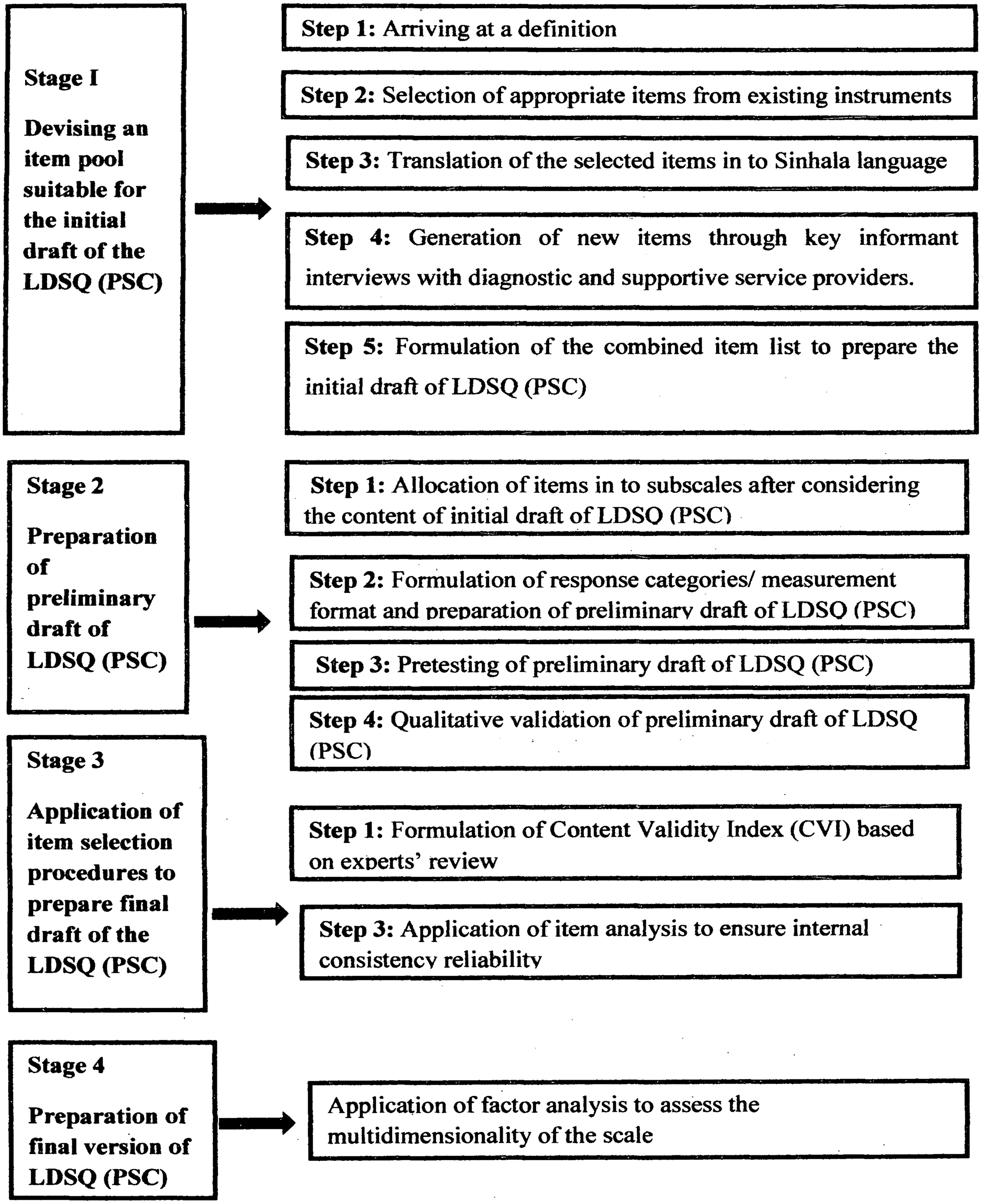
Stage II: Preparation of preliminary draft of LDSQ (PSC).

Stage III: Application of item selection procedures to prepare final draft of the LDSQ (PSC).

Stage IV: Preparation of final version of LDSQ (PSC).

All the stages in the instrument development process was designed according to the text books titled: "Health Measurement Scale: A practical guide for their development and use" by Prof. David L. Streiner and Dr. Geoffrey R. Norman (2003) and "Scale Development: Theory and Application by Robert F.De Vellis (2003).

Figure: 3.2 **Schematic presentation of the development of the LDSQ**



3.1.1.1 Stage I: Devising an item pool suitable for the initial draft of the LDSQ

Devising the items for the new instrument was carried out according to following steps.

Step 1: Arriving at a definition

Step 2: Selection of appropriate items from existing instruments.

Step 3: Translation of the selected items in to Sinhala.

Step 4: Generation of new items using key informants interviews with diagnostic and supportive service providers.

Step 5: Formulation of a combined list of items, using the items derived from above methods.

Step 1: Arriving at a definition

During literature search many definitions of LD that had been developed and used in the field of education, psychology and psychiatry were found and some of these definitions were explained under literature review (section 2.1).These definitions had been changed with time due to changing research evidences. Although varieties of definitions had been used in international studies, DSM IV and IDEA definitions had been used most commonly. After considering the existing definitions in the field, different types of definitions were formulated by PI with the assistance of supervisors and presented to an expert panel [Consultant Psychiatrists (01), Consultant Community Physicians (01), Clinical psychologists (02) and educational psychologists (01)] to comment on the definitions and or to select the most appropriate definition which can be used as the operational definition for the study (Annex II1- section A).

All the definitions were rated by experts from most appropriate (1) to least appropriate (5) definition. It was suggested to omit the word "significant" as it implies a discrepancy and to include the name of the standard IQ test and IQ range. Inclusion of the name of the particular IQ test was not recommended by many experts. Inclusion of grade in addition to the age was questioned initially, but later the consensus was achieved to include educational grade as the present study is based on the grade appropriate learning. After considering the rating by the experts and the comments made, the following socially and culturally acceptable operationalized definition was re-formulated for the present study and the consensus was achieved.

Learning difficulty is defined as difficulties in learning achievements in reading, writing and mathematics compared to chronological age and educational grade of a school child who does not have any physical disabilities that directly impair learning and who does not show a marked general impairment of intelligence (IQ≤70) measured by a standard intelligence test.

Step 2: Selection of appropriate items from existing instruments

Having conducted a literature survey to identify existing instruments suitable for item selection, PI identified LDES, LDDI, CPI parent and teacher forms and SNAP- Spld to screen children with LD. More appropriate items were found in the LDES R_2 than in other tools. Therefore all the items from the subscales of LDES; reading, writing and mathematics were included in an item list and then this item list was subjected to an opinion survey (Annex III - section B).

An opinion survey was conducted among the same panel of experts to determine the relevance, applicability and suitability of the individual items in the selected instrument to the local setting. The panel members were given an adequate period to go through the content and the selection of items was done individually by each panel member. The items selected by all the panel members after necessary alterations were then incorporated in to a list and item list I (English) was prepared. (Annex IV). Of the 46 items, 22 items were selected for item list I after the opinion survey. It was re circulated among the same panel members and consensus was achieved.

Step 3: Translation of selected items in to Sinhala

Selected items should be translated to the native language through a formal translation process to achieve equivalence between the original version and the translated version (Streiner & Norman, 2003). The item list 1 of the initial draft was translated to Sinhala language as further item generation was planned to be done in Sinhala language. Translation/back-translation method and bilingual test was used as the mechanism during translation of item list I.

The selected item list I was initially translated to Sinhala by a bilingual expert. Then this was back translated by a second independent translator who was well conversant in both English and Sinhala languages. The second translator was blinded to the original version. PI compared the back translated version with the original version and discrepancies were resolved with the consensus of the two translators (Annex V).

Bilingual test (Maneesriwongul, 2004) was performed by giving initial English version and the translated Sinhala version of the questionnaire for a teacher in an international school to rate 25 randomly selected students in each class (n=25). The items in the Sinhala version was written in a different order to minimize recall bias. After rating, item to item comparison of English and Sinhala version for each child was done to identify any discrepancies. Item equivalence was tested using kappa statistics (Annex VI).

Step 4: Generation of new items through Key Informant Interviews

The generation of new items for the instrument was done by applying a qualitative method. It was decided to conduct key informant interviews as a method of generation of new items. USAID (1996) recommended that Key informants should be selected for their specialized knowledge, experience and unique perspectives on a topic. Therefore, different types of service providers for the children with LD at health setting as well as educational settings were identified as key informants. Following groups were selected as they had experience in either identifying or managing children with LD. The purpose of these interviews was to identify and explore various concerns of identifying LD in the local setting.

1. Key informant group I

Personnel engaged in diagnostic service provision for the children with LD in the field of psychiatry, psychology and education.

2. Key informant group 2

Personnel engaged in supportive service provision in the field of education

- **Sampling and sample size**

According to the views of experts in the field of qualitative research, a qualitative sample does not need a statistically representative set of respondents (Pope et al. 2000, Malterud

2001). Therefore, a small number of people were chosen for each group because of their unique knowledge on the field of LD as key informants. A purposive sampling technique was applied and snow bowling was used when necessary especially in the field of education.

- **Selection and recruitment of study participants**

Key informant group I:

Following categories of staff, engaged in provision of diagnostic services were identified as key informants.

- A Consultant Psychiatrist
- A Senior Registrar from the Child Guidance Clinic
- A Medical officer Mental Health (Provides diagnostic services for LD during School Medical Inspection)
- A Clinical Psychologist
- An officer providing diagnostic services at National Institute of Education

Key informant group 2:

Following categories of staff, engaged in provision of supportive services were identified as the second group of key informants.

- A grade three teacher and a grade four teacher from each type of school (type IAB, IC, type 2 and type 3)
- A teacher of special education from a government school in Kalutara
- A teacher from Learning Support Unit in a private school (Provides supportive services for learning difficult children during class hours while keeping the child in a normal class)
- An Educational Psychologist

- **Preparation of interviewer guides**

An interviewer guide is an essential tool to elicit specific facts, attitudes, processes and perspectives (beliefs/opinions) of the people under the study (Soonthorndhada and

Isarabhakdi 1993). Interviewer guides I (Annex VIIA) and II (Annex VIIB) were prepared according to the guidelines given by Soonthorndhada and Isarabhakdi (1993), under the guidance of a Consultant Community Physician with wide experience in qualitative research. The interview guides consisted of mainly semi structured questions. Structured led questions were included where necessary to obtain information when this information is not voluntarily brought up by the informants. .

The interviewer guides were prepared in a manner to facilitate a free flow of ideas. The initial questions were formulated to build a good rapport with service providers and to direct them to the topic to be discussed. These general questions were gradually replaced by more specific questions to elicit difficulties in each specified areas of learning. The winding up question was again a general question about the services that can be provided to overcome this problem in our country.

- **Interviewing the key informants**

The PI herself conducted all the key informant interviews under the guidance of a Consultant Community Physician who has experience in qualitative research techniques. Interviews were conducted after obtaining prior permission from the relevant authorities. Date and time was fixed prior to the interview in order to minimize disturbance for the routine work of each officer. Written consent for participation was obtained from the service providers after explaining the objectives of the interview. Interviews were conducted in a quiet room arranged in their own working premises.

Special care was taken to ensure the privacy of the informants. Measures were taken to follow the sequence of the questions in the interviewer guide. In few instances it was altered according to the response given by the participants and additional probing questions were used intermittently in appropriate places, to elicit details of the information provided.

During the interview PI prepared a written note from the responses given by each participant. After each interview, the participants were given the written notes with a summary of salient points made during the discussion and they were instructed to express their views regarding the interviewer's interpretation of the facts they produced during the interview (respondent validation). Further, the informants were given the opportunity to

volunteer any additional information relevant to the topic under discussion, which are not elicited by the questions. Usual time taken for each interview varied from half an hour to one hour. One interview was arranged for a day and recording and summarization of each interview took place immediately after the interview. Interviews with teachers were arranged after the series of interviews with diagnostic service providers.

- **Method Triangulation**

Triangulation is the process of strengthening the findings obtained from a qualitative inquiry by cross-checking information. Triangulation is used in bringing together different sources of information to converge or conform to one interpretation, thereby making the interpretation more credible. Johnson (1997) identified method triangulation as one strategy that improves the internal validity of a qualitative research.

After completion of key informant interviews the obtained data were reconfirmed by two other methods.

1. Direct observation of children
2. Document observation.

Permission from school principals was obtained prior to direct observation of children in the class room set up. Relevant teachers who participated as key informants were contacted and requested to identify children with learning problems in their own class rooms. On the day of observation the PI participated as a passive observer and observed the natural setting during a class room session. Already identified children were monitored at a distance without disturbing the natural setting of the class room. This was followed by document observation where the writing books of all these children were checked as a mode of data verification.

- **Analysis and summarization of findings**

The summary of salient points taken down immediately after interviews was expanded to develop a detailed note on the same day of interview to ensure accuracy of information. During the phase of familiarization, PI compared the written notes prepared from one interview with another and analyzed sequentially in order to identify the similarities and

differences in the information gathered, to list key ideas and recurrent themes. This was carried out in two stages, first with diagnostic service providers and then with supportive service providers.

After going through recurrent ideas, a set of key themes or analytical categories were formulated to categorize the interview text in order to facilitate item generation. These themes were related to the major issues and topics on LD identified during literature survey, during the preparation of working definition as well as the issues raised by respondents themselves. Once these thematic areas were formulated, PI labeled the data into manageable chunks for subsequent retrieval and exploration.

All these thematic areas were applied with a numerical code and indexed for easy retrieval. Based on these thematic areas PI formulated new questions that should be included in item list 2 (with 33 items) generated via key informant interview (Annex VIIIA and B). Throughout the analysis guidance was obtained from a Consultant Community Physician experienced in managing qualitative data.

Step 5: Formulation of the combined item list to prepare the initial draft of LDSQ (PSC)

The initial item pool contained items adopted from the existing instruments {i.e. item list 1 (Sinhala version)} and items that were generated during key informant interviews (item list 2). PI combined these item lists and formulated a combined item list for the initial draft of LDSQ (PSC) which contained 55 items.

3.1.1.2. Stage II: Preparation of the preliminary draft of LDSQ (Annex IX)

The initial draft of LDSQ (PSC) which contained 59 items, derived from available instruments and generated through key informant interviews was then converted into a questionnaire by the PI. Preparation of preliminary draft of LDSQ (PSC) was carried out in four steps.

Step 1: Allocation of items into each subscale

Step 2: Formulation of response categories

Step 3: Pre testing of preliminary draft of LDSQ (PSC)

Step 4: Qualitative validation of preliminary draft of LDSQ (PSC)

Step 1: Allocation of items into each subscale

The LDSQ (PSC) was designed to be used as a teacher administered questionnaire. Each item described a specific behavior related to learning of primary school children. Items in the initial draft were then assigned to subscales representing the key areas of LD. Key areas were decided by considering the working definition of the study, definitions given in DSMIV and ICD 10 and from the thematic area emerged during key informants interviews. Therefore, after considering these facts it was decided to formulate three main subscales as reading, writing and mathematics. After allocating the items to these three subscales it was noticed that some items which explained behaviour of these children in the classroom remained, these items were then allocated to another subscale as "general". All the items in the initial draft were assigned to respective four subscales on the basis of the content of items. Each item in the questionnaire was worded as a closed ended question. The appropriateness of this categorization was later assessed using item analysis and factor analysis.

i. Subscale 1 included 17 items assessing the "reading behaviour"
ii. Subscale 2 included 18 items assessing the "writing behaviuor"
iii. Subscale 3 included 20 items assessing " behaviour in mathematics"

Step 2: Formulation of response categories

After devising the subscales and items related to each subscale, it was decided to choose a method by which responses could be obtained. As formulated questionnaire consisted of statements rather than questions, a continuous judgment scale was said to be more appropriate compared to categorical judgment such as "yes/no" response. Therefore response categories were formulated according to an adjective scale. The number of response alternatives was determined considering the need for a greater precision of responses while maintaining the brevity of the scale. According to Streiner & Norman (2003), to preserve the reliability of the scale the minimum number of response categories

should be in the region of 5-9. After reviewing all these facts, it was decided to formulate a five point adjective scale as the response categories.

The response choices for each individual item were designed to match the respective item stem. Respondents were expected to indicate the extent or the frequency of occurrence of each behaviour (item) by selecting the most appropriate response alternative that followed the item. As the purpose of the instrument was to measure the frequency of occurrence of learning behaviour the response alternative for the scale was designed in the following manner

- Always / often / sometimes / rarely / never.

To determine the extent of the LD, a score was allocated to each response alternative. The allocation of scores was based on the understanding of the impact of a particular learning behaviour (described by each item) by the class teacher. By observing the frequency of occurrence of a specified learning behaviour scoring was given in following manner.

- never = 1, rarely = 2, sometimes = 3, often = 4, always = 5

Some test constructors prefer to apply different 'weights' for each item, based on their understanding of the importance of its contribution to the total score. According to Streiner (2003), this differential weighting is rarely worth and it causes more trouble. Therefore during the development of the present instrument, it was decided to allocate equal weights for all the items and the final score was obtained by summing up the scores allocated for each response of individual items.

Step 3: Pre testing of preliminary draft of LDSQ (PSC)

The initial draft of the LDSQ (PSC) was pre-tested among a sample of 30 (15 each from grade three and grade four) primary school children in the Medical Officer of Health area of Dehiwala. Three children from each class were selected randomly and 10 teachers completed the questionnaires. The objective of the pre-test was to ensure comprehensibility and un-ambiguity of the items. Teachers were explained the objectives of the study. A draft questionnaire was given to each teacher and the teachers were instructed to read it carefully and voice any difficulties in understanding the items or selecting the appropriate responses. All the teachers found that it was not difficult to read and understand the

questions. It was suggested to indicate details of selected statement within parentheses or to prepare a separate manual explaining each item. After pre-testing, PI identified the areas needing modifications.

Step 4: Qualitative validation of preliminary draft of LDSQ (PSC)

After pre-testing, the preliminary draft of LDSQ (PSC) was circulated among the same panel of experts, in addition a Consultant Child Psychiatrist, a Consultant Community Physician and the Chairman of Daddy's' Lanka who has a wide knowledge about children with LD were included in to the panel.

Members of the previous panel were requested to focus more on items developed from key informant's interview as they had already contributed to the preparation of item list 1. The experts were requested to point out any area that was missed, duplicated and also to suggest any additional items to fill the gaps if any. With experts' opinion some questions which had similar meaning were put together under one statement. All questions were assessed for their validity based on the relevance to local context and appropriateness of wording used. The experts appraised the items in the list critically and provided their feedback on the face validity and content relevance of the instrument. Content relevance was assessed by formulating "Content Validity Index (CVI)" described under the section of item selection (3.1.1, step 1).

3.1.1.3 Stage III: Preparation of the final draft of the LDSQ

One of the aims of instrument development is to prepare an instrument with a manageable size to facilitate the administration procedure while preserving the validity and reliability of the instrument (Streiner & Norman 2003). The choice of item reduction techniques in instrument development vary from one researcher to another. One may simply use the consensus of a group of experts to select best items based on their face validity while others can prefer statistical procedures such as item analysis or even more sophisticated procedures such as factor analysis (Streiner & Norman 2003). Preparation of final draft of the instrument involved application of the following item selection procedures and this was carried out in two steps.

Step 1: Formulation of CVI based on expert review.

Step 2: Application of item analysis.

Step 1: Formulation of Content Validity Index (CVI) based on expert review

Evaluation of content relevance by determining CVI was a method applied in several studies (Lynn, 1986). During the assessment of face validity each expert was given the questionnaire to rate the content relevance on a four-point scale, where 1 indicates totally irrelevant, 2 as irrelevant, 3 as relevant and 4 totally relevant (Annex X). Then a CVI was derived for each item, which was the proportion of experts that rate the items as three or four. Lynn (1986) recommends a minimum of five raters, in which case the CVI should be 1.00 for each item. As the present instrument was reviewed by 8 experts cut off value for CVI was determined as 1.00.

Five items with a CVI less than 1.00 (Annex XI) were removed from the questionnaire. Some items in the preliminary draft which had similar meanings were combined and one statement was prepared.

Item number 21 and 22 in the preliminary draft were combined and named as item 21

Item number 45 and 49 in the preliminary draft were combined together and item 46 was formed

Item number 46 and 48 in the preliminary draft were combined together and item 45 was formed.

Therefore total number of items had been changed from 55 to 53.

After making these alterations, consensus of all the experts was achieved.

Step 2: Application of item analysis

Once the items of the questionnaire were pretested and content relevance was assured, it was then administered to a sample to proceed with further item selection which included statistical methods. This sample should be a large group of subjects where a "large" means a minimum of 50 subjects (Streiner & Norman, 2003).

After the preliminary draft is developed, scrutinized and administered to a large enough developmental sample, assessment of internal consistency reliability by applying item analysis procedures is vital to retain more appropriate items in the scale (De Vellis, 2003).

Whenever a trait, behaviour or symptom is measured by using a scale, the items in the scale should be homogenous. Which means all the items should measure different aspects of same latent variable (attribute) and not different aspects of different latent variables (Streiner 2003). If all the items in a scale are measuring the same trait, simple summing of scores over the individual items would be the most sensible index of the scale. If the items are measuring different attributes it is not logical to add up those items to form one total score. This is the rationale for using tests of homogeneity in selection of items for a scale. It helps to identify the best items that would form an internally consistent scale. Henson (2006) explained that moderate correlation of items with each other and correlation of items with total scale score are the two factors that forms the basis of the various test of homogeneity or internal consistency of the scale.

- **Preparation of LDSQ (PSC) Teachers' Manual**

Assessment of internal consistency reliability would involve administration of the tool in to a sample of children in grade three and four. At this point it is necessary to train the teachers on completing the questionnaire to maintain uniformity and accuracy of data. During pretesting of the LDSQ (PSC) it was suggested to prepare a teachers' manual in order to facilitate administration of the questionnaire by the teachers. Therefore a LDSQ (PSC) teachers' manual was prepared with the assistance of the two supervisors. Judgmental validity was ensured by obtaining expert opinion. Initially the manual was prepared for the entire preliminary draft. Each item in the draft was taken separately and an explanation was given on the specific learning behaviour that should be observed before completing the LDSQ (PSC). Items were further clarified with examples. (LDSQ (PSC) Teacher's Manual, final-Annex XII).

- **Selection of sample:**

One grade 3 (n=30) and one grade 4 (n=32) class in the Dodangoda division of Kalutara educational zone were selected as the sample for item analysis. A convenient sample was used for this part of the study as it needed the teacher to rate the entire class and this was not much feasible in type 1AB schools where there are a higher number of children. These two classes were selected from the list of type 1C and type 2 schools. Type 3 schools were also not included as to ensure sufficient variability of the sample.

- **Training of teachers and data collection**

PI met the selected class teachers of each selected schools and explained the purpose of the study, obtained consent after provision of information sheet and consent form for teachers (Annex XIII A) and parents (Annex XIII B). Teachers were provided with LDSQ (PSC) teachers' manual before completing LDSQ (PSC). Each item was taken separately and verbal instructions were given on completing the questionnaire. Teachers were instructed to select most appropriate response categories for particular item (learning behaviour).

Collected data was analyzed using the computer software package 'Statistical Package for Social Sciences (SPSS) version 20.0. Based on the responses of the developmental sample item analysis procedures were applied to assess inter item correlation, cronbach's alpha and item total correlation of the present instrument in order to eliminate items which distort the homogeneity of the scale.

a. Inter-item correlation

This measures the degree of correlation between items in a given scale. By applying some quantitative measure to find out the degree of correlation between items, one can assess the degree of homogeneity of a scale. If one item in a scale is highly correlated with another, the latter would add only a little additional information. On the other hand, if the correlation between items in a scale is low, then probably the items are measuring different attributes. According to current practice in test development, there should be a moderate correlation (0.2 to 0.8) between the items in a scale and mean inter-item correlation of subscales should be above 0.3 (Streiner & Norman, 2003).

When these criteria were applied for the present instrument, majority of inter item correlation of the subscales was found to be within that limit except one item in math subscale (poor left right orientation). Mean inter-item correlation of all three subscales was found to be above 0.3. This is presented in the section 4.1.

b. Cronbach's alpha

Internal consistency is typically equated with Cronbach's coefficient of alpha and it is the most widely used measure of internal consistency in test construction and validation.

Therefore, Cronbach's alpha and "Cronbach's alpha when item deleted" was calculated for each subscale separately. The items which increased overall alpha when deleted were eliminated from the scale as they did not contribute to the homogeneity of the scale and if remains it would be a threat to the internal consistency of the scale. This procedure was repeated until a set of items with a satisfactory internal consistency was obtained (section 4.1).

c. Item-total correlation

The degree to which an item on each scale contributes to the total score of that particular scale is shown by item-total correlations. This is calculated by correlating each item with the scale total omitting that item. For a scale to be satisfactory the item total correlations should be above 0.2 and any items with lower correlations should be discarded (Sreiner & Norman 2003). After applying above steps (explained in section 4.1) in item analysis the final draft of LDSQ (PSC) was prepared (Annex XIV).

3.1.1.4. Stage IV: Application of exploratory factor analysis and preparation of final version of LDSQ (PSC)

Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) are the two major classes of factor analysis: As the name implies, the EFA is exploratory in nature and the investigator has no expectations of the number or nature of the factors. It allows the researcher to explore the main dimensions to generate a theory, or model from a relatively large set of latent constructs often represented by a set of items. Factor analysis can be used to assess whether the items in a multidimensional scale are assigned to the correct subscales, by means of their factor loadings (Streiner & Norman 2003).

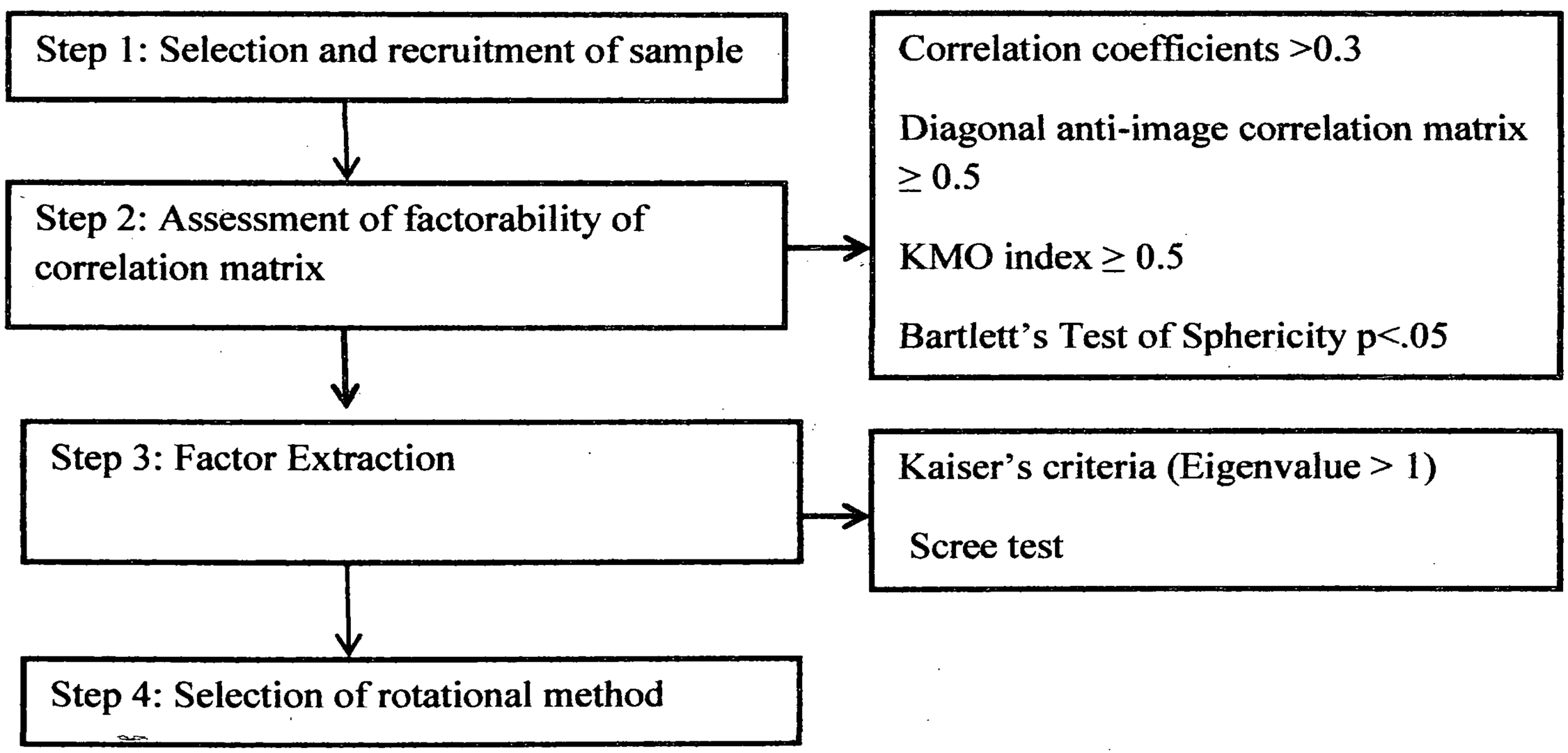
Sample size for factor analysis

Although sample size is an important attribute in factor analysis, different controversial opinions about the sample size has been existing in the field of test construction. Tabachnick's rule of thumb states that at least 300 cases are needed for factor analysis (Tabachnick, 2007). Hair (1995) suggested that the sample sizes should be 100 or greater to perform factor analysis. Comrey (1973) in their guide to sample sizes noted that a

sample of 100 as poor, 200 as fair, 300 as good, 500 as very good, and 1000 or more as excellent.

Henson and Roberts (2006) illustrated that factor analysis can be performed with smaller sample size when communalities are high (> .60) and each factor is defined by several items. Guadagnoli and Velicer (1988) found that solutions with correlation coefficients >.80 require smaller sample. Another recommendation was to calculate sample size according to subject to variable ratio and the rule of thumb varied from 2: 1 to 20:1 (Tabachnick, 2007). Most of the research conducted in Sri Lanka have used subject to item ratio of 5:1 in calculating sample size for factor analysis (Wijesinghe et al. 2005, Kumarapeli et al. 2006). After considering all these facts, based on 10:1 subject to variable ratio the total of 400 was decided as the sample size for the factor analysis for the present study. Factor analysis was performed according to following four steps (Figure 3.3).

Figure: 3.3 **Schematic presentation of the methodological flow of factor analysis**



Step 1: Selection and recruitment of sample

Data collection of factor analysis was done in the Dodangoda division of Kalutara educational zone. A convenient sample of schools representing all four school types was selected for the study (Annex XV). Children were selected randomly from the class register

(20 children from each class). PI obtained consent from the selected class teachers after explaining the purpose of the study. Parental written consent was also taken by sending Parent Information Sheet and Consent Form through the children. Once the parental consent was obtained these children were included in the study.

Selected class teachers were given the final draft of LDSQ (PSC). Proper instructions were given about completing the questionnaire and Teachers' Manual was provided for all the teachers. All selected class teachers in a school were gathered together and trained by PI on how to complete the questionnaire. After an adequate time period the completed questionnaires [final draft of LDSQ (PSC)] were collected. Exploratory factor analysis was done by using SPSS (version 20) to confirm its multidimensionality and to check whether the items were in the right subscales that measure different dimensions of LD.

Step 2: Assessment of factorability of correlation matrix

According to literature, further proceeding in factor analysis is permitted only if the collected data are confirmed as suitable for factor analysis. Thus, as the initial step of factor analysis the assessment of factorability should be performed. There are different methods of assessing factorability, out of which inspection of correlation matrix and anti-image correlation had been used more frequently. Henson and Roberts (2006) pointed out that a correlation matrix is most popular to assess factorability among investigators while Tabachnick and Fidell (2007) recommended inspection of correlation matrix (often termed Factorability of R) for correlation coefficients > 0.30 as a method of assessing factorability. Usually this is followed by inspection of diagonals of the anti-image correlation matrix. According to James Neil (2013) variables with diagonal anti-image correlation matrix < 0.5 should be excluded from the analysis as they lack sufficient correlation with other variable.

Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy/Bartlett's Test of Sphericity

Prior to proceeding further with factor extraction, two other tests are recommended to assess the suitability of the respondent data for factor analysis. These tests include Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and Bartlett's Test of Sphericity. Williams et al (2010) stated that the KMO index should be 0.50 and Bartlett's test of

Sphericity should be significant ($p<.05$) to consider the suitability for factor analysis. According to Field (2005), Kaiser recommends a KMO statistic of 0.5 as acceptable, between 0.5-0.7 as a mediocre value, between 0.7-0.8 as good, between 0.8-0.9 as greater and >0.9 as superb. Factorability of the present instrument was also assessed using above criteria (Section 4.1).

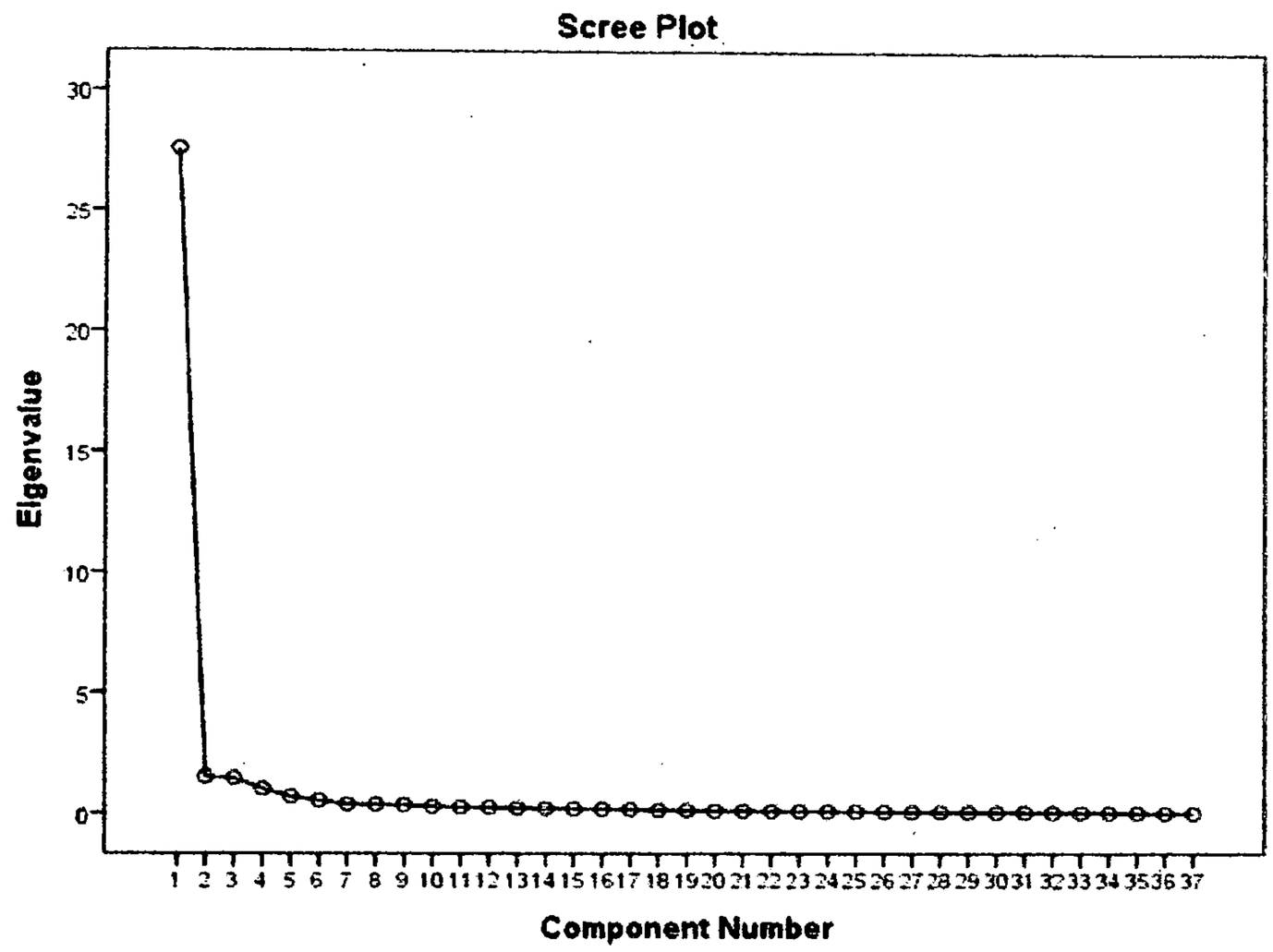
Step 3: Factor Extraction

Factor extraction is generally done to reduce large number of items in to groups or factors (Streiner, 2003). Several criteria are applied in order to produce scale unidimensionality, and to simplify the factor solutions. However, it is stated that using single criteria as a factor extraction method is not advisable. Simultaneous use of multiple decision rule is appropriate and often desirable to determine factor extraction (Thompson and Daniel, 1996). Kaiser's criteria (Eigenvalue > 1 rule), the Scree test, the cumulative percent of variance extracted, and parallel analysis are some of the extraction rules and approaches that are available for factor extraction. In Kaiser's criteria the components that show an Eigenvalue more than one are extracted as factors while the scree test examines a graph of Eigenvalues in deciding the number of factors extracted. Cumulative percentage of variance is another criterion that is used to decide the number of factors to be retained but there is disagreement. Some researchers suggest that there is no fixed threshold. According to Hair et al factors should be stopped when at least 95% of the variance is explained. Thompson (2004) suggested that parallel analysis appears to be one of the best methods of factor extraction. In parallel analysis, actual Eigenvalues are compared with random order Eigenvalues. Factors are retained when actual Eigenvalues surpass random ordered Eigenvalues.

The data gathered from final draft of LDSQ (PSC) was analyzed by using SPSS version 20. The 37-item LDSQ (PSC) was subjected to principal component analysis and principal axis factoring. Principal component analysis revealed four components each exceeding Eigenvalue of 1. Principal axis factoring also revealed same number of factors (Section 4.1).

Inspection of scree test revealed a clear break after the fourth component (Figure: 3.4). After considering these facts it was decided to retain four components for rotation.

Figure: 3.4 Number of components extracted in Scree Plot



Step 4: Selection of rotational method

Once the number of factors or components was decided the next decision was to select a rotational method in order to facilitate and clarify data structure. The goal of rotation is to examine whether a variable is related to more than one factor. Rotation maximizes high item loadings and minimizes low item loadings, thereby producing a more interpretable and simplified solution. There are two common rotation techniques, orthogonal rotation and oblique rotation. Orthogonal Varimax rotation first developed by Thompson (2004) is the most common rotational technique used in factor analysis. Castello (2005) stated that orthogonal rotation will produce factor structures that are uncorrelated, while oblique rotation will produce factors that are correlated, which is often seen as producing more accurate results for research involving human behaviours. Regardless of which rotation method is used, the main objective is to provide easier interpretation of results, and produce a solution that is more meaningful.

For the present instrument number of factors to be retained was decided as four and these four factors were subjected to rotation. Different rotation techniques such as principal

component with varimax and direct oblimin rotation as well as prinicipal axis factoring with varimax and direct oblimin rotation methods were applied to select the best interpretable solution. Principal component analysis with direct oblimin rotation demonstrated a more clear and interpretable structure compared to other methods.

Tabachnick and Fidell (2001) stated .32 as a good rule of thumb for the minimum loading of an item. A factor with fewer than three items is generally weak and unstable; 5 or more strongly loading items (.50 or better) are desirable and indicate a solid factor (Castello, 2005). Tabachnick and Fidell (2007) also addressed the limitations of EFA, stating that "decisions about number of factors and rotational scheme are based on pragmatic rather that theoretical criteria". These criteria were utilized during selection of factors and items for LDSQ (PSC) (Section 4.1). After factor analysis, the final version of LDSQ (PSC) was prepared (Annex XVI A and B)

3.1.2 Phase 2: Validation of developed screening instrument – LDSQ (PSC).

It has been the usual practice among the test constructors to establish the validity and reliability of an instrument using various procedures. The purpose of validation is to assess how well an instrument is measuring the characteristic it intends to measure. Criterion validity; which is the comparison of a scale with some other measure of the trait, ideally a 'gold standard', that is believed to be closer to the truth is considered as the best method to support validity of an instrument (Abramson, 1999). Validity of LDSQ (PSC) was established by using the following methods.

3.1.2.1. Judgmental validity of the LDSQ (PSC)

Face validity, content validity and consensual validity are the three forms of judgmental validity that had been used to appraise whether the operational definition of a variable being measured appears to be an appropriate interpretation of its conceptual definition, based on judgment alone (Abramson & Abramson 1999). This is the minimum pre-requisite for acceptance of a scale.

i. **Face validity** – This indicates whether the intended variables appear to be assessing what the investigator wishes to measure.

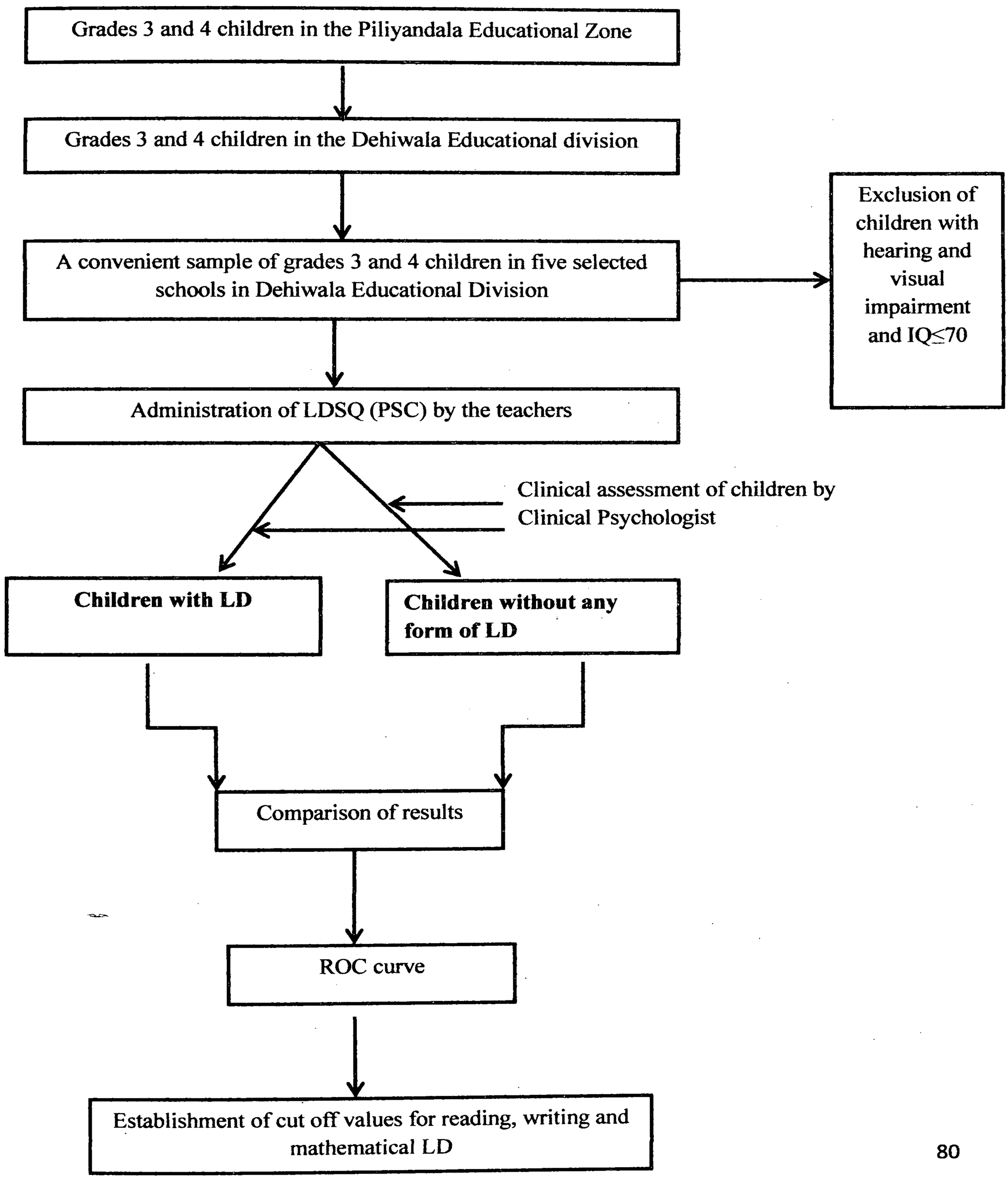
ii. **Content validity** – This consists of a judgment whether the instrument samples all the relevant or important contents or domains.

iii. **Consensual validity** – This appraises the appropriateness of an instrument through agreement of a panel of experts.

The items in the LDSQ (PSC) were generated from a review of existing measures and by performing in depth interviews with different types of service providers. It also obtained the opinion of experts on content of the questionnaire during item selection. Therefore judgmental validity of the instrument was ensured during the process of development of the questionnaire.

3.1.2.2. Criterion validity

Figure 3.5 Schematic presentation of methodological flow of the validation study to assess criterion validity



A measure that has higher face validity than the measure being tested is the best criterion. In the process of assessing criterion validity of a physical attribute it is compared with a gold standard that already exists in the field. The existing gold standard to compare hypothetical construct like LD is the clinical diagnosis made by the expert in the field. International Classification of Diseases (ICD-10) and DSM-IV contain diagnostic criteria to diagnose LD. The experts in the field of psychiatry and psychology utilize these criteria together with direct assessment of child including, parent and teacher interviews to diagnose LD. Therefore it was decided to assess the criterion validity of LDSQ (PSC) by comparing the children identified as LD and non LD by the LDSQ (PSC) with clinical diagnosis of LD by a Clinical Psychologist (Figure 3, 5).

3.1.2.2.1 Study design

A descriptive cross sectional validation study was conducted (Figure 3.5).

3.1.2.2.2 Study setting

Validation study was conducted in the Piliyandala Educational Zone which is one of the four Educational Zones in the Colombo district. Piliyandala Educational Zone is further divided in to three Educational Divisions, Kesbewa, Moratuwa and Dehiwala.

3.1.2.2.3 Study population for the validation study

Study population consisted of grades three and four students in selected schools in the Piliyandala Educational Zone.

3.1.2.2.4 Study sample

Study sample consisted of grade three and four students in five selected schools in the Dehiwala Educational Division of the Piliyandala Educational Zone. Selection of the division was made purposively after considering the feasibility of assessment by the Clinical Psychologist.

Inclusion criteria

- Sinhala medium grade three and grade four children
- Children who had being taught by the respective teacher for a minimum period of three months.

Exclusion Criteria

- Primary school children in grades three and four who were in the special classes
- Special need children in normal classes – Some classes in government schools have special need children eg: children with hearing aids,
- Children with physical disabilities that can directly impair writing ability
- Children who are acutely ill
- Children with chronic illness with ≥50% school absenteeism during previous term
- Children taking medication for a psychiatric condition
- Children with visual impairment confirmed by Snellens' E chart
- Children with hearing impairment (confirmed by whisper test, parent and teacher report)
- Children with mild mental retardation IQ≤70.

3.1.2.2.5 Sample size for the validation study

Sensitivity and specificity are two components that measure the inherent validity of a screening test compared to gold standard. An adequate sample size is needed to ensure that the study will yield estimate of the sensitivity and specificity with acceptable precision. The prevalence of disease should also be included in the sample size formula because the sample size without considering the prevalence would be adequate either for sensitivity or for specificity but not for both (Buderer, 1996).

Sample size for the present study at the required absolute precision level for sensitivity and specificity was calculated by Buderer's formula (Buderer, 1996).

$$\text{Sample size (n) based on sensitivity} = \frac{Z^2_{1-\alpha/2} \text{ X } S_N \text{ X } (1- S_N)}{L^2 \text{ X } P}$$

$$\text{Sample size (n) based on specificity} = \frac{Z^2_{1-\alpha/2} \text{ X } Sp \text{ X } (1- S_p)}{L^2 \text{ X } (1-P)}$$

Where n= required sample size

S_N = anticipated sensitivity (90%)

Sp = anticipated specificity (85%)

α = size of the critical region (1-α is the confidence interval)

$Z_{1-\alpha/2}$ = standard normal deviate corresponding to the specified size of the critical region (α) (1.96)

L= absolute precision desired on either side of the of the sensitivity (.05) and specificity (.06)

P= expected prevalence of learning difficulty (50%)

As there was no information available about the sensitivity of a LD screening tool, after considering the fact that a LD screening instrument should be able to correctly detect more children with LD, expected sensitivity was set as 90%. Considering that the instrument should also be able to correctly identify children without LD as non-cases specificity was set as 85%,.05 and .06 was set as the desired level of precision for sensitivity and specificity respectively. When using a confidence level of 95% the required minimum sample size for sensitivity and specificity was calculated by,

$$\text{Sample size (n) based on sensitivity} = \frac{(1.96)^2 \times 0.9 \times (1-0.9)}{(.05)^2 \times 0.5}$$

$$= 276.6$$

$$= 277$$

$$\text{Sample size (n) based on specificity} = \frac{(1.96)^2 \times 0.85 \times (1-0.85)}{(.06)^2 \times 0.5}$$

$$= 272.1$$

$$= 272$$

As both the sensitivity and specificity was important above sample size was calculated separately and the larger sample size (n=277) was taken as the final sample size. As it was decided to take 15 children from each class, the total sample size was considered as 300 (15X20) for the validation study.

3.1.2.2.6 Sampling method

- **Selection of schools and classes**

Out of all schools in Dehiwala Education Division five schools located closer to Colombo South Teaching Hospital were selected. When selecting the schools a representative sample from each type of school (Type 1AB, Type 1C, Type 2 and 3) was ensured (Table 3.6).

- **Selection of study units**

Following facts were considered during the selection of children from each class

1. In practice an instrument should have the ability to separate obvious cases and non-cases as well as to categorize the borderline or middle range scores to cases or non-cases (Streiner & Norman, 2003).
2. It is better to reduce unnecessary work load of the class teachers who are involved in administration of the instrument
3. As diagnosis of LD needs time (15min to 30 min) an unnecessary increase in the number of children to be assessed by the expert would lead to unnecessary work load.

After considering these facts it was decided to select a sample of children from each grade that represent the entire range of performance. The class teachers were instructed to list the entire class children according to performance basis. The PI selected bottom 15 students from the list as the sampling units. This fulfilled the purpose of including students with extremely poor, borderline and good performance. The selected schools and number of children is presented in Table 3.1.

Table 3.1: School name, type and number of children selected for validation study

Name of the school	Type of the school	Number of children
Prespatarian Girls School	1AB	120
S.D.S. Jayasinghe Vidyalaya	1C	90
Methodist Vidyalaya	Type II	30
St. Mary's College	Type III	30
Suboda Balika Vidyalaya	Type III	30
Total		**300**

3.1.2.2.7 Collection of data for validation study

PI obtained the permission of Provincial Director of Education Western Province and Zonal Director of Education Piliyandala to conduct the study in the selected schools. Permission from particular school principals was also obtained. Class teachers were explained about the objective of the study and informed consent was taken (Annex XVII A). Informed written consent from the parents/ care givers of the children was also taken after sending parent information sheet through the selected children (Annex XVII B).

- **Screening of children for hearing and vision**

PI was trained on whispering hearing test by a Senior Registrar in ENT. Selected children were screened for hearing. Hearing was checked by whispering hearing test together with parent and teacher report. During this component of the study screening of vision was done by a Public Health Inspector (PHI) who had training on using "Snellens E" chart and experience in assessing visual impairment during school medical inspection. Guideline for using Snellens E chart (Annex XVIII A) and whispering hearing test (Annex XVIII B).

- **Screening for mild mental retardation**

IQ test was carried out to exclude children with mild mental retardation and this was done by the Clinical Psychologist. As performing IQ test for the entire group was not feasible the proposed alternative measure to screen high risk children was implemented at this stage. Children who obtained less than 30 marks in Sinhala and Mathematics during the previous term test were only included in this group. Children who had IQ ≤ 70 by the standard Toni - 3 IQ test were excluded from the study.

Administration of LDSQ (PSC)

Children without parental / caregiver consent were not enrolled as study participants. None of the class teachers refuse to participate in the study. Most of the class teachers were same teachers who had taught the same group of children in the previous year. The new teachers who had two month experience with the children by the time of data collection were given one more month to observe the children. Teachers' manual was prepared after omission of items identified during item analysis and factor analysis. All the teachers in each selected

school were trained on completing the LDSQ (PSC) in one session (mentioned in 3.1.1.2 stage III, step 2). Teachers were given adequate time period to complete the LDSQ (PSC).

- **Assessment of children by Clinical Psychologist**

During the same period the selected children were subjected to a clinical assessment by the Clinical Psychologist. At this point, the Clinical Psychologist was blinded to the performance outcome of the children rated by using LDSQ (PSC). Together with diagnostic criteria given in DSM IV, individual assessments of children by giving reading, writing and math assessments, observation of writing materials, teacher interviews and sometimes parent interviews were utilized to arrive at a diagnosis.

- **Collection of basic socio demographic information**

Parents/ Care giver questionnaire of the children with and without LD was completed by the parents/caregivers. Basic socio demographic information such as sex, date of birth, ethnicity, religion, parental education and occupation was obtained by interviewing the parents (Annex XIX).

3.1.2.2.8 Establishment of cut off points

Scoring of LDSQ (PSC) was carried out according to the instructions provided during the process of development of the questionnaire. As this questionnaire was prepared on a continuous scale, establishment of cut points in order to predict a dichotomous outcome such as cases and non-cases was required. One of more objective method that had been used by many researchers for this purpose is Receiver Operating Characteristic Curves (ROC Curve) (Streiner, 2003). Therefore the results of LDSQ (PSC) and judgement given by the Clinical Psychologist were compared to obtain a ROC curve.

- **Receiver Operating Characteristic Curves (ROC Curve)**

ROC curve compares sensitivity versus specificity across a range of values to predict a dichotomous outcome, The ROC curve graphically displays the trade-off between sensitivity and specificity and is useful in assigning the best cut-offs for clinical use.

Sensitivity, specificity, predictive values, likelihood ratios (LRs) and area under the ROC curve are all different ways of expressing test performance. Sensitivity ("positivity in disease") refers to the proportion of subjects who have the target condition (reference standard positive) and give positive test results. "Specificity ("negativity in health") is the proportion of subjects without the target condition and gives negative test results. Positive predictive value is the proportion of positive results that are true positives (have the target condition) whereas negative predictive value is the proportion of negative results that are true negatives (do not have the target condition). Predictive values will vary depending upon the prevalence of the target condition in the population being studied, even if the sensitivity and specificity remain the same" (Florkwoski, 2008). LR explains how much the test improves likelihood of making a correct diagnosis. Positive LR explains improvement of likelihood of correctly diagnosing the presence of the condition while negative LR explains the improvement of likelihood of correctly diagnosing the absence of the condition. A positive LR >10 and a negative LR <0.1 are considered to exert highly significant changes in probability, such as to alter clinical management.

3.1.2.2.9 Statistical analysis

Results of LDSQ (PSC) and judgment of Clinical Psychologist were entered in sigma plot window 12.5 in Systat software. Data for each subscale was entered separately and separate analysis was done. Report on sensitivity, specificity, predictive values and LRs for different cut off points were obtained for each subscale. Output for area under ROC curve and optimal cut off point for each subscale were also obtained. Cut off values for each difficulty, reading, writing and math was then decided.

3.1.3. Assessment of reliability of LDSQ (PSC)

3.1.3.1 Internal consistency reliability

During the phase of development of LDSQ Crohnbach's alpha was calculated for each domain of the instrument to assess the internal consistency reliability of the items. Chronbach's alpha value for all three subscales was found to be more than 0.8. Final 36 items LDSQ (PSC) was assessed for internal consistency after applying it for the validation sample and internal consistency was reconfirmed.

3.1.3.2. Test retest reliability

Ten class teachers who participated in the validation study were selected randomly in order to evaluate the test-retest reliability of the LDSQ. Five children from each class who participated in the validation study were then selected randomly. After two weeks interval the teachers were instructed to complete the questionnaire once again for the selected children. Test-retest reliability (i.e. how stable the questionnaire is over time) was assessed for all three subscales separately and for the entire questionnaire by checking correlation for each subscale and for the total scale.

3.1.4. Assessment of acceptability of LDSQ (PSC)

Acceptability of the LDSQ (PSC) by the teachers was assessed as a single class teacher had to assess 15 children using a 36 item questionnaire. The proportion of teachers consented to participate, response rate (proportion of teachers completed the questionnaire), proportion of missing data, time required to complete a single questionnaire, the proportion of teachers willing to complete 15 questionnaires, proportion of items found to be difficult to understand or confused were the aspects that considered to assess the acceptability of the questionnaire.

3.2. Component 2

A school based descriptive cross sectional study to determine the prevalence and to describe the behavioral comorbidities of LD among primary school children in grades three and four in the district of Kalutara.

This component consisted of two sub components,

3.2.1 Sub component 1- Assessment of the prevalence of LD among primary school children.

3.2.2 Sub component 2- Determination of behavioural comorbidities of LD among primary school children.

3.2.1 Sub component 1- Assessment of the prevalence of LD among primary school children

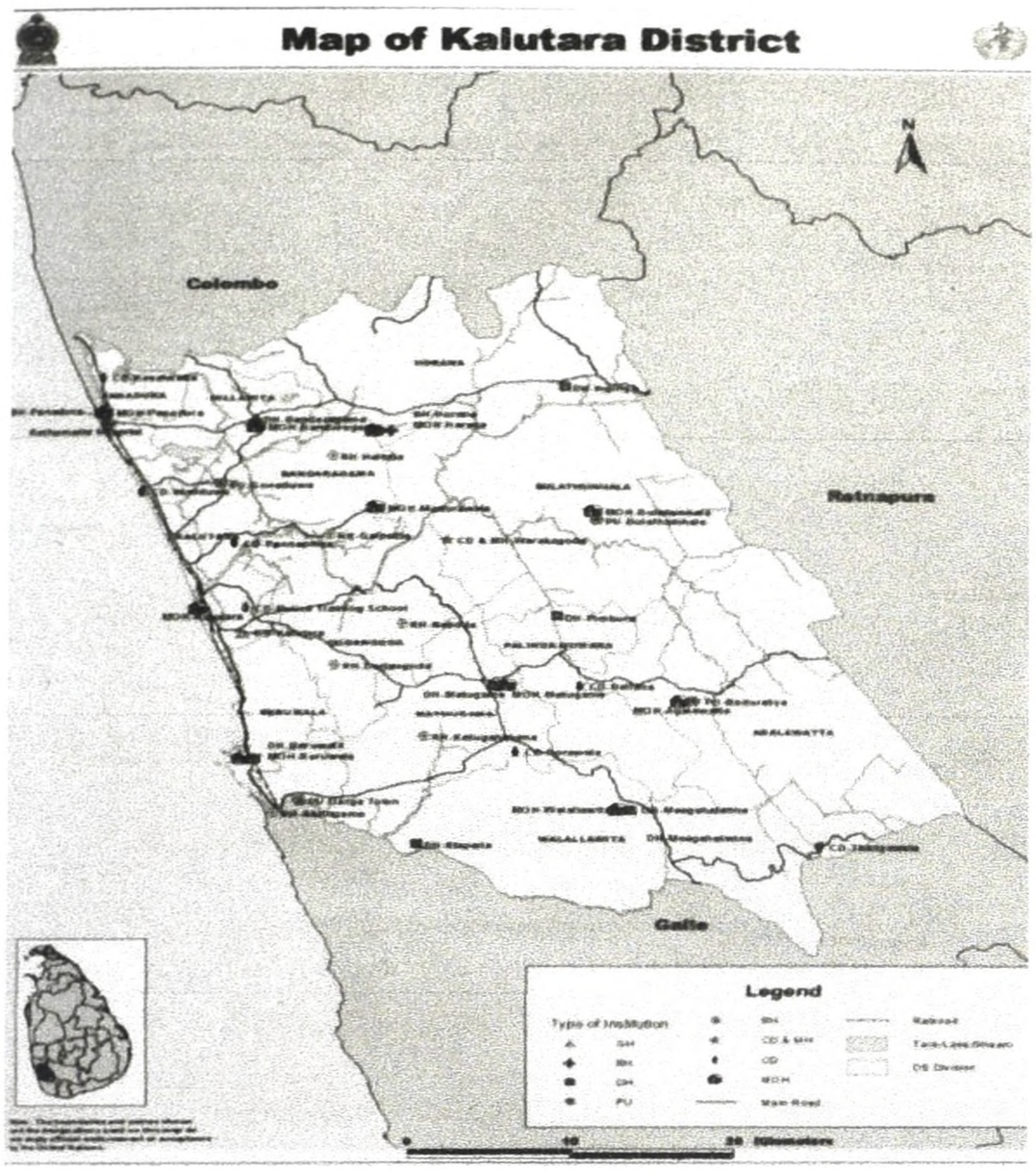
3.2.1.1 Study design

This was a descriptive analysis of the cross sectional study to determine the prevalence of LD among primary school children in grades three and four

3.2.1.2 Study setting

The study was conducted in Sinhala medium government schools in the District of Kalutara, Western Province of Sri Lanka (Figure 3.6). The Kalutara District comprises 14 Divisional Secretary (D.S) areas and a total of 1135000 populations according to the last census in 2011 (Urban 11.8%, rural 85.9% & estate 2.3%). The district is divided in to three educational zones, Kalutara, Matugama and Horana. Kalutara educational zone is further divided in to four divisions, Kalutara, Beruwala, Panadura and Dodangoda. Matugama zone consists of four divisions, Matugama, Wallallawita, Agalawatta I and II. Horana zone has three divisions namely Bandaragama, Horana and Bulathsinhala.

Figure 3.6: Area Map of Kalutara District



The district consists of 406 functioning government schools that provide education for 192,501 children (Table3.7). Out of all schools, majority (334) is Sinhala medium government schools and total student population is 167,724 (school census, 2006).

Table 3.2 Number of state schools in Kalutara district by type and student population

Type of School	Number of Schools	Student population
1AB (Schools with Advanced level Science stream)	38	75,595
1C (Schools with Advanced level Arts and/or Commerce stream)	73	58,808
Type 2 (Schools with classes only up to grade 11)	194	47,402
Type 3 (Schools with classes only up to grade 8)	101	10,696
Total	406	192,501

3.2.1.3 Study period

This part of the study was conducted from March to December 2013.

3.2.1.4 Study Population

The study population included all children in grades three and four attending Sinhala medium government schools in the district of Kalutara.

3.2.1.5 Study sample

Children in grades three and four attending Sinhala medium government schools in the district of Kalutara

3.2.1.6 Inclusion criteria

- Sinhala medium grade three and grade four children
- Children who had being taught by the respective teacher for a minimum period of three months.

3.2.1.7 Exclusion Criteria

- Primary school children in grade three and four who were in the special classes in government schools
- Special need children in normal classes – Some classes in government schools have special need children eg: children with hearing aids,
- Children with physical disabilities that can directly impair writing ability
- Children who are acutely ill
- Children with chronic illness with ≥50% school absenteeism during previous term
- Children taking medication for a psychiatric condition
- Children with mild mental retardation (whose IQ level in the range of 50-70 assessed by Toni-3 IQ test) as the learning difficulty of these children is due to impaired cognitive function)
- Children with visual impairment confirmed by Snellens' E chart
- Children with hearing impairment (confirmed by whisper test, parent and teacher report)

3.2.1.8 Sample Size

The sample size for the study was the minimum sample size required to detect the expected prevalence of learning difficulty among children in grades three and four with a predetermined level of precision and confidence level.

As there were no previous studies conducted to determine the prevalence of LD among primary school children in Sri Lanka, to get the maximum sample size the expected prevalence was considered as 50%.

Sample size was calculated using the following formula (Lawanga and Lameshow 1991)

$$n = z^2 p (1-p)/ d^2$$

n=calculated sample size

Z= z value corresponding to the required level of confidence (1.96)

P= expected prevalence of learning difficulty (50%)

D= desired level of precision for margin of error (.05)

$$n= \frac{(1.96)^2 \text{ X } 0,5 (1-0.5)}{(0.05)^2} =384$$

An identified disadvantage of the cluster sampling is the fact that naturally occurring groups are often relatively homogeneous for the variables of interest. This is known as cluster effect or design effect. Therefore correction for design effect was carried out to increase the precision of the study (Bennet, 1991).

The final sample size will be

N=Design effect x n

The design effect is given by the following formula.

Design effect=1+ (b-1) rho

b = Average number of respondents to the item per cluster

(If the cluster size is 20, and all the respondents answer all the items, then b=20)

roh= rate of homogeneity

"roh" is a measure of the degree of homogeneity of study units within the cluster. The value of roh is considered to be a measurement of variability between clusters compared to variability within clusters. The value of roh is higher for the variables that vary greatly between clusters compared to within clusters (Benette, 1991). As this is a school based study the variability of socioeconomic condition within cluster is less compared to between clusters variability. Mostly children with higher socioeconomic level attend type 1AB or

1C schools while lower socioeconomic conditions attend type2 and 3 schools. Based on socioeconomic variable roh for present study was set as 0.2 (Bennete, 1991).

Design effect=1+ (b-1) rho

Cluster size was set as 20 and therefore b= 20,

D= 1+ (20-1) 0.2

D= 4.8

n= 384X4.8

n= 1843

This sample was added an additional 10% for the non-responders.

n= 1843+184= 2027

Number of clusters to be included in the study was decided as 101 (2027/20=101). According to the number of clusters, 2020 was decided as total sample size.

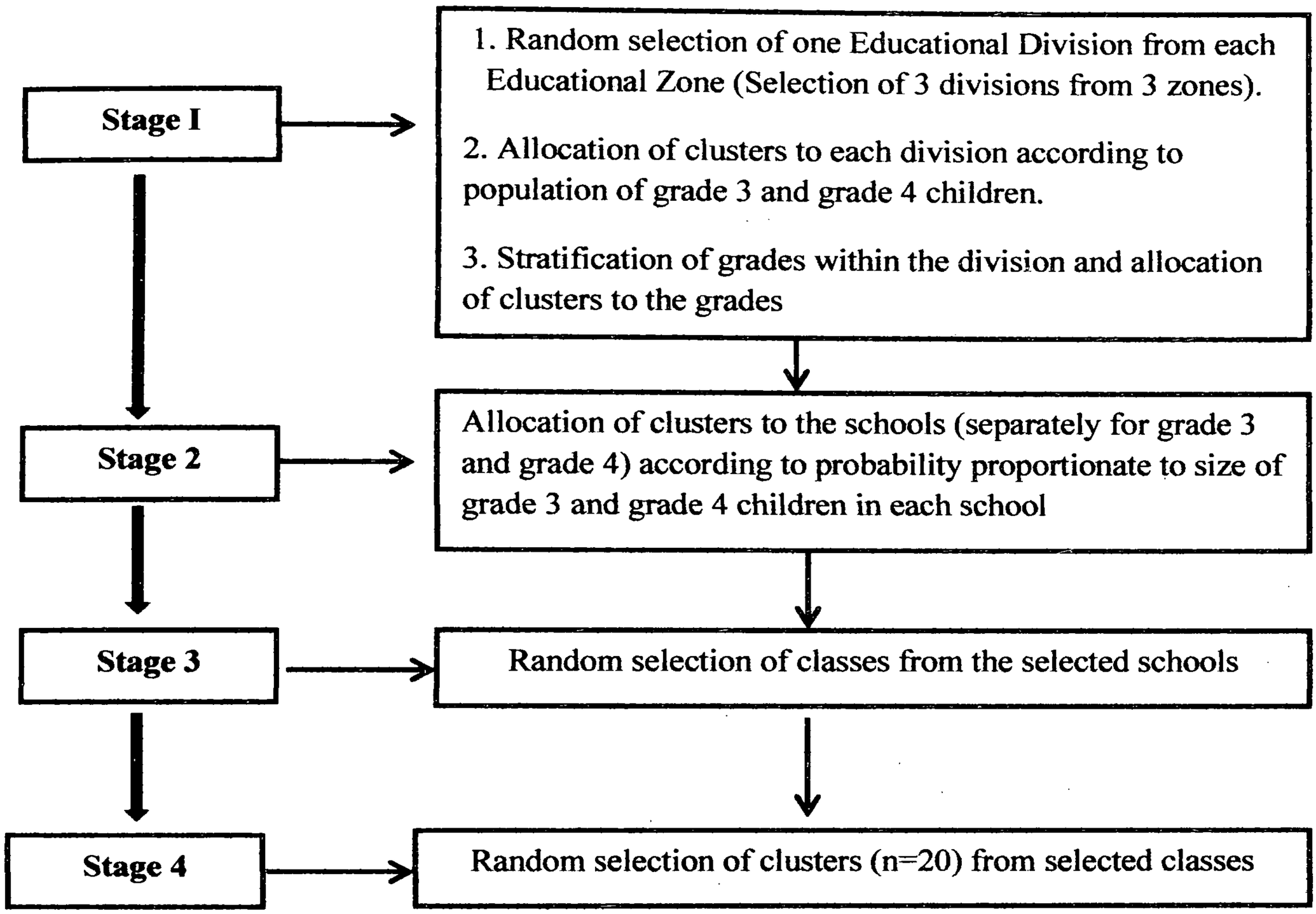
- **Reason for setting cluster size as 20**

As this study involved primary school children, all types of schools, 1AB, 1C, type 2 and type 3 were included in the study. Considering that the minimum number of children in a type 3 school class would be 20, the number of children in a cluster or cluster size was decided as 20. Other reason for setting the cluster size as 20 was the work load of the class teacher. As this is a teacher administered questionnaire, by reducing cluster size the work done by the teacher could also be improved. At the same time, it is stated that studies with smaller cluster size and large number of clusters would produce more precise results compared to studies with larger cluster size and small number of clusters for equal sample size (Bennet, 1991). After considering these facts cluster size was determines as 20.

3.2.1.9 Sampling technique

During selection of study units, Multi staged cluster sampling method with probability proportionate to size of grades three and four children in the selected educational divisions was carried out (Figure 3.7).

Figure 3.7 Schematic presentations of stages of sampling technique



Sampling was carried out by using School Census (2010) provided by the Provincial Department of Education, Western province. All four types of schools (type AB, type C, type 2 and type 3) were included in this list as all these types of schools have primary school children. Type 3 schools with less than 20 children in either grade three or four classes and Tamil medium schools were excluded from the sampling.

- **Selection of Educational Division from each Educational Zone**

There are three educational zones and 11 educational divisions in Kalutara district. As the first stage of sampling one educational division was selected randomly from each educational zone. Agalawatta division is subdivided in to two divisions as Agalawatta I and II due to extensive land area that represent this division. But the number of schools and student population in each division is very less. Therefore it was decided to consider both divisions as one during sampling (Table 3.3).

Table 3.3: Educational Zones and Divisions in Kalutara District

Zone	Division	Selected division (1st stage of sampling)
Kalutara	Kalutara Beruwala Panadura Dodangoda	Kalutara
Mathugama	Mathugama Walallawita Agalawatta I Agalawatta II	Agalawatta I and II
Horana	Horana Bandaragama Bulathsinhala	Bandaragama

- **Allocation of clusters to the selected divisions**

Clusters were allocated to each division after considering the population proportion of grade three and four children in the selected divisions (Table 3.4).

Table 3.4 Number of clusters allocated to the selected division

	Kalutara	Bandaragama	Agalawatta	**Total**
Grade 3	2046	1500	871	4417
Grade 4	1986	1354	723	4063
Total	4032	2854	1594	8480
Allocated Number of Clusters	**48**	**34**	**19**	**101**

- **Allocation of clusters to the grades within the division**

The number of clusters in each division was further allocated in to grades according to population of grade 3 and grade 4 children in each division (Table 3.5).

Table 3.5: Number of clusters allocated to each grade in the selected divisions

	Kalutara	Bandaragama	Agalawatta	Total
Grade 3	24	18	10	52
Grade 4	24	16	09	49
Total number of clusters	**48**	**34**	**19**	**101**

- **Allocation of clusters to the schools**

For each division, a list of schools with total number of grade 3 and grade 4 children was prepared by using the school census. Separate sampling interval for grades three and four in each division was calculated

Eg.

$$\text{Sampling interval} = \frac{\text{Cumulative population (grade 3 in the selected division)}}{\text{Numbers of clusters (allocated for grade 3 in that division)}}$$

Cluster allocation for each school was done by applying probability proportionate to the size of the grade three and grade four student population (PPS) within each educational division. This was done separately for grade three and four (Annex XX).

3.2.1.10 Data collection

Schematic presentations of the stages of data collection of the cross sectional study is presented in Figure: 3.8

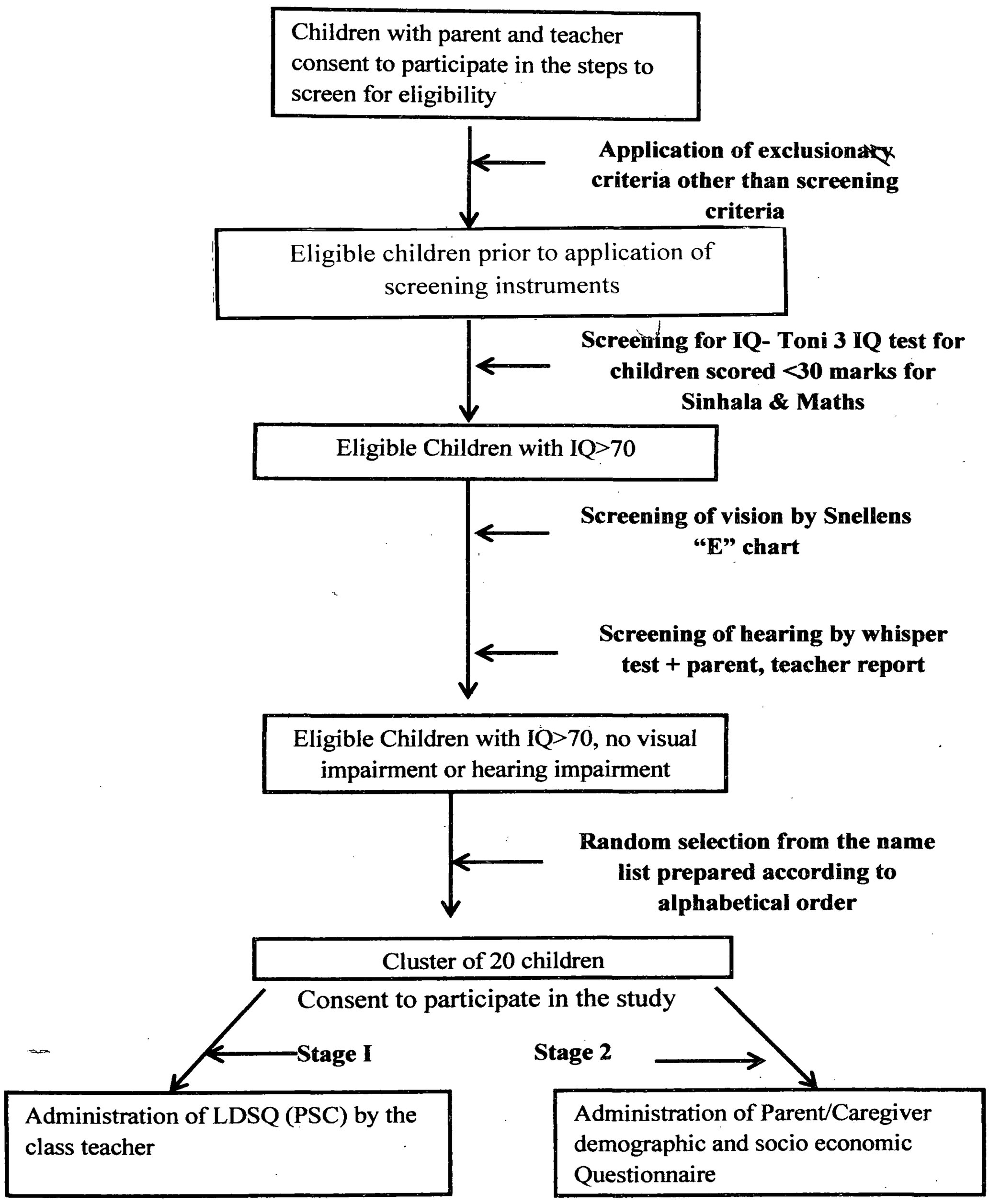


Figure: 3.8 Stages of data collection of cross sectional study

3.2.1.10.1 Instruments used for eligibility checking

Ton1-3 IQ test

The Test of Nonverbal Intelligence, Third Edition (TONI 3) is designed to test nonverbal abstract / figural problem solving in individuals ages 6 years 0 months to 89 years 11 months. Toni 3 is a language free pictorial scale that can be administered to children with LD as it does not involve reading or writing. There is no culture inappropriateness as it is a pictorial scale. The TONI-3 administration takes approximately 15-20 minutes to complete (CUP, 2011).

Toni -3 IQ test is a standard IQ test that had been most commonly used in child guidance and psychiatry clinics in government and private hospitals in Sri Lanka. This is a very simple tool that can be administered by any trained professional in the field of Psychiatry, Psychology and Education. This instrument was selected with the expert opinion after considering the difficulties that could be encountered during application of other available instruments.

Pre testing of Toni 3 IQ test

Pre testing of Toni 3 IQ test was done to assess the feasibility of application in the school context, time needed to assess a single child and ability of children to understand the way of instruction. The pretest revealed the necessity of a calm environment in order to facilitate concentration of children. During the pretest it was found that the minimum time needed to assess a single child was 10 to 15 minutes. After considering this fact, as the purpose of screening is to exclude children with mild mental retardation, instead of screening the entire class an alternative way to screen only high risk children was proposed by the expert panel.

Selection and training of data collectors for eligibility checking

Data collectors were needed for this stage of the study for screening of vision and hearing. Two pre intern medical officers (one pre intern for each screening procedure) were enrolled as the data collectors for this part of the study. One officer received one day training from a qualified optometrist on screening of vision using Snellen's "E" chart. A guideline with

written instructions on how to use the chart was provided to ensure the accuracy of measurement.

Screening for hearing utilized whispering voice test. One pre interns received training under a Senior Registrar ENT on how to perform whisper test. A guideline with written instructions was provided to ascertain accuracy and uniformity of measurements. At the end of the training a practical session was carried out in a school that was not included in the study proper. Each pre intern carried out measurement of hearing, vision under the supervision of the PI.

PI received one day training on administration of Toni-3 IQ test in Mental Health Unit, National Institute of Health Science Kalutara under the guidance of Medical Officer In charge (MOIC) who had a diploma in Psychiatry and had been working in the field of Psychiatry for more than 10 years. MOIC Mental Health is responsible for screening children for LD during school medical inspection.

3.2.1.10.2 Study instruments used for data collection

Following instruments were used for data collection for this component of the study

1. Learning Difficulty Screening Questionnaire for Primary School Children – LDSQ (PSC)
2. Demographic and socio economic Interviewer Administered Questionnaire (IAQ) for Parent and Care giver (Annex XXI A and B)

1. Learning Difficulty Screening Questionnaire for Primary School Children – LDSQ (PSC) (Annex XVIA &B). Explained in the section of 3.1

2. Demographic and Socio economic IAQ for Parent/ Care giver

Demographic and socio economic questionnaire with close ended questions to collect information on selected demographic and socio economic variables related to child and parents or caregivers is an interview administered questionnaire. This is a very simple questionnaire which needs 10 minute to complete.

3.2.1.10.2.1 Development of data collection instruments

Development of LDSQ (PSC) is explained in section 3.1. During the development of interview administered questionnaire literature search of similar questionnaire and expert advice was obtained. Most related items that specifically measure socio demographic aspect was included in the questionnaire. Socio economic status was assessed by social class and Asset Index (Thalagala, 2004).

3.2.1.10.2.2 Pre testing of data collection instruments

1. LDSQ was pre tested during the phase of developing the preliminary draft (section 3.1).
2. The demographic and socioeconomic IAQ was pre-tested among a group of parents of primary school children (n=20) in a school in Dehiwala MOH area. Parents / care givers of the selected children were interviewed during the class circle and interview was directed to each questionnaire item separately to determine whether the wording used made any of the items difficult to answer, confusing or difficult to understand and whether the parents would expect to ask particular question in a different way. On the basis of the interview, necessary modifications were made to the questionnaires.

3.2.1.10.2.3 Assessment of validity of data collection instruments

Judgmental validity of the LDSQ (PSC) was ensured during the phase of development of the study instrument. Criterion validity was assessed in the phase of validation.

The validity of IAQ was ensured by assessing the face validity and content validity by a panel of experts in the fields of Community Medicine (1), Psychiatry (1), Psychology (1) and Social Science(1). All questions in the questionnaire were assessed for its relevance in assessing demographic and socioeconomic variables, appropriateness of the wording used and acceptability in the local context.

3.2.1.10.2.4 Assessment of reliability of data collection instruments

- Reliability of LDSQ was ensured during the stage of development and was assessed in the validation study.
- Test retest reliability and inter interviewer reliability for demographic and socio economic questionnaire was assessed during this stage of the study. Once the initial

interview was over a sample of parents (n=50) were re interviewed two weeks apart on 5 randomly selected variables in the questionnaire. Response categories were compared to assess test retest reliability.

- Inter-interviewer reliability of demographic and socio economic questionnaire was measured by administering the questionnaire to a group of 10 parents by each FI and re-administering the same by PI to the same group of parents (n=40). Five selected variables were assessed for inter interviewer reliability.

3.2.1.10.2.5 Definitions of selected variables in the data collection instrument -Demographic and socioeconomic IAQ

Q: 3.1- Who is the primary care giver of the child – Mother only/father only/both parents/ non-parental caregiver

This refers to the parent (mother/ father/ both parents) or another person (non parent) who has the greatest responsibility for the daily care and rearing of a child.

If fathers are working full time outside the house (eg Armed forces/ occupied in abroad) mother was considered as primary caregiver.

Q: 3.3.4 Marital status of mother/father was categorized according to the following definitions.

- Unmarried – those who are never married
- Currently married - a person whose current marriage was registered according to the law or who claims to be married according to the custom or repute.
- Divorced- a person who was married but obtained divorce/legal separation in a court of law
- Separated- a person who was married but voluntarily separated (and not currently married)
- Widowed – a person whose spouse is dead and who is not currently married to another.

Q: 3.3.5 Highest level of education obtained by mother /father was classified as following

- Never gone to school

- Attended to school up to grade five
- Attended Grade six to ten but not passed GCE(O/L)
- Passed GCE (O/L)
- Attended Ggrade 11 to 13 but not passed GCE(A/L)
- Passed GCE (A/L)
- Received university education
- Received higher education other than university education.

Q: 3.3.7 Occupation category of father and mother was obtained via an open ended question. During data entry occupation of mother/ father was categorized according to International Standard Classification of Occupations (ISCO). This is an International Labor Organization (ILO) classification structure for organizing information on labor and jobs. It is part of the international family of economic and social classifications of the United Nations. The current version, known as ISCO-08, was published in 2008 (ILO, 2011). During data collection name of the occupation was obtained by the data collector. During data entry PI, classified the occupations according to following classification.

- Managers
- Professionals
- Technicians and associate professionals
- Clerical support workers
- Service and sales workers
- Skilled agricultural
- Forestry and fishery workers
- Craft and related trades workers
- Plant and machine operators, and assemblers
- Elementary occupations, Armed forces occupations.

Q: 3.3.8 Type of occupation of father/mother was categorized according to following definitions

- Full time and spend nights outside home – full time work was defined as working 40hours or more per week and spending at least 2 or more nights per week outside home

- Full time and spend nights at home – Works 40 or more hours per week and spends all nights at home or Works 40 or more hours per week and spends one night per week outside the house
- Part time out side home – Works less than 40 hours per week and spends all nights at home
- within the home – does a home based occupation

Socio economic status of the child was assessed by social class and Wealth Index

Q: 3.5 Asset index was calculated for each house hold of the participant using the method described by Thalagala (2004). The asset categories include,

- Consumer durables -possession of a radio, TV, refrigerator, phone, bicycle, car,
- Access to two public services -water and electricity
- Housing characteristics - number of sleeping rooms, quality of floor material, roof material, wall material and quality of toilet facility
- Type of fuel using for cooking – whether electricity, gas, kerosene oil, wood etc

All these variables were categorized according to a binary scale and analyzed by using principal component analysis and wealth quintiles were formulated (Annex XXII).

Social Class:

The social class of the child was determined according to the social class categorization given by Barker and Hall (1991). The following categories were used in determining the social class. If mothers were unemployed father's occupation was used as the basis for social class classification. If fathers were unemployed mother's occupation was used as the basis for social class classification In families where the mother was working full time or part time, the higher occupational category of the two was used (Palmer et al., 2009).

Social class I - Leading professions and businessmen (professional, managerial)

Social class II - Lesser professions and businessmen (teacher, nurse)

Social class III- Skilled workers and non-manual workers (armed forces, police, clerk, shop keepers)

Social class IV- Partly skilled workers (farmer, estate worker, skilled labourers)

Social class V- Unskilled workers (petty traders, hawker, semiskilled labourers); (Unemployed individuals were also included in this category)

3.2.1.10.3 Data collection (Figure 3.8)

Data collection was carried out in two stages.

Stage I - Data collection using LDSQ (PSC).

Stage II - Data collection from parents (maternal caregiver if not paternal Caregiver)/ non- parental care givers using Demographic and socioeconomic IAQ.

Stage I - Data collection using LDSQ (PSC).

3.2.1.10.3.1 Permission from relevant authorities

At the onset of the study administrative clearance was obtained from the Provincial Director of Education Western Province. The objectives of the study were explained. Permission was granted to conduct the study in the District of Kalutara and separate letters for Zonal directors were issued (Annex XXIII A, B & C). PI then met the Zonal Directors and relevant Divisional Directors to obtain permission to visit each selected school. Prior permission was obtained from school principals of selected schools after explaining the objectives of the study and the procedure of data collection and data collection instruments specially the LDSQ.

- **Period of data collection**

Period of data collection extended from March to December 2013 excluding school holidays. Initial period was allocated for screening. Data collection from caregivers commenced in May 2013.

3.2.1.10.3.3. Application of eligibility criteria (Figure 3.8)

After meeting the school principals the required numbers of classes were selected randomly from each grade by the PI. Majority of school principals granted permission to meet the relevant class teachers on the same day of meeting the principals. PI met the relevant class teacher, explained the objectives of the study and obtained consent to screen the children with the consent of parents. Those students who failed to fulfill eligibility criteria were excluded at the beginning of the study.

3.2.1.10.3.4. Screening for mild mental retardation (Figure 3.8)

IQ test was carried out to exclude children with mild mental retardation and this was done by the PI. As performing IQ test for the entire class was not feasible the proposed

alternative measure to screen high risk children was implemented at this stage. Children who obtained less than 30 marks in Sinhala and Mathematics during the first term test were only included in this group. A child who's IQ ≤70 by the standard Toni -3 IQ test was excluded from the study. Precautionary measures were taken to cause minimum disturbance to the class while conducting all screening tests.

3.2.1.10.3.5. Screening for vision and hearing impairment (Figure 3.8)

Screening for vision, and hearing was done by the trained pre interns according to the guidelines provided. Vision was screened by using Snellen's "E" chart while hearing was assessed by whispering voice test. The parent information sheet included a section regarding suspected hearing impairment. Teachers were also inquired whether any child was suspected to have hearing problems. This information was collected as an additional evidence to interpret the results of whisper test.

3.2.1.10.3.6. Selection of clusters (n=20) from selected classes

Once the screening was completed, list of names of all eligible students according to alphabetical order of the first name was prepared. As the cluster size was set as 20, 20 students were chosen randomly as study units by using the prepared list.

3.2.1.10.3.7 Completion of the questionnaire LDSQ (PSC) by the teachers

Consent to participate

The objectives of the study were explained to the selected class teachers. They were explained that they have the freedom for not to participate. Further, the completion procedure and the need of completing 20 questionnaires by each teacher were explained. Teachers consent for participation was taken after providing teacher information sheet and consent forms (Annex XXIV A). All the teachers consented to participate. Parent information sheet and consent forms were sent through the children (Annex XXIV B).

Training

The training for teachers in each school was conducted in one session. All the selected class teachers were invited and a short training was given by the PI. Each item in the questionnaire was discussed separately and explained using teachers' manual. Two

children from each class were selected and a demonstration session with the teachers was done. The class teachers were given adequate time period to observe the children for each learning behavior before completing the questionnaire.

Supervision

Questionnaires were completed by the teachers in the class room setup. During this period PI randomly selected few schools in each division and met the teachers. Teachers were inquired about difficulties encountered and PI randomly checked the filled questionnaires for completeness. Most of the teachers could complete the questionnaire in 20 to 30 minutes time. After one month time period PI collected the completed LDSQ (PSC) questionnaire, the response rate was 100%.

3.2.1.10.3.8 Stage II- Data collection from primary caregiver using Interview Administered Demographic and Socioeconomic questionnaire (Figure 2.7).

- **Training of Field Investigators (FI)**

Four Sociology Graduates were trained as FI to collect data from parents using IAQ. The purpose of the study was carefully explained initially. The importance of taking informed written consent, ensuring confidentiality and minimizing non-response was emphasized during this training. Each item in the instrument was discussed along with an interviewer guide (Annex XXV). Errors that can arise in data collection were discussed and precautionary measures to overcome such errors were explained. A practical session was carried out in a school that was not included in the study proper. Each interviewer carried out three interviews under the supervision of the PI.

- **Interview of primary caregiver**

This stage was initiated as soon as the eligible children were selected for stage I. Teachers were explained the importance of parental support to make the study a success. The interview was conducted mainly with maternal caregivers. In the absence of maternal care givers paternal caregivers were interviewed. In the absence of a parental caregiver, a non-parental caregiver was interviewed. With the schools' support primary caregiver was invited to school to participate in the study. This was specially carried out in Type 1C, Type 2and 3 schools. Primary caregivers of Type IAB schools were interviewed on the day

of parent teacher meeting or class circle and in some occasions by arranging a special health day. All the interviews were arranged in a calm place where privacy could be maintained.

- **Supervision**

At the beginning of the study, PI visited all the schools and mainly engaged in selection of classes, selection of clusters, training of teachers and testing of IQ. Similarly, PI ensured close supervision of screening of vision and hearing by the pre interns. During administration of demographic and socio economic IAQ, PI selected a team of FI in one of the division in every week and closely supervised throughout the entire duration of the data collection. PI periodically checked the questionnaires when the data collection is going on in the field for accuracy and completeness.

- **Measures to minimize non-participation**

Parent information sheet explaining the importance of the study and benefits for the child and other children was sent to the parent of each child.

The invitation letter for parent interview was sent to the parents with the involvement of school principals and class teachers.

Interviews were arranged on the day of parents meeting or class circle in some schools to improve participation.

Special mental health programmes were arranged with the support of Mental Health Unit – NIHS and area Public Health Inspectors in charge of particular schools in order to improve participation.

3.2.1.11 Measures to ensure quality of data

At every stage of the study, measures were taken to ensure validity and reliability of data and to minimize bias. Following measures were taken to ensure the quality of data.

3.2.1.11.1 Measures taken to ensure quality of data during selection of the sample

- The information regarding the schools was obtained from most recent school census obtained from the office of Provincial Director of Education, Western Province.

- Every stage of sample selection was done according to the described selection procedure mentioned in methodology.
- Eligibility criteria were strictly applied during selection of study units by PI
- During selection of study units random selection was done adhering alphabetical ordering of names

3.2.1.11.2 Measures taken to ensure quality of data during designing of the study instruments

- PI strictly adhered to the scale development procedure described in standard text books during the development of LDSQ (PSC).
- Questions were worded clearly using simple language and teacher instruction manual was prepared in order to clarify the questions when needed.
- Technical terminologies were avoided whenever possible during the preparation of socio demographic questionnaire

3.2.1.11.3 Measures taken to ensure quality of data during data collection

- Trained pre intern medical officers conducted the screening of vision and hearing as they had the knowledge and experience in measurement procedures.
- Only one pre intern was trained for each screening procedure in order to minimize inter observer variation
- IQ testing was performed by the PI in order to minimize variation
- Four trained sociology graduates (FI) were selected to facilitate organization and conduction of parent interviews. Training, supervision and the provision of an interviewer guide helped in reducing the interviewer variation.
- Questionnaires were checked for completeness once the interview session was over.
- PI re administered the IAQ for 2.5% of the sample of parents and accuracy was ensured

3.2.1.12 Data entry and statistical analysis

Data entry was carried out by the PI using the software EpiData 3.1 package. Following data entry, frequency distributions of categorical variables were examined and incomplete

entries were identified and corrected after tracing the original questionnaire. Statistical analyses was done using the software package SPSS (version 20) by the PI. Descriptive analysis of socio-demographic profile was done. Prevalence of each type of LD was assessed by using the clinically validated cut off points for each subscales identified under Component I.

3.2.1.13 Ethical Consideration

Following measures were undertaken to minimize ethical issues related to the study.

- Ethical clearance for the study was obtained from the Ethics Review Committee of the Faculty of Medical Sciences – University of Sri Jayawardanapura.
- Participation of teachers and parents in the study was strictly on a voluntary basis.
- All participants were informed of the study details and written consent was obtained prior to the commencement of any data collection.
- The interviews were conducted in a convenient place where privacy could be maintained.
- Names of the children were obtained in order to trace the parents. Names, address and contact details were obtained from the parents to arrange relevant interviews and conduct the case control study. These were explained to the parents and all the information were kept under lock and key by the PI until data entry. All other personal details provided by the participants were also treated as strictly confidential.
- PI referred the children who were diagnosed to have vision and hearing problems to relevant clinics with the consent of parents.
- PI referred the children who were screening positive for LD after considering the opinion of the mother and teacher to Child Guidance Clinic in nearby Hospital.
- All details regarding the children who were diagnosed to have LD were kept confidential with PI.
- Teachers were instructed to keep all information very confidential.

3.2.2 Sub component 2- Description of behavioral comorbidities of LD among primary school children in grades three and four

3.2.2.1 Study design

This was a descriptive cross sectional study to describe different behavioral problems that exist as comorbid conditions of LD.

3.2.2.2 Study setting

Study setting was the same setting where the sub component 1 of the study was conducted (Section 3.2.1.2).

3.2.2.3 Study Population

The study population included all children in grades three and four attending Sinhala medium government schools in the district of Kalutara.

3.2.2.4 Study sample

Same study sample selected for prevalence study (sub component1) was used as the study sample (Section3.2.1.5).

3.2.2.5 Inclusion and exclusion criteria

As this component was conducted to determine behavioral comorbidities of LD same inclusion (Section 3.2.1.6) and exclusion (Section 3.2.1.7) criteria which had been used for sub component 1 was used.

3.2.2.6 Data collection

3.2.2.6.1 Data collection instrument

- **Selection of Strength and Difficulties Questionnaire (SDQ) – Teacher version (Annex XXVI A and B)**

Many instruments have been used around the world to assess the behaioural problems of children. However, most of the tools are age specific, and therefore cannot be used in children who are outside the age range specified for that instrument. Out of all instruments that can be used to measure behavioral problems among PSC, most commonly used ones

are the Child Behaviour Checklist, Strengths and Difficulties Questionnaire. Rutter's Scales, Behavior Assessment System for Children, Pediatric Symptoms Checklist, and Eyberg Child Behaviour Inventory.

Considering the work load of the teachers, the expert panel suggested to use a simple questionnaire with less number of items for this component of the study. SDQ had been translated in to Sinhala language and had been used in several studies in Sri Lanka. Self-administered version was validated to Sri Lanka (Perera, 2004). Therefore after expert opinion it was decided to select SDQ to assess the behavioral problems among these children. As assessment of this age group includes Parent and teacher versions of SDQ (4-16 yrs.), it was decided to select only teacher version for the current study as self-administered parent version would not provide valid results due to varying literacy level of the primary caregivers.

This is a brief behavioral screening questionnaire developed based on both DSM-IV and ICD-10 classification. It exists in several versions to meet the needs of researchers, clinicians and educational specialists. The questionnaire is available in the form of parent and teacher versions for ages 4 to 16 years (Goodman, 1997) .All versions of the SDQ have 25 items on psychological attributes; some are positive and others negative. These 25 items are grouped in to five scales and each scale consists of five items which should be rated as "not true", "somewhat true", and "not at all true". It generates separate scores for conduct problems, inattention-hyperactivity, emotional symptoms, peer problems and pro-social behaviour. The difficulties of each child in each behavior were assessed. All the subscale scores except pro social behaviour was summed to get a total difficulty score (Annex XXVII).

- **Validity of SDQ**

Self-rated version of SDQ for the age group 11-16 years was translated and validated in Sri Lanka (Perera, 2004). The cut off points for this version was similar to the original version. Although the translated versions of parent and teacher formats were available, it was not validated. During validation of above version face, consensual, content and semantic validity were assessed.

- **Reliability of SDQ**

Test-retest reliability

Ten selected teachers were asked to rate the behavior of five randomly selected children from each class using teacher format of SDQ. Total score for both occasions were compared to measure the test-retest reliability.

- **Pre testing of SDQ**

Teacher version of SDQ was pre tested among a group of 10 teachers with the pre testing of LDSQ (PSC). Teachers were asked whether the questions were comprehensible. Wording used made any of the items difficult to answer, confusing, difficult to understand, or whether the teachers would expect to ask particular question in a different way.

3.2.2.6.2 Completion of SDQ by the class teachers

This part of the study was also conducted with the prevalence study from May to December 2013. As this component of the study was also conducted together with subcomponent 1, same eligibility criteria were applied during data collection. Teacher version of SDQ was given to the teachers as a self-administered questionnaire together with LDSQ (PSC). PI explained the objective of assessing behavior in children with learning difficulty. And teachers were asked to fill the questionnaire from the observation they have made about the behaviour of each child in the class room setting.

3.2.2.7 Data entry and analysis

Scoring of SDQ was done according to the manual provided by the author. Data entry was done using Epidata software and data analysis using SPSS (version 20). Difficulty score for each behavioral problems, emotional scale, conduct problem, peer problem and hyperactivity was computed according to the instruction provided by the author on scoring of teacher version of SDQ (Annex XXVII). Both borderline and abnormal categories were considered as abnormal during analysis. A total difficulty score was computed using above scale scores. Problem behaviours among children with and without LD were analyzed.

3.3 Component 3

3.3.1 Study design

A case control study to identify selected risk factors of LD in a sample of primary school children in grades three and four in the district of Kalutara.

3.3.2 Study setting

Study setting was the same as sub components 1 and 2 (3.2.1.2)

3.3.3 Study population

The study population consisted of children with LD (cases) and without LD (controls) who fulfilled the following eligibility criteria.

- **Definition of "case"**

Case- A grade three or grade four school child identified as having all three types of learning problems by LDSQ (PSC) and confirmed as a LD child after clinical assessment by Medical Officer Mental health (MO-Mental health).

Exclusion criteria

Children identified as having LD but residing with a non-maternal primary care giver were excluded from the study.

- **Definition of "control"**

Control- A grade three or grade four school child identified as not having any type of LD by LDSQ (PSC) and confirmed as a Non LD child after clinical assessment by a MO-Mental health.

Exclusion criteria

Children identified as Non LD but residing with a non-maternal primary care giver were excluded from the study.

3.3.4 Sample size

The sample size (n) was calculated using the following formula for unmatched case-control studies (Schlesselman 1982).

$$n = \frac{[Z_{1-\alpha/2}\sqrt{(2pq)} + Z_{1-\beta/2}\sqrt{p1q1+p0q0}]^2}{(P1-p0)^2}$$

$$n = \frac{2x\,(Z_{1-\alpha/2} + Z_{1-\beta/2})^2 x p\,(1-p)}{(P1-p0)^2}$$

α desired probability of type I error or the level of significance which was taken as 0.05

β desired probability of type II error which was taken as 0.20

$1-\beta$ the desired study power which was taken as 0.80

$Z_{1-\alpha/2}$ corresponds to 1.96

$Z_{1-\beta/2}$ corresponds to 0.84

R Odds Ratio (OR)

$$p1 = \frac{p0\,R}{1+p0\,(R-1)}$$

$$p = \frac{p1+p0}{2}$$

There are no available data on risk factors for LD in Sri Lanka. Therefore hypothesized odds ratio (OR) which was selected as 2 was taken as the desired OR for the present study. Anticipated exposure prevalence (P_0) among controls was taken as 50%.

The sample size was calculated as follow:

p0 = proportion of exposure among controls = 0.5

R = 2

p1 = proportion of exposure among cases

$$= \frac{0.5*2}{1+(0.5*(2-1))} = 0.67$$

$$p = \frac{0.67+0.5}{2} = 0.58$$

$$n = \frac{2x\,(1.96 + 0.84)^2 x 0.58 x 0.42}{(0.67-0.5)^2} = 131.7$$

According to the above, a minimum of 132 cases and 132 controls were needed. Further adjustment for non-response was calculated considering a non-response rate of 5%.

$n_a = n / (1-r)$

r = non response rate

$n_a = 132 / (1-0.05) = 139$

Therefore, a total of 139 cases and 139 controls were selected to the study.

3.3.5 Sampling technique

a) Selection of cases:

This part of the study was conducted after the prevalence study. At the beginning of selection procedure total number of children detected as LD by LDSQ (PSC) during prevalence study was listed out. Out of total 336 children identified to have LD during prevalence study, 145 (43.2%) and 108 (32.1%) children had all three and two problems respectively. From the group of children with all three problems four children with non-maternal caregiver were excluded (This was decided from the data available from the prevalence study). All 141 children with all three learning problems were listed out with their schools and grades. These children were confirmed by MO MH as having LD and were recruited for the study. MO MH who involved in clinical diagnosis had a diploma in Psychiatry and more than ten year service experience in the field of Psychiatry. He had training on diagnosing LD because MOMHs involve in routine identification of LD children during School Medical Inspection.

b) Selection of controls

Once the case was detected, a child without any type of LD who fulfilled the eligibility criteria and participated in the prevalence study was selected randomly from the same school and grade as controls. The selected children were then confirmed as controls by MO Mental Health after clinical assessment.

3.3.6 Data collection

3.3.6.1 Study instrument for data collection

Interviewer administered Risk Factor Questionnaire was used as the study instrument for this part of the study (Annex XXVIII A and B).

- **Development of Risk Factor Questionnaire**

During literature search of similar studies PI was able to found possible risk factors that other studies had studied and these factors were incorporated in to the present questionnaire with expert opinion.

Several key informants interviews were conducted for data generation during preparation of LDSC (PSC). During these interviews potential risk factors for LD were questioned from the service providers. And these items were also incorporated as possible risk factors for LD. During the key informant interviews with teachers, children with possible LD were identified and personal discussions were made with the mothers of these children. Possible factors identified for LD during these discussions were also included in the study instrument after expert opinion.

Thus the potential risk factors to be included in the study instrument were identified through

1. Literature review
2. Expert opinion
3. Key informants interviews with teachers
4. Discussion with mothers of possible LD children.

Based on this information a list of variables with operational definitions were prepared together with the supervisors. The questionnaire was prepared under 8 broad areas. As the demographic and socioeconomic variables were incorporated in to the demographic and socio economic IAQ, following areas were included in the risk factor questionnaire.

1. Maternal perinatal factors
2. Infancy related factors
3. Developmental factors
4. Early childhood related factors
5. Family related factors
6. Factors related to home physical environment

The questionnaire was structured and administered by an interviewer who was a pre intern, so as to avoid responses getting affected by varying levels of education and reading ability of the study population. The questions were arranged in such a way to achieve the best line of flow. Specific instructions for interviewers were given in a separate interviewer guide (Annex XXIX).

- **Translation of Risk Factor Questionnaire**

Original questionnaire was prepared in English language. The questionnaire was translated into Sinhala language from the original English version. The forward-backward translation methodology was employed in the translation of the study instrument.

a) Forward translation (English → Sinhala)

Two translators with medical knowledge, both with a high level of fluency in English and Sinhala languages, independently translated the questionnaire into Sinhala language. The two forward translations were then compared by an independent expert in Sinhala language.

- Where there was agreement, the items were accepted for forward translation.
- Where there were differences, these were resolved through discussion with the translators to yield a provisional translation.
- Where disagreement was difficult to resolve, alternative wording were offered in the provisional forward translation (for resolution through the back translation process).

The provisional forward translation was then back translated.

b) Back translation (Sinhala → English)

Two more translators, both with a high level of fluency in Sinhala and English languages and medical knowledge, independently translated the provisional forward translation of each questionnaire back into English without reference to the English original. The independent expert in English language compared the English translation with the original questionnaire.

- Where there was agreement between the translation and the original, those sections of the provisional forward translation were considered as ready for pre-testing.
- Where there were differences, these were resolved by discussion with the translators. Where agreement was reached, the relevant sections of the provisional translation were then regarded as ready for pre-testing.
- Where agreement was not reached, revisions were arrived at by repeating the forward-backward translation process until the back translation was sufficiently similar to the original model.

- **Assessment of validity of Risk Factor Questionnaire**

Validity of most items of the questionnaire was ensured during the development of the questionnaire as experts were involved during the process of development. The entire questionnaire was reviewed by the same panel of expert (mentioned in Component I of the study) for face validity, content relevance, appropriateness of the wording, suitability of questions to local context and consensus was achieved. Final Risk factor questionnaire was then prepared.

- **Pretesting of the Risk Factor Questionnaire**

Pretesting of Risk Factor Questionnaire was done among a group of mothers of primary school children (n=20) in a school in Dehiwala MOH area. Each questionnaire item was discussed separately to determine whether the wording used made any of the items difficult to answer, confusing or difficult to understand. Acceptability of the questionnaire and feasibility of tracing pregnancy records and other relevant documents were also assessed. Relevant modifications were made for the final questionnaire. Time taken for a single interview was 10 to 15minutes.

- **Assessment of reliability of Risk Factor Questionnaire**

Once the initial interview was over a subsample (n=20) from the same group of mothers were re interviewed two weeks apart on five randomly selected variables in the questionnaire. Response categories were compared to assess test retest reliability.

Inter-interviewer reliability of the questionnaire was measured by administering the questionnaire to a group of 20 parents. Each FI (pre interns) administered the questionnaire for 10 parents and this as re administered by the PI. Five selected variables were assessed for inter interviewer reliability.

- **Study variables and operational definitions (Conceptual frame work – Annex XXX)**

Following study variables that were considered as risk factors were incorporated in to demographic and socioeconomic IAQ.

1. Age of the child (Date of birth)
2. Sex of the child

3. Ethnicity of the child
4. Religion of the child
5. Sector of residence - Whether residence is urban or rural
6. Educational status of parents – Highest educational level achieved. (Both parents educational status was considered highest level of education either fathers or mothers was taken as educational status of parents
7. Whether parents employed or not- either mother or father is employed, it was considered as employed
8. Type of occupation –
    a. Full time and spend nights outside home – full time work was defined as working 40hours or more per week and spending at least 2 or more nights per week outside home
    b. Full time and spend nights at home – Works 40 or more hours per week and spends all nights at home or Works 40 or more hours per week and spends one night per week outside the house
    c. Part time out side home – Works less than 40 hours per week and spends all nights at home
    d. within the home – does a home based occupation

9. Monthly family income in rupees
10. Socio economic status (measured by social class and Wealth index)

Following study variables that were considered as risk factors were included in the Risk factor questionnaire

1. Maternal perinatal factors

Maternal perinatal Scale (Hill, 1998) was also utilized during the item generation. Some of the items in maternal perinatal scale were incorporated after considering availability of documents in local context and ability of recalling.

Factors related to pre conception.

History of subfertility

- Subfertility (primary or secondary) - failure to achieve a clinical pregnancy after 12 months or more of regular unprotected sexual intercourse

- Parity of the index child: An intrauterine or ectopic pregnancy confirmed by hCG irrespective of the period of gestation and the outcome

Outcome of previous pregnancies

- Live birth - Fetus, irrespective of its gestational age exiting the maternal body and subsequently showing signs of life
- Still birth – A baby born with no signs of life at or after 28 weeks' gestation.
- Abortion - Intentional or unintentional premature exit of the products of conception (the fetus, fetal membranes and placenta) from the uterus.
- Ectopic pregnancy - development of a fertilized egg elsewhere than in the uterus (as in a fallopian tube or the peritoneal cavity).

During analysis live birth was compared with all other types together

Factors related to the antenatal period of index child.

- Planned pregnancy or not - Pregnancy status of indexed child was an intended/ wanted one
- Nature of the pregnancy (single/twin)
- Diseases complicating pregnancy – Whether one or more of the given list of diseases present or not
- Smoking during the pregnancy period of index child
- Consumption of alcohol
- Taking drugs
- Violence during pregnancy – Assessed by a statement from the Abuse Assessment Screen "since you have been pregnant, have you been hit, slapped, kicked, or otherwise physically hurt by someone? (Rebecca et al, 2009)
- If yes, by whom?
- Perceived psychological wellbeing during antenatal period (prepared a study specific instrument with five statement regarding care, nutrition and support during pregnancy)
- Age of mother at the time of delivery
- Marital status of the mother at the time of delivery
- Period of conception at the time of delivery
    - Term - Birth of a baby at or after completion of 37 weeks of gestational age

- Pre term - Birth of a baby of less than 37 weeks of gestational age

- Mode of delivery
  - Normal Vaginal delivery
  - Assisted vaginal delivery (Delivery is assisted by using forceps, vacuum etc)
  - Elective cesarean section (cesarean section but already planned)
  - Emergency cesarean section (cesarean section but unplanned and performed due to an emergency reason)
- Presenting part of the fetus at the time of normal vaginal delivery
  - Cephalic presentation (The first part comes out is the head)
  - Breech presentation (The first part comes out is the buttock)
  - Other presentation

Factors related to neonatal period

- Birth weight in grams
- Apgar score at 5 min
- Presence of delivery complications
  - Fetal distress/ Birth trauma/ Meconium aspiration
- Presence of neonatal complications
  - Jaundice <24hours/ Jaundice >24 hours/ Feeding difficulty/ Hypoglycemia/ Neonatal meningitis/ Neonatal sepsis/ congenital deformities
- Receipt of care at Premature Baby Unit (PBU)
- Duration of stay at PBU

2. **Infancy related factors (Child needed special attention during infancy)**
   - Congenital abnormalities requiring special care
   - Severe maternal illnesses after delivery
   - Meningitis during infancy
   - Febrile or non- febrile fits
   - Frequent hospitalization
   - Formula feeding during 1st four months
   - Filature to thrive

- Feeding and weaning difficulties
- Death of father
- Separation from mother/father
- Frequent change of primary care giver
- Exposure to anesthesia.

3. **Developmental factors**
   - Delayed or abnormal crawling
   - Delayed or abnormal walking
   - Delayed or abnormal speech.

4. **Early childhood related factors**
   - History of febrile/non febrile fits – Episodes of fits with fever spikes or without fever spikes
   - Recurrent middle ear infection with effusion
   - Child with Special Health Care Need (SHCN) (Altarac, 2007) – Assessed by four statement.
     - Recurrent hospital admissions
     - Regular clinic visits
     - Long term medication use
     - Use of mental health care services at any time during early childhood.
   - Primary care giver during early childhood – Who mainly did the daily caring and rearing of the child
   - Exposure to major life events – Presence of one or more major childhood life events. Some items were derived from Child Life Events Longscan (1992).
   - Sleep disorders – Assessed from four statements.
   - Allergic rhinitis – Questions were derived from Patient Allergic Rhinitis Questionnaire (www.guideline.audit.com). Higher values above median indicate symptoms suggestive of allergic rhinitis
   - Exposure to anesthesia
   - Age 1st attended to preschool

- Dominant hand of the child – The mostly used hand of the child, whether right or left.

5. **Family related factors**
   - Type of family – Whether members other than own family members living in the house (extended family Vs. nuclear family)
   - Nature of the family. Whether single mother family, step family or family with on mother and father
   - Presence of siblings (elder, younger, both and no siblings)
   - Family history of LD – Whether father, mother or siblings having reading, writing or math LD.

6. **Home physical environment**
   - Total number of members in the house
   - Smoking status of father – duration of smoking and frequency of smoking were obtained. Frequent smoker was defined as " smoking for >5years and one packet or more than one packet a day
   - Status of alcohol intake by father – duration of taking alcohol and frequency of taking alcohol were obtained. Frequent alcohol user was defined as " taking alcohol for >5years and daily/ several time a week
   - Whether the father of the child using drugs
   - Any sibling with cognitive, psychological problems needing special attention
   - Home disagreement pattern- behaviour pattern of the mother during a disagreement with family members (Moore, 2005). Assessed by asking the mother about the type of behaviour
     - Discuss the disagreements calmly;
     - Argue heatedly or shout;
     - End up hitting or throwing things.

     For each question, the response choices were "Never", "Rarely", "Sometimes", "Usually", or "Always".

     Violent disagreement- disagreements involved *hitting or throwing*, even rarely, the household was categorized as having "violent disagreements."

Heated disagreement- if the respondent did not hit or throw, but reported heated argument and shouting "sometimes," "usually," or "always," the household was classified as having "heated disagreement.

Calm - if the respondent did not hit or throw, and only rarely reported shouting, the household was classified as "calm" in its disagreement style.

- Storage of pesticides/ insecticides inside the house or handling of pesticides/insecticides

3.3.6.2 Data collection

- **Training of Field Investigators**

The two pre intern medical officers who were trained for the sub component I of the study (for screening of vision and hearing) were trained for this part of data collection. It was suggested to select pre interns as data collectors as several questions were health related and data extraction from medical records was also needed. A one day training programme was done; an interviewer guide with necessary instructions on each and every item in the Risk factor questionnaire was prepared.

- **Period of data collection**

This part of the study was conducted after the prevalence study from January to March 2014.

- **Method of data collection**

Once the cases and controls were confirmed, Using contact information obtained during the prevalence study, the mothers of these children were invited to school. They were asked to bring the following records.

1. Child Health Development Record (CHDR) of the child
2. All pregnancy records of the mother
3. Diagnosis cards related to mother and child.

Mothers were interviewed by the FIs. All records were checked to ensure accuracy of data. During the supervision of the interviews PI checked 5% of the questionnaires randomly for accuracy and completeness. The mothers who did not attend for the interviews were

contacted and interviews were arranged at home. The mothers who could not be contacted by both methods were considered as non-responders.

3.3.7 Measures to ensure quality of data

- Selection of children with only maternal caregiver
- Preparation of the questionnaire in a standard way while preserving validity of the questionnaire
- Training of Pre intern Medical officers as FIs
- Preparation of an interviewer guide to maintain uniformity
- Minimization of recall bias by reconfirming the information with available records
- Supervision of data collection by PI and checking the questionnaires for completeness
- PI re administered the questionnaire to 5% of the sample of mothers and accuracy was ensured
- Assistance of Public Health Inspectors was obtained during school visit.
- Minimization of non-responses by interviewing the absentees at home.

3.3.8 Data entry and analysis

Data entry was carried out by the PI using Epidata 3.1. Following data entry, the frequency distribution of categorical variables were examined and incompatible entries were identified and corrected after referring to the original questionnaire. Statistical analysis was done employing the software SPSS- Statistical Package for Social Sciences (version 20).

The potential risk factors of LD were analyzed using bivariate cross tabulation and calculation of odds ratio (OR) and 95% confidence interval. Statistical significance for the association was calculated based on the chi square test, a p value of <.05 was considered as statistically significant. The potential risk factors that showed significance in the bivariate analysis were entered in to the logistic regression model for multivariate analysis. The OR with the 95% CI was calculated using binary logistic regression to quantify the strength of association between LD and the potential risk factors. Results were expressed in terms of exact of ORs and 95% CI.

The variable with only 2 levels of responses were used as it is in the cross tabulation. For the variables which had more than 2 levels of responses, the response categories were amalgamated to be used in the cross tabulation.

The variables in which the responses were amalgamated for cross tabulation are presented below.

1. Ethnicity- categorized as "Sinhalese" and all the other ethnicities together as "Others".

2. Religion- categorized as "Buddhists" and all the other religions together as "Others".

3. Parent education- highest level of education either father's or mother's was taken as educational status of parents. Never gone to school and schooling up to grade 6 to 10 was categorized as <O/Level. Passed GCE O/L and above education was considered as ≥O/Lvevel.

4. Social class- Social class I and II were grouped together as "high" social class and social class III, IV and V were grouped together as "low".

5. Wealth quintile- This was categorized in to five quintiles, 1st quintile as poorest and 5th quintile as richest during prevalence study. During bivariate analysis 1st (poorest) to 3rd quintile was amalgamated as "poor" wealth quintile group while 4th and 5th (richest) was amalgamated as "rich" wealth quintile.

6. Marital status of the mother at the time of delivery- Categorized as married and unmarried during analysis. Marital status, unmarried, divorced, separated and widowed were amalgamated as "unmarried".

7. Prior pregnancy outcome- This was categorized as "live" and "other". Mothers with a prior history of subfertility and live births were amalgamated as live. Mothers with a history of intrauterine deaths, still births, abortions and ectopic pregnancies were amalgamated as "other" prior pregnancy outcome.

8. Parity of the index child- This was categorized as "low" parity and "high" parity. 1st (P_1) and 2nd (P_2) parity was amalgamated as low parity. Parity of P_3 and above was categorized as "high" parity.

9. Pregnancy related disease- This was estimated as "No disease" or presence of one or more diseases. If the mother did not have any diseases mentioned in the questionnaire during the pregnancy of index child it was considered as "No diseases". If mother had any of the diseases mentioned, it was considered as "one or more diseases"

10. Violence during pregnancy- This was estimated by a single statement in the Abuse Assessment Questionnaire. If mothers responded yes, it was considered as "yes". As 100% of the participants said that violence was caused by the husband, this part was not analysed.

11. Perceived psychological wellbeing during pregnancy- This was estimated by a study specific scale which had five statements related to psychological wellbeing during pregnancy. Scale was prepared as a five point Likert scale and converted in to a binary scale during analysis using "binned variables". The score above the median value was .considered as bad psychological wellbeing and below the median as good psychological wellbeing.

12. Presence of delivery or neonatal complications- This was estimated by 12 complications that a child would experience during neonatal period. During analysis it was categorized as "No" and "One or more". If the child experience one or more types of complication it was considered as "One or more".

13. Duration of PBU care- During analysis this was categorized by number of days. No PBU stay and stay ≤3days was amalgamated as ≤3days stay.

14. Child needed special attention during infancy- This was estimated by a lsit of problems during infancy that needs special attention. Presence of one or more problems was categorized as "Yes" while absence of problems was considered as "No".

15. Motor delay- This was estimated by checking the presence of walking delay or delay in crawling. Presence of either delayed or abnormal walking or delayed or abnormal crawling was considered as motor delay during analysis.

16. Sleep problems- Used 4 statements to estimate whether there are symptoms suggestive of sleep problems. Scale was prepared as a five point Likert scale and converted in to a binary scale during analysis using "binned variables". The score above the median value was .considered as presence of a sleep problem while below the median as absence of a sleep problem..

17. Allergic rhinitis- Assessed by Patient Allergic Rhinitis questionnaire which has five items rated from 1(Never) to 5 (Always) using a Likert scale. Total scale score more than the median score was considered as "Yes" while less than the median value was considered as "No".

18. Child with Special Health Care Need (SHCN)- This was estimated by four statements. During analysis categorized as "No" and "One or more". Presence of one or more criteria of Special Health Care Need was categorized as "One or more".

19. Life events during early childhood- Presence of one or more life events in the child life event scale was categorized as "Life event present" and absence of life events was categorized as "Life event absent".

20. Parental occupation type- Estimated using the Socio demographic IAQ that assess the place of occupation (home/outside home), working hours per week (<40hours or 40 hours or more), spending night at home or not. This was initially categorized as.

- Full time and spend the nights outside home
- Full time and spend nights at home
- Part time out side home
- within the home – does a home based occupation

During bivariate analysis this was re categorized as Type I and Type II. Full time and spend the nights outside home was named as Type I. Occupation type full time and spend nights at home, part time out side home and within the home was amalgamated and name as Type II.

21. Sibling category – Categorized as "No younger siblings" and "One or more younger siblings". Elder siblings only and no siblings groups were amalgamated as "No younger siblings".

22. Father's smoking status- This was categorized as "Non frequent smoker" and "frequent smoker". Smoking< 5years, >5years but less than a packet/day or other category, non-smokers and single mother family were amalgamated as non-frequent smokers.

23. Father taking alcohol- This was categorized as frequent users and non-frequent users. During bivariate analysis non-alcoholic, taking alcohol for <5years, taking alcohol for >5years but monthly or occasionally and single mother groups were amalgamated as "Non frequent users".

24. Home disagreement pattern- Categorized as "Non-violent" and "Violent". Nonviolent pattern included the group discussing the disagreement calmly. Heated argument group and hitting and throwing things group were amalgamated as "Violent" category.

3.4 Component 4

A qualitative study to describe LD specific psychological distress among parents of children with learning difficulty

3.4.1 Study design

After considering all available methods on qualitative data collection, it was decided to conduct focus group discussion (FGD) to obtain qualitative data

3.4.2 Study setting - same as above

3.4.3 Study population

The study population was the mothers of children with LD in the district of Kalutara. Mothers were selected since mothers have traditionally been more involved than fathers in the day-to-day responsibilities of child rearing and educational activities that they would experience more stress than fathers (Montemayor, 1982).

3.4.4 Study sample

The study sample was the mothers of children with LD selected for the case control study in the division of Kalutara

3.4.5 Sample size

Focus group discussions were conducted until the theoretical saturation point was reached.

3.4.6 Sampling method

A purposive sampling method was applied for the selection of mothers for FGD. They were selected based on the extent of the LD of the child, representing working as well as non-working mothers and different educational levels to capture the variation of the experience. A group of 8 to 10 mothers were selected for a single FGD.

3.4.7 Exclusion criteria

Mothers who experienced any acute stress conditions like death of husband or death of a child within last three months and who were on treatment for any psychiatric conditions was excluded from the study.

3.4.8 Study instrument

The study instrument was a set of guidelines (FGD) that was developed to probe for responses. Based on the findings of the literature review a FGD with open ended questions was prepared. A flexible loose structure was ensured to accommodate variety of information, experiences and to encourage discussions (Annex XXXII A and B).

The guide was reviewed by an expert in psychiatry and community medicine (with experience in qualitative research) for wording and sequencing of the questions.

FGD guide was pre tested by performing one discussion with 8 mothers. This helped to find out difficult areas for probing and to determine average time duration for interview and transcription of materials.

3.4.9 Data collection

Data collection for this part of the study was conducted during January to March 2014.

All the FGD were moderated by PI with the help of a note taker. The PI and the note taker were trained on FGD by a Consultant Community Physician with the experience of conducting qualitative research.

Pre arrangements with the mothers were done when they presented for the data collection of case control study in the school. After explaining the objective of FGD consent was obtained. As it was suggested to conduct FGD in a place other than the child's school to encourage a free flow of information, it was arranged in the field at Public Health Midwives' (PHM) offices.

FGDs were organized with the help of area PHMs at their offices in evenings. The moderator explained the objectives of the study, topic to be discussed and the importance of mothers' contribution for the success of the study. Moderator also obtained permission

for taking notes and recording of information provided during discussion. They were further explained that the confidentiality of all information would be ensured.

Moderator initiated the discussion in a friendly manner and a non-judgmental attitude was maintained throughout the discussion. The note taker wrote down all verbal responses in the respondents' words while non-verbal responses were noted down as gestures. Each FGD was conducted over one to one and half hour. These FGDs were conducted until theoretical saturation point was achieved. Thus, altogether six FGDs were conducted to collect data on parental psychological distress.

3.4.10 Analysis of the Qualitative data

Analysis was done by the PI by going through the notes taken and recording done during the discussions. Immediately after each FGD transcripts were made by the PI with the assistance of note taker. The exact words that respondents used were written down. The transcripts were coded and the compilation of data was done according to the main domains that were discussed.

The principals steps involved in analysis of data included narration, coding, ordering and data reduction, summarizing data in compilation sheets, presentation and conclusion.

Narration was done by the PI by transcribing the proceeding of the FGD verbatim from recorded cassettes and it was augmented by the written records.

Elaborated narratives were coded and rough categories were made from answers that seemed to be belonging to similar categories. Next all the answers were listed per code. Labels were checked to see whether the coded item fits in to categories. A final list of labelled categories with coded data was obtained.

Ordering and reduction of data was done to make analysis easier. Ordering was done in relation to the objectives and discussion topics. Reading and re reading of objectives and moderator's guide was carried out. All key words belonged to a certain topic in the subcategories were listed out. Data were interpreted to ensure categorization in the most suitable and appropriate topic.

Ordering of data was followed by compilation of data in each category separately. Matrices were used for easy comparison between different set of data on important variables, which were presented as key words.

The presentation was done by listing information obtained under main pre identified areas.

3.4.11 Measures to ensure quality of data

- PI and the note taker were trained on conducting FGD by an expert in qualitative research
- FGD guides were prepared to ensure uniformity of information
- A convenient sample was selected after considering ability of obtaining more relevant information.
- Information were recorded and notes were taken
- Transcript were prepared immediately after the discussion by PI and note taker

Ethical consideration

Verbal consent of mothers was taken

Privacy and confidentially was maintained at every points from data collection to data analysis and presentation.

Note taking and tape recording was done only with the permission of the mothers.

CHAPTER FOUR

RESULTS

The present study was carried out as a quantitative component and a qualitative component. The quantitative component was conducted to determine the prevalence, to describe the behavioural comorbidities and to identify the risk factors of LD among primary school children in grades three and four. The qualitative component was carried out to describe the maternal concern towards parenting children with LD. The results section is arranged according to the objectives of the study (pg.10)

4.1. Component I: Development and validation of LDSQ (PSC) to assess LD among primary school children in grade three and four

During the first phase of this component, a new teacher administrated screening instrument – Learning Difficulty Screening Questionnaire for Primary School Children {LDSQ (PSC)} was developed to assess LD among primary school children.

4.1.1. Phase 1: Development of LDSQ (PSC)

The process of development of the new instrument, LDSQ (PSC) is described in detail under section 3.1.1.Selected analysis of the questionnaire development is presented in this section.

4.1.1.1 Item Analysis

- **Inter-item correlation**

A summary of mean inter-item correlations and Cronbach's alpha for the three subscales of the final draft of the LDSQ (PSC) is given in Table 4.1. All three subscales showed average inter-item correlations in the moderate range and good internal consistency.

Table 4.1: Mean inter-item correlations and Cronbach's alpha for the three subscales of the final draft of the LDSQ.

Scale	No. of items	Mean inter-item correlation	Cronbach's alpha
Subscale 1	15	.846	.988
Subscale 2	14	.742	.976
Subscale 3	18	.630	.971

- **Cronbach's alpha**

After application of item analysis, three items from the subscale 1, reading, two items from subscale 2, writing, and five items from subscale 3, mathematics were deleted as these items increased the chronbach's alpha value when deleted. The items that increase the overall alpha when deleted for reading, writing and Math subscale is presented in Table 4.2, 4.3 and 4.4.

- **Item-total correlation**

The items in all 3 subscales had item-total correlation above 0.2 except one item in subscale 3. The item total correlation for reading, writing and Math subscale is presented in Table 4.2, 4.3 and 4.4.

Table 4.2 Item-Total Statistics of Reading subscale

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Dislike reading/Avoid reading	29.45	358.219	.825	.747	.989
Reads very slowly	29.10	346.286	.957	.944	.987
Read with many starts, stops and hesitation	29.05	342.834	.954	.957	.987
losses place while reading	29.13	343.983	.960	.966	.987
Omit, add or distort the reading matter while reading	29.11	343.512	.959	.972	.987
Tries to keep the finger while reading	29.03	341.474	.949	.947	.987
read by joining letters one by one	29.11	343.479	.967	.968	.987
Doesn't differentiate between similar looking letters and words	29.52	359.631	.775	.907	.989
Reverses words while reading	29.69	364.511	.723	.882	.990
guesses unfamiliar words while reading	29.19	349.405	.922	.919	.987
difficulty in pronouncing complex words	29.10	343.138	.955	.964	.987
Difficulty in reading words with many letters	28.92	343.026	.936	.944	.987
Fails to finish work on time due to reading difficulty	29.02	344.082	.948	.982	.987
Has poor retention in new vocabulary	29.02	344.311	.959	.989	.987
Fails to correctly answer the comprehension questions from reading activities	28.95	344.571	.931	.959	.987

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Dislikes writing/ and avoid writing	24.69	242.019	.868	.836	.974
Holds the pencil in an awkward / wrong position when writing	25.21	257.939	.604	.562	.978
Writes very slowly	24.40	233.490	.906	.886	.974
Writes letters with different sizes on the same line/writes very big or very small letters	24.89	245.807	.840	.882	.975
Has trouble in staying "on the line" while writing	25.11	258.987	.636	.603	.978
Uses uneven spacing between letters and words while writing	24.79	242.365	.882	.895	.974
Miss out / substitute letters while writing	24.68	240.353	.888	.894	.974
Reverses letters/ numbers and symbols while writing	25.05	249.391	.836	.818	.975
write complex letters incorrectly	24.40	238.507	.916	.933	.973
confuses similar looking words while writing	24.55	238.317	.922	.952	.973
Finds difficulty/ delay in copying work from a blackboard or from a text book	24.53	237.597	.913	.890	.973
Doesn't divide the words/ incorrectly divide the words when writing	24.71	239.849	.919	.874	.973
write letters with wrong pronunciations	24.52	238.844	.903	.930	.974
Write in a messy and incomplete way	24.44	242.250	.894	.822	.974

Table 4.4 Item-Total Statistics of math subscale

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
dislike/avoid doing math	34.10	271.761	.907	.812	.968
doesn't complete math work in a given time	33.94	265.832	.920	.864	.968
doesn't do math home work	33.87	263.458	.910	.812	.968
ask for help before trying math problem	33.77	262.145	.938	.814	.968
Difficulty in naming numerals	34.26	275.670	.862	.603	.969
reverse numbers when writing	34.74	298.359	.647	.895	.972
confuses similar looking numbers	34.71	296.406	.503	.627	.973
Confuses operational signs when working with math problems	33.47	263.794	.912	.828	.968
Poorly align numbers resulting in computational errors.	33.90	265.204	.909	.923	.968
Has difficulty in solving math problems requiring borrowing/simple subtraction	33.05	264.244	.940	.916	.968
Has difficulty in solving math problems requiring carrying over/simple addition	33.11	268.135	.904	.873	.968
Has difficulty in learning multiplication tables	33.35	263.347	.900	.912	.968
Has difficulty in telling time from a clock	34.61	290.372	.648	.907	.971
difficult in solving math word problem	33.32	265.599	.897	.822	.968
works math problems from left to right instead of right to left	34.15	278.093	.746	.876	.970
Has difficulty in arranging numbers in ascending or/ and descending order	33.15	261.569	.936	.972	.968
Poor left right orientation	34.74	305.408	.198	.947	.974
Has difficulty in differentiating concepts such as big/small, tall/short, few/many	34.66	299.277	.490	.968	.973

4.1.1.2 Factor Analysis

- **Assessment of factorability of correlation matrix**

The final draft of LDSQ (PSC) was assessed for factorability. All the correlation in the correlation matrix was found to be > 0.3 while all the diagonals in the anti-image correlation matrix were found to be > 0.5. All these indicate that the instrument is suitable for factor analysis. Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacyand Bartlett's Test of Sphericity were also done to assess the factorability and sampling adequacy. KMO index and Bartlett's Test of Sphericity is presented in Table 4.5.

Table 4.5 KMO index and Bartlett's Test of Sphericity.

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.961
Bartlett's Test of Sphericity	Approx. Chi-Square	27842.110
	df	666
	Sig.	.000

Factor Extraction

During factor extraction principal component analysis revealed a four component structure each exceeding Eigenvalue of one. Principal axis factoring also revealed a four factor structure. Component 1, 2, 3 and 4 explained 74.4%, 4.1%, 3.9% and 2.7% of total variance respectively. All four components together explained 85% of the total variance (Table 4.6). High communalities (>0.5) also indicated that factors extracted explained most of the variance in the item being analyzed.

Table 4.6 Total number of components extracted with Initial Eigenvalues >1

Component	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	27.561	74.488	74.488
2	1.517	4.101	78.589
3	1.464	3.956	82.545
4	1.023	2.765	85.310

- **Rotated component matrix for LDSQ (PSC)**

The four component structure after rotation is presented in Table 4.7.

Explanation of the output of rotated component matrix

Rotated component matrix (Table 4.7) for the present instrument showed several strongly loaded items on component 1, 2 and 3. All items related to reading showed highest loading on component 1 while all items except one item related to mathematics showed highest loading on component 2. The item, difficulty in naming or writing numerals showed highest loading on component 4. Out of 12 items related to writing, 8 items showed highest loading on component 3. Three items related to writing showed highest loading on component 1 while one item on component 4.

When deciding number of factors theoretical concept was also considered. With the expert opinion it was decided to drop component 4 as only two items showed highest loading on component 4. It was further justified by the analysis of component correlation matrix which showed that poor correlation of 4th component with other components (Table4.8).

As the item "reversal of letters" did not show even a minimum loading on component 3 where other items related to writing loaded, after expert opinion it was decided to drop that item. The item "difficulty in naming numerals" showed a minimum loading on component 2 as well and it was retained in the component it belonged. The 3 items related to writing that showed a highest loading on component 1 also retained in component 3 after expert opinion as these items showed some loading on component 3. Therefore, from the results obtained during factor analysis the three components, reading, writing and mathematics were reconfirmed and final version of LDSQ (PSC) was prepared.

Table 4.7 **Pattern matrix showing highest item loading on each component**

Item	Component			
	1	2	3	4
Reads very slowly	**.567**			
Read with many starts, stops and hesitation	**.719**			
Losses place while reading	**.749**			
Omit, add or distort the reading matter while reading	**.648**			
Tries to keep the finger while reading	**.842**			
Doesn't differentiate between similar looking letters /words	**.773**			
Guesses unfamiliar words while reading	**.825**			
Difficulty in pronouncing complex words	**.800**			
Difficulty in reading words with many letters and complex	**.690**			
Fails to finish work on time due to reading difficulty	**.667**			
Has poor retention in new vocabulary	**.557**		.418	
Fails to correctly answer the comprehension questions from	**.543**		.395	
Dislikes writing/ and avoids writing			**.841**	
Writes very slowly			**.701**	
Writes letters with different sizes on the same line/writes			**.558**	.325
Uses uneven spacing between letters and words while			**.709**	
Miss out / substitute letters while writing	.556		.398	
Reverses letters/ numbers and symbols while writing	.371			.582
Writes complex letters incorrectly	.523		**.532**	
Confuses similar looking words while writing	.673		.361	
Finds difficulty/ delay in copying work from a blackboard			**.751**	
Doesn't divide the words/ incorrectly divide the words			**.655**	
Writes letters with wrong pronunciation			**.323**	
Writes in a messy and incomplete way			**.682**	
Dislikes/avoids doing math		**.440**	.420	
Doesn't complete math work in a given time		**.511**	.497	
Doesn't do math home work		**.582**	.357	
Asks for help before trying math problems		**.418**	.383	
Difficulty in naming numerals/ Difficulty in writing		.388		.519
Confuses operational signs when working with math		**.741**		.339
Poorly align numbers resulting in computational errors.		**.641**		
Has difficulty in solving math problems requiring		**.946**		
Has difficulty in solving math problems requiring carrying		**.937**		
Has difficulty in learning multiplication tables		**.941**		
Has difficulty in solving math word problems		**.777**		
Works math problems from left to right instead of right to left	.397	**.634**		
Has difficulty in arranging numbers in ascending or/ and descending order		**.862**		

Extraction method: Principal Component Analysis, Rotation: Oblimin with Kaiser Normalization

Table 4.8 Component correlation matrix

Component	1	2	3	4
1	1.000	0.746	0.673	0.253
2	0.746	1.000	0.655	0.308
3	0.673	0.655	1.000	0.252
4	0.255	0.308	0.252	1.000

4.1.2. Phase 2: Validation of LDSQ (PSC)

The validity of the LDSQ (PSC) was appraised using the following two methods.

i. Judgmental validity

ii. Criterion validity

4.1.2.1 Judgmental validity

The three forms of judgmental validity (Face validity, content validity and consensual validity) of the LDSQ (PSC) were established through the process of item generation and item selection during the development of the questionnaire which is described under section 3.1.1.

4.1.2.2 Criterion validity

Criterion validity of the LDSQ (PSC) was assessed as described in section 3.1.2.2. The entire sample was examined by the Clinical Psychologist and the children with and without LD was confirmed. Children with two or all three problems were recruited as cases for the validation study. Table 4.9 show the composition of LD children recruited as cases for the validation study.

Table 4.9 Distribution of different types of LD among diagnosed children with LD

Type of difficulty	Total LD		RD+	WD+	MD+
	No	%	No	No	No
Reading, writing and mathematics	15	32.6	15	15	15
Reading and writing	11	23.9	11	11	-
Writing and mathematics	11	23.9	-	11	11
Reading and mathematics	9	19.6	9	-	9
Total	**46**	**100.0**	**35**	**37**	**35**

RD+-with Reading Difficulty, WD+= with Writing Difficulty, MD+= with Math Difficulty

4.1.2.2.1 Socio-demographic characteristics of the study population

Of the 300 children 30 children did not get the parental consent to participate in the study. Therefore 270 children participated in the study giving a response rate of 90%. Socio-demographic characteristics of the study population are presented in Table 4.10.

Majority of children in the study population was in the age group of less than 8 years (53%, n=143; 95% CI: 47-58.8)). Of the study population 58.1% (n=157; 95% CI: 51.9-64.3)) was boys. The proportion of grade four children was higher (51.1%, n=138; 95% CI: 45.1-57)) compared to grade three children. Majority of the study population (93.3%, n=252; 95% CI: 90.2-96)) was Sinhalese and Buddhist (85.6%, n=231; 95% CI: 81.6-89.6).
The proportion of children with the highest parent education (highest education of either mother or father was considered) up to grade 10 was 53% (n=143; 95% CI: 47-58.8). Higher proportion (51.1%, n=138; 95% CI: 45-57.1). of children belonged to the group of monthly family income $\leq$ 20,000 compared to children with monthly family income >20,000.

Table 4.10 Distribution of the study population by socio-demographic characteristics

Characteristic		No.(270)	%	95% CI
Age	<8 years	143	53	47-58.8
	≥8 years	127	47	41.2-53
Sex	Male	157	58.1	51.9-64.3
	Female	113	41.9	35.7-48.1
Grade attending	Grade 3	132	48.9	43.-54.9
	Grade 4	138	51.1	45.1-57
Ethnicity	Sinhala	252	93.3	90.2-96
	Other	18	6.7	4-9.8
Religion	Buddhist	231	85.6	81.2-89.6
	Other	39	14.4	10.4-18.8
Parent income	≤ 20,000	138	51.1	45-57.1
	>20,000	132	48.9	47.9-55
Parent education	Up to grade 10	143	53	47-58.8
	O/L and above	127	47	41.2-53

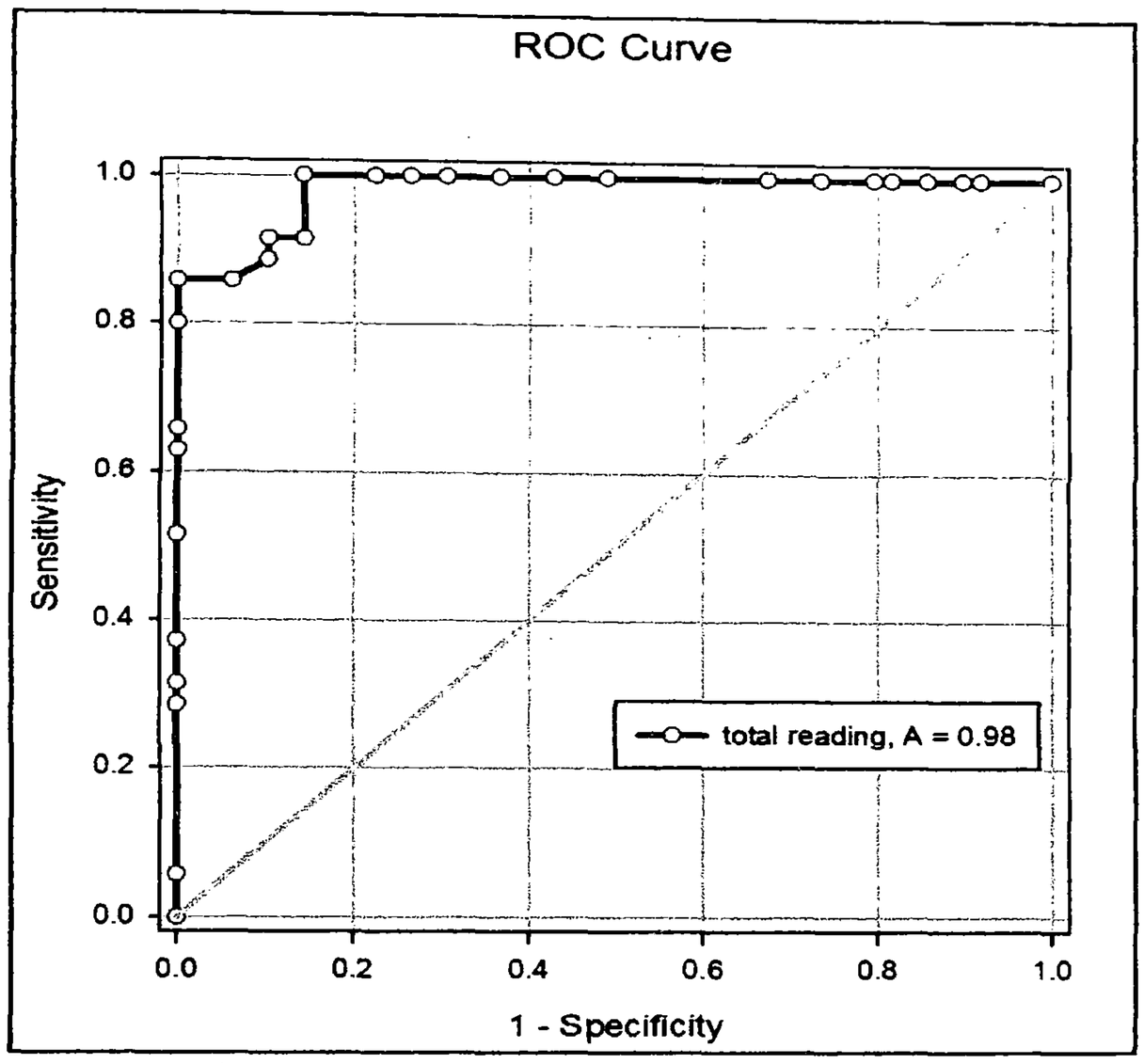
4.1.2.2.2 Determination of optimal cut-off points for LDSQ (PSC)

Using the total scores for each subscale as test variable and clinical diagnosis of different types of LD as the dependent variable, separate ROC curves were plotted for subscales, reading, writing and mathematics.

4.1.2.2.2.1 Determination of optimal cut-off point for the reading subscale

Figure 4.1 shows the ROC curve plotted for the different cut off values of the total reading scores giving the sensitivity against different values for (1-specificity).

Figure 4.1 ROC curve for total reading scores of LDSQ (PSC)



As shown in Table 4.11, the area under the curve (AUC), which was 0.98 is closer to one. In addition, the AUC was different from the diagonal reference line and the difference was statistically significant ($p<0.0001$). It indicates good performance of the reading subscale in detecting reading difficulty.

Table 4.11 Statistics of the AUC of the ROC curve for the total reading score against clinical diagnosis

AUC	Standard error (a)	Asymptomatic Sig (b)	Asymptomatic 95% CI	
			Upper bound	Lower bound
0.9825	0.01	0.000	1.002	0.9627

a Under the nonparametric assumption b Null hypothesis: true area = 0.5

Sensitivity, specificity, likelihood ratios and predictive values for different cut off points of the reading subscale is given in Annex XXXIII.

Optimal threshold is the point that gives maximum correct classification. The distance between the point (0, 1) and any point on ROC curve is d^2 .To obtain the optimal cutoff point to discriminate children with and without RD, d^2 was calculated for the cut off points

starting from sensitivity (1.00) and highest specificity to specificity (1.00) and highest sensitivity. The point where the minimum distance was located was considered as the optimum cut off point.

Following formula was used to calculate d^2 (Pudrovska and Anikputa, 2012).

$d^2 = [(1-S_N)^2 + (1-S_p)^2]$, S_N – sensitivity, S_p – specificity

Cut off points for total reading scores ranged from 17 to 60.5. Cut off points with highest sensitivity and specificity ranged from 43.5 to 48.5. Table 4.12 shows distance from curve (d^2) calculated for these cut off points.

Table 4.12 Sensitivity, specificity and d^2 corresponding to selected cut off values of total reading scores

Cut off value >	Sensitivity	Specificity	Distance from curve (d^2)
43.5	1.0000	0.8571	.0204
44.5	0.9143	0.8571	.0277
45.5	**0.9143**	**0.898**	**.0177**
46.5	0.8857	0.898	.0234
47.5	0.8571	0.9388	.0241
48.5	0.8571	1.0000	.0204

The shortest distance (d^2) in the ROC curve was 0.0177. It corresponded with the total reading score of 45.5. Therefore optimum cut-off point for reading subscale was set as 45.5. The sensitivity, specificity, positive predictive value and negative predictive value which are validity indicators of the reading subscale of LDSQ (PSC) at 45.5 cut-off level are shown in Table 4.13.

Table 4.13 Validity indicators of reading subscale of LDSQ (PSC)

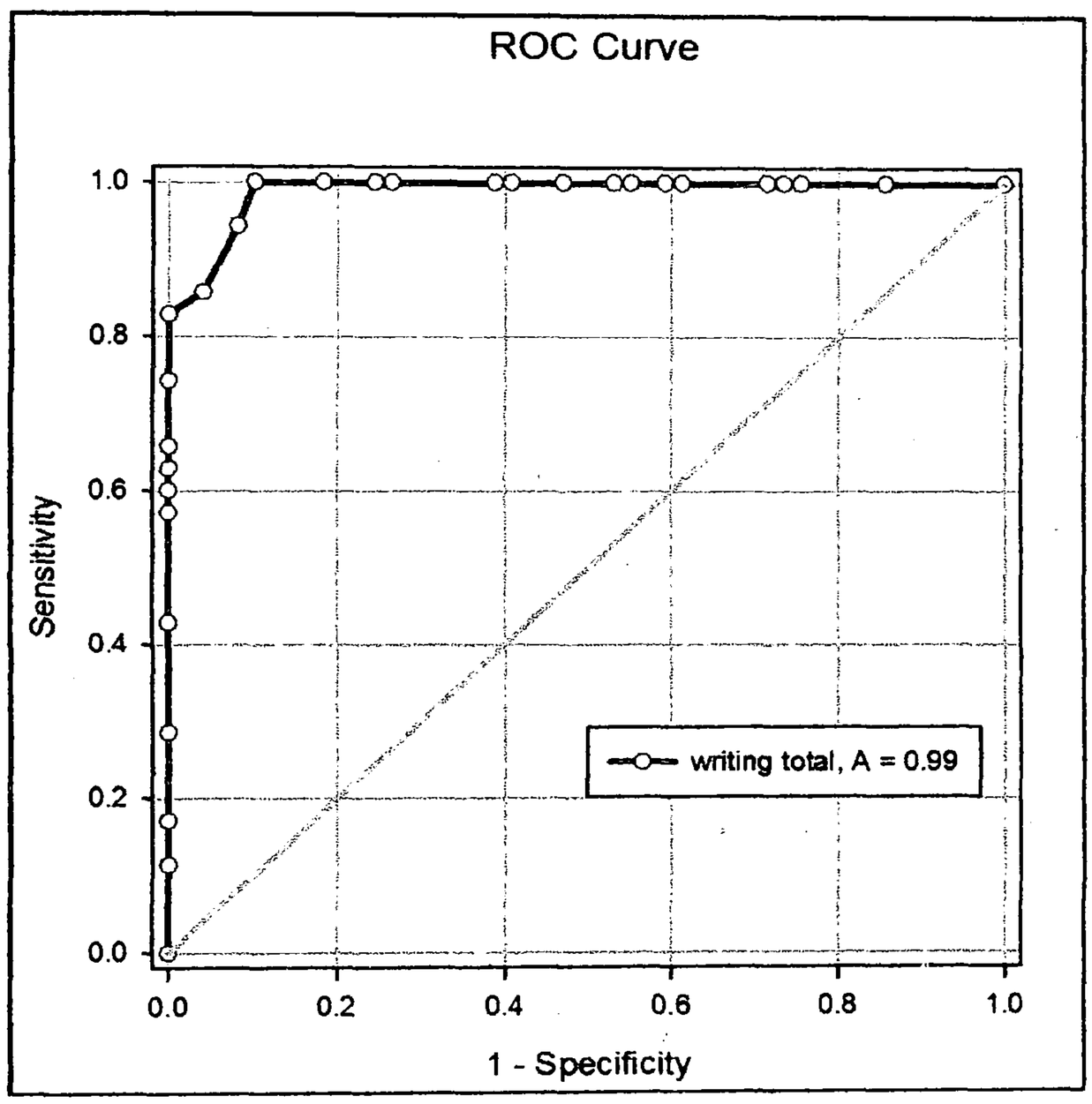
Cut off value	Sensitivity	95% CI	Specificity	95% CI	PPV	NPV	LR+	LR-
>45.5	91.4%	76.9 -.98.2	89.8%	77.7 – 96.6	90%	91%	8.9	.09

The optimal cut off point for the reading subscale indicates a sensitivity of 91.4% and specificity of 89.8%. High predictive values and LR+ 8.9 (closer to 10) and LR- .09 (<.1) also indicates higher validity of reading domain in detecting reading difficulty.

4.1.2.2.2.2 Determination of optimal cut-off point for the writing subscale

Figure 4.2 shows the ROC curve plotted for the different cut off values of the total writing scores giving the sensitivity against different values for (1-specificity).

Figure 4.2 ROC curve for total writing scores of LDSQ (PSC)



The AUC was 0.99 and was different from the diagonal reference line and the difference was statistically significant (p<0.0001).

Table 4.14 Statistics of the AUC of the ROC curve for the total writing scores against clinical diagnosis

AUC	Standard error (a)	Asymptomatic Sig (b)	Asymptomatic 95% CI	
			Upper bound	Lower bound
0.9889	0.00727	0.000	1.003	0.9747

a Under the nonparametric assumption b Null hypothesis: true area = 0.5

Sensitivity, specificity, likelihood ratios and predictive values for different cut off points of the writing subscale is given in (Annex XXXIV). Optimal cut off point was calculated as described in the section 4.1.2.2.2.1

Table 4.15 Sensitivity, specificity and d^2 corresponding to selected cut off values of total writing scores

Cut off value>	Sensitivity	Specificity	Distance from curve ($d^{2)}$
40	1	.898	.0104
41.5	**.9429**	**.9184**	**.0099**
42.5	.8571	.9592	.022
43.5	.8286	1	.029

The shortest distance (d^2) in the ROC curve was 0.009. It corresponded with the total writing score of 41.5. The sensitivity, specificity, positive predictive value and negative predictive values of the writing domain of LDSQ (PSC) at the cut-off point of 41.5 are shown in Table 4.16.

Table 4.16 Validity indicators of writing subscale of LDSQ (PSC)

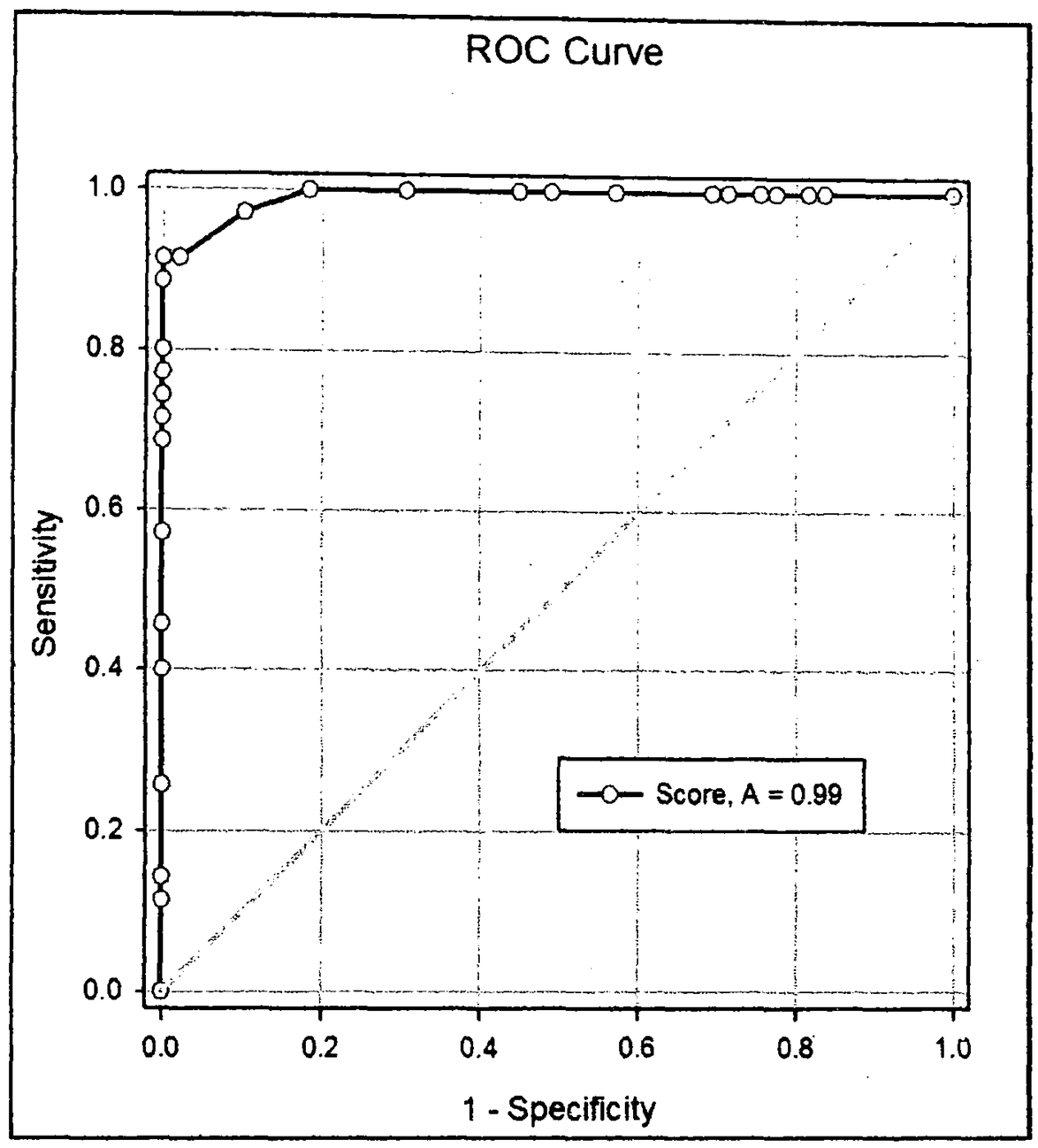
Cut off value	Sensitivity	95% CI	Specificity	95% CI	PPV	NPV	LR+	LR-
>41.5	94.3%	80.8 -.99.3	91.8%	80.4 – 97.7	92%	94%	11.5	.06

The optimal cut off point for the writing domain indicates a sensitivity of 94.3% and specificity of 91.8%. High predictive values and LR+ 11.5 (> 10) and LR- .06 (<.1) also indicates higher validity of writing domain in detecting writing difficulty.

4.1.2.2.2.3 Determination of optimal cut-off point for the math subscale

Figure 4.3 shows the ROC curve plotted for the different cut off values of the total mathematical scores giving the sensitivity against different values for (1-specificity).

Figure 4.3 ROC curve for total math scores of LDSQ (PSC)



The AUC was 0.99 for the ROC curve of math difficulty and is closer to one. The AUC was different from the diagonal reference line and the difference was statistically significant ($p<0.0001$).

Table 4.17 Statistics of the AUC of the ROC curve for the total math score against clinical diagnosis

AUC	Standard error (a)	Asymptomatic Sig (b)	Asymptomatic 95% CI	
			Upper bound	Lower bound
0.9914	0.0068	0.000	1.005	0.9780

a Under the nonparametric assumption b Null hypothesis: true area = 0.5

Sensitivity, specificity, likelihood ratios and predictive values for different cut off points of the math subscale is given in Annex XXXV. Optimal cut off point was calculated as described in the section 4.1.2.2.2.1.

Table 4.18 Sensitivity, specificity and d^2 corresponding to selected cut off values of total math scores

Cut off value >	Sensitivity	Specificity	Distance from curve (d^2)
43	1.00	.8163	.033
47	.9714	.898	.011
48.5	.9143	.9796	.0077
50	**.9143**	**1**	**.0073**
51.5	.8857	1	.013

The shortest distance (d^2) in the ROC curve was 0.0073. It corresponded with the total mathematical score of 50.0. The sensitivity, specificity, positive predictive value and negative predictive values of the mathematical domain of LDSQ (PSC) at 50.0 cut-off level are shown in Table 4.19.

Table 4.19 Validity indicators of math subscale of LDSQ (PSC)

Cut off value	Sensitivity	95% CI	Specificity	95% CI	PPV	NPV	LR+	LR-
>50.0	91.4%	76.9 -.98.2	100%	92.7 – 100	100%	92%	>10	.08

The optimal cut off point for the Math subscale indicates a sensitivity of 91.4% and specificity of 100%. High predictive values and LR+ >10 and LR- .08 (<.1) also indicates higher validity of math subscale in detecting mathematical learning difficulty.

Table 4.20 summarizes the cut off values and validity indicators for the three subscales.

Table 4.20 cut off values and validity indicators for the three subscales of LDSQ (PSC)

Sub scale	Cut off value	Sensitivity	95% CI	Specificity	95% CI	PPV	NPV	LR+	LR-
Reading	>45.5	91.4%	76.9 -.98.2	89.8%	77.7 – 96.6	90%	91%	8.9	.09
Writing	>41.5	94.3%	80.8 -.99.3	91.8%	80.4 – 97.7	92%	94%	11.5	.06
Math	>50.0	91.4%	76.9 -.98.2	100%	92.7 – 100	100%	92%	>10	.08

4.1.3. Reliability of LDSQ (PSC)

The reliability of the LDSQ (PSC) was confirmed by assessing the internal consistency and the test-retest reliability of the instrument.

4.1.3.1. Internal consistency

Internal consistency of the subscales and the overall instrument was assessed separately using Cronbach's alpha (*a*). An alpha value of 0.7-0.9 was considered as evidence to support good internal consistency of the instrument (Streiner & Norman, 2003). During the development of the questionnaire the internal consistency was assessed and found to be good. After omission of certain items applying item selection procedures including factor analysis the internal consistency of the final instrument was re assessed. The reliability coefficients for the 3 subscales and the total scale are given in Table 4.21

Table 4.21 Internal consistency of LDSQ (PSC)

Measure	No. of items	*a* value
LDSQ (PSC) total	36	.955
Subscale 1 (Reading)	12	.991
Subscale 2 (Writing)	11	.991
Subscale 3 (Math)	13	.992

n=50

All the subscales were found to have alpha values above 0.9, signifying high internal consistency. The overall scale also had an alpha value above 0.9. These results confirmed that the LDSQ (PSC) has a good internal consistency as a LD screening instrument.

4.1.3.2. Test-retest reliability of LDSQ (PSC)

The test-retest reliability of the LDSQ (PSC) was assessed by re administering the instrument to a sample of 50 children (5 children from each class x 10 classes) selected for the validation study after two weeks interval. The two sets of responses were compared to assess test retest reliability. Correlation coefficient (Pearson's r) was calculated for each subscale and for the total scale (Table 4.22).

Table 4.22 Test-retest reliability of LDSQ (PSC)

Subscale	Correlation	Sig.
Subscale 1 (Reading)	0.935	<.001
Subscale 2 (Writing)	0.931	<.001
Subscale 3 (Math)	0.932	<.001
Total Scale	0.912	<.001

n=50

4.1.4. Acceptability of LDSQ (PSC) by the teachers

The acceptability of the LDSQ (PSC) by the teachers was assessed. All the teachers (100%) gave the consent to participate, all responded to the questionnaire, the proportion of teachers willing to fill 15-20 questionnaire was 100%. Completeness was 100%. No complaints about difficult areas or confused questions were made. Time taken to fill the single questionnaire was 20minutes.

4.2 Component 2

Prevalence of LD and behavioral comorbidities of LD among primary school children in grades three and four in the district of Kalutara.

4.2.1 Sub component 1

Prevalence of LD among primary school children in grades three and four in the district of Kalutara

4.2.1.1 Quality of data

Measures taken to ensure the quality of data are described in detail in section 3.2.1.11. Measures taken to minimize non participation are described in the section 3.2.1.10.2.11. Reliability assessment of selected variables and response rate of the study population are presented in section 4.2.1.1.

4.2.1.1.1 Test re-tests reliability of the Demographic and Socioeconomic IAQ

Test re-test reliability was assessed by re interviewing 2.5% of the primary care givers two weeks after initial interview. Level of agreement on selected variables between 1st and 2nd interviews was calculated using Cohen's Kappa co-efficient. Kappa values between 0.81–1.0 was taken as perfect agreement (Viera and Garrett, 2005). The level of agreement on two occasions was in the range of perfect agreement (Table 4.23).

Table 4.23 Test-retest reliability of selected variables of Demographic and Socioeconomic IAQ

Variable	Kappa co-efficient
Date of birth of the child*	1.00
Highest level of education of mother	0.82
Employment status of father	1.00
Type of occupation	0.93
Primary care giver	1.00

n=50, *year was categorized for the analysis

4.2.1.1.2 Inter interviewer reliability of the Demographic and Socioeconomic IAQ

Level of agreement between the PI and data collectors was assessed by administering the questionnaire to 2% of the sample (n=40), initially by an FI and then by PI. Each FI interviewed 10 primary care givers. Level of agreement of selected variables between two occasions was measured by using Cohen's Kappa co-efficient. The level of agreement between each FI and the PI was in the range of perfect agreement (Table 4.24).

Table 4.24 Inter interviewer reliability of selected variables of Demographic and Socioeconomic IAQ

Variable	Level of agreement between PI and Field Investigator (Measured by Kappa co-efficient)			
	FI 1[1]	FI 2[1]	FI 3[1]	FI 4[1]
Date of birth*	1.00	1.00	1.00	1.00
Highest level of education of mother	1.00	0.78	1.00	0.78
Employment status of father	1.00	1.00	1.00	1.00
Type of occupation	1.00	1.00	0.78	1.00
Primary care giver	1.00	1.00	1.00	1.00

[1]Number interviewed =10 by each interviewer,

*year was categorized for the analysis

4.2.1.1.3 Response rate of the study participants

A sample of 2020 primary school children in grade three and grade four in the district of Kalutara was selected as the study sample. Of the 2020 children, 21 children did not receive parental consent to participate in the study and were declared as non-respondents. Further, 135 primary caregivers did not turn up for interviews even after two reminders and also considered as non-respondents. Thus, 1864 primary school children participated in the study and the response rate was 93%.

4.2.1.1.4 Characteristics of respondents and non-respondents

Some basic socio demographic characteristics of non-respondents were obtained from the class teachers and were compared with the respondents (Table 4.25).

Table 4.25 Comparison of socio demographic characteristics of respondents and non-respondents

Characteristics	Response status of the child				
	Respondents (n=1864)		Non respondents (n=156)		Sig.
	No.	%	No.	%	
Age (years)					χ^2=0.77
<8	357	19.2	34	21.8	df=1
≥8	1507	80.8	122	78.2	P>0.5
Sex					χ^2=0.51
Male	972	52.1	86	55.1	df=1
Female	892	47.9	70	44.9	P>0.25
Religious categories					χ^2=1.04
Buddhist	1836	98.5	152	97.5	df=1
Other religions	28	1.5	4	2.5	P>0.25

Among respondents 19.2% (n= 357) was in the age group of <8years while 21.8% (n=34) non-respondents was in the age group of <8years. The difference between respondents and non-respondents was not statistically significant. Responded proportion of males was 52.1% (n=972) compared to non-responded proportion of males (55.1%, n=86) and the

difference was not statistically significant (p>0.25).The difference in the responded and non-responded proportion of religious categories was not statistically significant (p>0.25).

4.2.1.2 Basic characteristics of the study population

Basic demographic, socio economic, parental and family information were obtained from the primary care giver who participated for the study. Therefore, parental information could not be obtained when the primary caregiver was a non-parent. At the same time either maternal or paternal information was lacking for those children living with only maternal or paternal caregivers due to marital disharmony or due to death of the spouse. Distribution of study population by primary care giver is presented in Table 4.26.

Table 4.26 Distribution of the study population by primary caregiver

Primary caregiver	No.	%
Maternal caregiver only		
Living alone due to marital reasons	51	20.1
Father currently employed abroad	37	14.6
Father employed in armed forces (full time outside the house)	86	33.8
Father doing other employment (full time outside the house)	80	31.5
Paternal caregiver only		
Living alone due to marital reasons	6	33.3
Mother currently employed abroad	12	66.7
Both maternal and paternal caregivers	**1530**	**82.1**
Non parental care giver	**62**	**3.3**
Total	**1864**	**100**

Majority, 82.1% (n= 1530) of children had both parents as primary caregivers. Number of children who had only a maternal caregiver was 254 (13.6%). Of these 254 children, 20.1% (n=51) had been cared by mothers only, as fathers were separated due to marital reasons. Another14.6% (n=37) had fathers employed abroad, 33.8% (n=86) had fathers employed in

armed forces as full time outside the house and 31.5% (n=80) had fathers employed in other occupations as full time outside the house. Out of 18 paternal only caregivers, 33.3% (n=6) had separated due to marital reasons and 66.7% (n=12) had spouse employed abroad. Sixty two (3.3%) children had been cared by non-parental caregivers and all of them (100%) were related to indexed child.

Basic demographic characteristics of the study population are presented in Table 4.27.

Table 4.27 Distribution of the study population by demographic characteristics

Socio demographic characteristics	**n=1864**	**100%**
Age in completed years	No	%
<8	357	19.2
≥8	1507	80.8
Mean age =8.5 yrs.(SD±0.6yrs)		
Sex		
Male	972	52.1
Female	892	47.9
Ethnicity		
Sinhala	1853	99.4
Other ethnicities	11	0.6
Religious categories		
Buddhist	1836	98.5
Other religions	28	1.5
Sector of residence		
Urban	367	19.7
Rural	1497	80.3

Age of the study population was normally distributed with a mean age of 8.5yrs (SD± 0.6yrs) and median age of 8.5yrs. The age ranged from 7.4 yrs. to 9.7 yrs. Majority of child population was in the age category of ≥8 years (80.8%, n=1507). The proportion of boys (52.1%, n=972) was higher than the girls. Study population mainly comprised Sinhala

(99.4%, n=1853) Buddhists (98.5%, n=1836) compared to other ethnicities and religions. Majority (80.3%; n=1497) of children were residing in rural areas.

Distribution of the study population according to socioeconomic characteristics is presented in Table 4.28. During the analysis children whose primary caregiver was a non-parent were excluded. List of asset items and the statistics used in developing the Wealth Index is presented in Annex XXII.

Table 4.28 Distribution of the study population by socio economic characteristics

Socio economic characteristics	**N=1802**	**100%**
Average monthly income (Rs.)	No	%
≤20,000	1116	61.9
>20,000 -50,000	629	34.9
>50,000	57	3.2
Social Class		
1-Leading professions and businessmen	60	3.3
11-Lesser professions and businessmen	136	7.5
111-Skilled workers and non-manual workers	737	40.9
1v-Partly skilled workers	520	28.9
v-Unskilled workers	349	19.4
Wealth quintile		
1st Quintile (Poorest)	362	20.1
2nd Quintile	363	20.1
3rd Quintile	358	19.9
4th Quintile	364	20.2
5th Quintile (Richest)	355	19.7

Table 4.28 shows that the majority (61.9%,n=1116) of the study population was in the income group of <Rs. 20,000. Only 3.2% (n=57) of the study population was in the highest income group of >50,000 rupees. The highest proportion of the children belonged to social class III (40.9%, n=737).

Distribution of the study population by demographic characteristics of parents is presented in Table 4.29.

Table 4.29 Distribution of the study population by demographic characteristics of parents

Parent Characteristics	Father		Mother	
Age	**N0.**	**%**	**No.**	**%**
20-29	29	1.6	184	10.3
30-39	774	44.2	1012	56.3
40-49	840	48.0	568	31.6
≥55	108	6.2	32	1.8
Mean age	40.8yrs. (SD±5.9yrs)		37.5yrs.(SD±5.98yrs)	
Ethnicity				
Sinhala	1740	99.3	1785	99.4
Tamil	8	0.5	8	0.4
Muslim	3	0.2	3	0.2
Religion				
Buddhist	1724	98.4	1763	98.1
Hindu	8	0.5	8	0.4
Islam	3	0.2	3	0.2
Roman Catholic/ Christian	16	0.9	12	0.7
Marital status				
Currently married	1745	93.8	1745	93.8
Divorced	12	0.7	12	0.7
Separated	23	1.3	23	1.3
Widowed	22	1.2	22	1.2

Ages of both parents were normally distributed with fathers' mean age 40.8yrs (SD±5.9yrs), median age 40.8yrs and mothers' mean age 37.5yrs. (SD±5.98yrs), median age 37.0 yrs. Majority of the fathers (48.0%, n=840) was in the age group of 40-49 years while mothers were in the age group of 30-39years (56.3%, n=1012). Higher proportion of fathers and mothers were Sinhalese (99.3%, n=1740and 99.4%, n=1785) and Buddhist (98.4% and 98.1%) and 93.8% (n= 1745) of them were legally married.

Table 4.30 Distribution of the study population by parent education and employment status

Parent characteristics	Father		Mother	
Highest educational level	**No**	**%**	**No**	**%**
Never gone to school	11	0.6	12	0.7
Grade 1-5	74	4.2	58	3.2
Grade 6-10	664	37.9	653	36.4
O/Level completed	606	34.6	551	30.7
Grade 11-12	143	8.2	159	8.9
A/Level completed	201	11.5	307	17.1
University education	26	1.5	34	1.9
Higher education other than university	26	1.5	22	1.1
Current employment status				
Employed	1730	98.8	408	22.7
Not employed	21	1.2	1388	77.3
Currently employed abroad	37	2.1	12	2.9
Currently not employed abroad	1693	97.9	396	97.1
Category of occupation				
Managers	12	0.7	5	1.2
Professionals	48	2.8	60	14.7
Technicians and associate professionals	73	4.2	13	3.2
Clerical support workers	62	3.6	35	8.6
Service and sales workers	318	18.4	71	17.4
Skilled agricultural, forestry and fishery workers	133	7.7	40	9.8
Craft and related trade workers	307	17.7	30	7.4
Plant and machine operators and assemblers	358	20.7	72	17.6
Elementary occupations	317	18.3	82	20.1
Armed forces occupations	102	5.9	0	0
Type of occupation				
Full time and spend the nights outside the house	203	11.7	12	2.9
Full time and spend the nights in the house	483	27.9	175	35.0
Part time	774	44.7	143	19.1
Home based	270	15.6	78	42.9

As shown in Table 4.30 most of the fathers (37.9%, n=664) and mothers (36.4%, n=653) in the study population had studied up to grade 6 to grade 10. Higher proportion of fathers was employed (98.8%, n=1730) compared to mothers (22.7%, n=408). Of the employed fathers (n=1730), 2.1% (n=37) were employed abroad. Of the fathers 20.7%, (n=358) were occupied as plant and machine operators and assemblers while18.4% (n=318) were service and sales workers and 18.3% (n=317) in elementary occupations).

4.2.1.3 Distribution of LDSQ subscale total scores in the study population

Table 4.31 shows the descriptive statistics of subscale total scores of the study population and children with and without LD. All the subscale scores in the study population were normally distributed with a mean reading score of 25.2 (SD±14.0), mean writing score of 23.6 (SD±12.9) and mean math score of 28.7 (SD±15.6).

Table4. 31 Distribution of reading, writing and math total scores of LDSQ (PSC) in the study population

Subscale	Mean	SD	Min	Max	95% CI for mean	Skewness
Reading						
Total(n= 1864)	25.2	14.0	12	60	24.62- 25.90	1.02
RD+ (n=235)	54.3	5.2	46	60	53.61-54.97	-0.148
RD- (n=1629)	21.0	9.13	12	45	20.63-21.51	0.679
Writing						
Total(n= 1864)	23.6	12.9	11	55	23.04- 24.21	0.909
WD+ (n=251)	48.8	5.0	42	55	48.20-49.44	0.175
WD- (n=1613)	19.7	8.6	11	41	19.28-20.13	0.631
Math						
Total(n= 1864)	28.7	15.6	13	65	28.06- 29.48	0.867
MD+ (n=248)	59.1	5.48	51	65	58.42-59.79	-0.133
MD- (n=1616)	24.1	10.6	13	50	23.60-24.64	0.665

RD+ with Reading Difficulty, RD- without Reading Difficulty, WD+ with Writing Difficulty, WD- without Writing Difficulty, MD+ with Math Difficulty, MD- without Math Difficulty.

4.2.1.4 Prevalence of LD among primary school children in grade 3 and grade 4

Using the clinically validated cut off points, the prevalence of reading, writing and math LD was assessed in the study population. Adjusted prevalence for each LD was also calculated using the validity indicators of the cut off points for each subscale (Table 4.32).

Table 4.32 Prevalence and adjusted prevalence of different types of LD in the study population

Type of LD	No:	%	95% CI	PPV %	Sensitivity	Adjusted Prevalence No. x PPV/ Sensitivity
Reading	235	12.6	11.1-14.1	90	91.4	235 x 90/91.4 = 231 =12.3%
Writing	251	13.5	12.0-15.1	92	94.3	251x92/94.3 = 244 =13.0%
Math	248	13.3	11,7-15.0	100	91.4	248x100/91.4 =271 = 14.5%

N=1864

Prevalence of reading, writing and math LD in the study population was 12.6% (n=235). 13.5% (n=251) and 13.3% (n= 248) respectively. The adjusted prevalence of reading and writing difficulty was 12.3% and 13.0% while math LD was 14.5%. The adjusted prevalence of math LD had increased due to high (100%) positive predictive value.

Although each LD showed the above calculated prevalence, it will not always exist as isolated difficulty. There can be single difficulty as well as coexisting difficulties. As each type of LD can coexist the sum of the prevalence of each difficulty would not give the prevalence of total LD. Prevalence of LD in the study population is presented in Table 4.33

Table 4.33 Prevalence of LD in the study population

Status of LD	No	%
LD+	336	18.0
LD-	1528	82.0
Total	**1864**	**100**

Of the 1864 children, 336 (18.0%) children had one or more type of LD. Therefore the prevalence of LD in the study population was 18%.

The prevalence of the different types of LD, under one type, two types and all three types is presented in Table 4.34.

Table 4.34 Distribution of LD children according to number of types of LD

Type of LD	No	%
One type of LD	83	24.7
Two types of LD	108	32.1
All three types of LD	145	43.2
Total	**336**	**100**

Out of total 336 children with LD, 24.7% (n=83) had only one type of LD, 32.1% (n=108) had two types of LD and 43.2% had all three types of LD.

The distribution of children according to different categories of LD is presented in Table 4.35. Of the 1864 children 0.9% (n=16), 1.5% (n=29) and 2.0% (n=38) had only reading, writing and math LD respectively. The proportion of children with only reading and writing difficulty was 2.3% (n= 43), only reading and math difficulty was 1.7% (n=31) while only writing and math difficulty was 1.8% (n=34). The proportion of children with all three difficulty, reading, writing and math was 7.8% (n=145). Therefore the prevalence of all three types of LD was 7.8%, two types of LD was 5.8% (n=108) while single type of LD was 4.4% (n=83).

Table 4.35 Prevalence of different categories of LD in the study population

Type of LD	No	%
One type of LD		
Reading only	16	0.9
Writing only	29	1.5
Math only	38	2.0
Two types of LD		
Reading and writing	43	2.3
Reading and Math	31	1.7
Writing and mathematics	34	1.8
All three types of LD		
Reading, writing and mathematics		
Total	**145**	**7.8**

4.2.1.5 Distribution of LD according to school characteristics

Distribution of LD among primary school children according to educational division, grade and school type is presented in Table 4.36.

Table 4.36 Distribution of LD among primary school children according to educational division, school type and grade

Characteristic	LD+			LD-		
	n=336			n=1528		
	No.	%	95% CI	No.	%	95%CI
Educational Division						
Kalutara	166	19.0	13-16.5	706	81.0	78.2-83.5
Bandaragama	109	17.6	14.5-20.7	511	82.4	79.3-85.5
Agalawatta	61	16.4	12.5-20.2	311	83.6	79.8-87.5
School Type						
1AB	59	12.5	9.6-15.4	413	87.5	84.6-90.6
Other types (1C, type2 and 3)	277	19.9	17.8-22	1115	80.1	78-82.2
Grade						
Grade 3	190	19.4	16.8-21.8	790	80.6	78.2-83.2
Grade 4	146	16.5	14.1-19.1	738	83.5	80.9-85.8

In Kalutara Educational division 19% (n=166; 95% CI:13-16.5) had LD while in Bandaragama and Agalawatta divisions it was 17.6% (n=109; 95% CI: 14.5-20.7) and 16.4% (n=61; 95% CI:12.5-20.2) respectively. The proportion of children with LD was higher in other types of schools (19.9%, n=277: 95% CI:17.8-22) compared to Type 1 AB schools (12.5%, n=59; 95%CI:9.6-15.4). The proportion of LD children was higher in grade three (19.4%; 95% CI:16.8-21.8) compared grade four (16.5%; 95% CI:14.1-19.1).

4.2.1.6 Distribution of LD according to demographic characteristics of the child

Table 4.37 shows the distribution of LD among primary school children according to demographic characteristics of the child.

Table 4.37 Distribution of LD among PSC children according to demographic characteristics of the child

Characteristic	LD+			LD-		
	n=336			n=1528		
	No.	%	95%CI	No.	%	95% CI
Age						
<8 years	79	22.3	18-26.8	278	77.7	73.2-82
≥8 years	257	17.1	15.1-18.9	1250	82.9	81.1-84.9
Sex						
Male	226	23.3	20.6-26.1	746	76.7	73.9-79.4
Female	110	12.3	10.1-14.3	782	87.7	85.6-89.9
Ethnicity						
Sinhala	332	17.9	16.3-19.8	1521	82.1	80.2-83.7
Other	4	36.4	8.5-46.3	7	63.6	35.9-71.4
Religion						
Buddhist	326	17.8	16-19.6	1510	82.2	80.4-84
Other	10	35.7	19.5-54.8	18	64.3	45.2-80.5

LD was higher among children aged < 8 years (22.3%, n=79; 95% CI:18-26.8) compared to children ≥8 years (17.1%, n=257; 95% CI:15.18-18.9). Among males, the proportion of LD was 23.3% (n=226; 95% CI: 20.6-26.1) and it was 12.3% (n=110; 95% CI: 10.1-14.3) among females. Other ethnic categories (36.4%, n=4; 95% CI: 8.5-46.3) had a higher proportion of PSC with LD compared to Sinhalese (17.9%, n=332; 95% CI: 16.3-19.8). In other religious categories 35.7% (n=10; 95% CI: 19.5-54.8) of PSC had LD compared to 17.8% (n=326; 95% CI: 16-19.6) among Buddhists children.

4.2.1.7 Distribution of LD according to socioeconomic characteristics

The distribution of LD among PSC according to socioeconomic factors is presented in Table 4.38. A higher proportion of children with LD was found in the income category of ≤Rs.20, 000 (20.8%, n=232; 95% CI: 18.5-23.4) compared to >Rs.20, 000 income category (12.5%, n=86; 95% CI: 10.2-15.1). The proportion of children with LD among social class

III – V (19.1%, n=306; 95% CI: 17-21.1) was higher compared to the proportion of PSC in social class I-II (6.1%, n=12; 95% CI: 3.1-9.9). The proportion of LD was 26.9% (n=195; 95% CI: 23.5-30.5) among 1st (poorest) and 2nd wealth quintiles while it was 11.4% (n=123; 95% CI: 9.5-13.4) among 3rd – 5th (richest) wealth quintile group.

Table 4.38 Distribution of LD among primary school children according to socio economic characteristics.

Characteristic	LD+			LD-		
	n=318			1484		
	No.	%	95% CI	No.	%	95% CI
Parent monthly income						
≤ 20,000	232	20.8	18.6-23.4	884	79.2	76.9-81.4
>20,000	86	12.5	10.2-15.1	600	87.5	84.9-89.8
Social Class						
Social Class I and II	12	6.1	3.1-9.9	184	93.9	90.1-96.9
Social Class III- V	306	19.1	17-21.1	1300	80.9	78.9-83.9
Wealth Quintile						
1st (Poorest)- 2nd Quintile	195	26.9	23.5-30.5	530	73.1	69.7-76.5
3rd -5th Quintile	123	11.4	9.5-13.4	954	88.6	86.6-90.5

N= excluded 62 (Non- parental primary caregiver)

4.2.1.8 Distribution of LD according to caregiver type

Table 4.39 shows the distribution of LD among PSC according to category of primary caregiver. The proportion of LD among children whose primary caregiver was a non-parent (29%, n=18; 95% CI: 17.9-49) was higher compared to children who had only maternal or paternal caregiver (21%, n=57; 95% CI: 16.2-24.3) and both parental caregivers (17.1%, n=261; 95% CI: 15-18.9)..

Table 4.39 Distribution of LD among PSC according to caregiver category.

Caregiver	LD+			LD-		
	n=336			n=1528		
	No.	%	95% CI	No.	%	95% CI
Both parent	261	17.1	15-18.9	1269	82.9	81.1-85
Maternal/ paternal only	57	21.0	16.2-24.3	215	79.0	72.1-83.1
Non parent	18	29.0	17.9-49	44	71.0	60-82.1

4.2.2 Sub component 2

Behavioural comorbidities of LD among primary school children in grades three and four.

4.2.2.1 Quality of data

4.2.2.1.1 Test re-tests reliability of the Strength and Difficulties (SDQ) Questionnaire

Test re-tests reliability of the teacher version as well as the parent version of SDQ was assessed by re administering the questionnaires two weeks after the initial administration. Ten randomly selected teachers were asked to complete the questionnaire once again for five randomly selected children from the previous sample after two weeks.

At the same time 2% of the parents were given the parent version and the total scale score on both occasions were compared using correlation coefficient (Pearson's r).

Table 4.40 presents correlation of total difficulty scores between 1st and 2nd occasions was satisfactory.

Table 4.40 Test-retest reliability of SDQ

Version of SDQ	Correlation coefficient	Sig:
Teacher version	0.81	<.001
Parent version	0.83	<.001

n=50

4.2.2.2 Description of Behavioral comorbidities of LD

Externalizing as well as internalizing behavioural problems were assessed using subscale scores for emotional problems, conduct problems, hyperactivity and peer problems. Presence of a total difficulty was assessed by total difficulty score.

Presence of symptoms of behavioral problems assessed by different subscales of SDQ as comorbidities of LD is presented in Table 4.41.

Table 4.42 presents total difficulty score for children with and without LD. TDS is a summary value obtained from scores of four related subscales, emotional problems,

conduct problems, hyperactivity and peer problem. Based on TDS, children were categorized as having or not having overall behavioral problems.

Table 4.41 Presence of symptoms of behavioural problems as assessed by different subscales of SDQ as comorbidities of LD

Behavioural problem	**LD**		**Non LD**		**Sig.**
	n=336		**n=1528**		
	No.	**%**	**No.**	**%**	
Emotional difficulties					χ^2=89.6
Yes	133	39.6	252	16.5	df=1
No	203	60.4	1276	83.5	P<0.001
Conduct problems					χ^2=108.1
Yes	170	50.6	345	22.6	df=1
No	166	49.4	1183	77.4	P<0.001
Hyperactivity					χ^2=272.9
Yes	231	68.8	347	22.7	df=1
No	105	31.2	1181	77.3	P<0.001
Peer problem					181.5
Yes	142	42.3	178	11.6	df=1
No	194	57.7	1350	88.4	P<0.001

As shown in Table 4.41 39.6% of children with LD had emotional difficulties while only 16.5% of children without any LD had emotional difficulties. Emotional difficulties were significantly associated with LD (p<.001).

Among children with LD 50.6% had associated conduct problems, among children without LD the prevalence of conduct problem was 22.6%.Conduct problem was significantly associated with LD (p<.001).

Proportion of hyperactivity among children with LD was 68.8% and this was 22.7% among children without LD. Hyperactivity was a significant comorbidity of LD (p<.001)

Proportion of children with peer problems was statistically significantly higher (p<.001) among children with LD (42.3%) compared to children without LD (11.6%).

Table 4.42 Presence of overall behavioral problems as assessed by TDS of SDQ as comorbidity of LD

Presence of overall behavioral problems	**LD+**		**LD-**		**OR**
	n=336		**n=1528**		**95% CI**
	No.	**%**	**No.**	**%**	**P value**
					7.7
Yes	251	74.7	423	27.7	5.8-10.1
No	85	25.3	1105	72.3	P<0.001

Mental health problems were present in 74.7% (n=251) of PSC with LD compared to 27.7% (n=423) of PSC children without LD. Presence of overall behavioral problems measured by TDS was significantly associated (p<.001) with LD.

4.3 Component 3

Risk factors of LD among primary school children in grades three and four

A case control study was conducted to determine the risk factors of LD among PSC in grade three and grade four.

4.3.1 Quality of data

Measures taken to ensure the quality of data and to minimize non participation are described in detail in section 3.3.5.2.4. Test retest reliability of Risk Factor Questionnaire and inter interviewer reliability of selected variables are presented in this section.

4.3.1.1 Test re-tests reliability of the Risk Factor Questionnaire

Test re-test reliability was assessed by re interviewing 20 mothers two weeks after initial interview. Level of agreement on selected variables between 1st and 2nd interviews was calculated using Cohen's Kappa co-efficientThe level of agreement on two occasions was in the range of perfect agreement (Table 4.43).

Table 4.43 Test-retest reliability of selected variables of Risk Factor Questionnaire

Variable	Kappa co-efficient
History of subfertility	1.00
Marital status during delivery	1.00
Mode of delivery	0.88
Stay in Premature Baby Unit	1.00
Family type	0.88

n=20,

4.3.1.2 Inter interviewer reliability of the Risk Factor Questionnaire

Level of agreement between the PI and data collectors was assessed by administering the questionnaire to 20 selected mothers, initially by an FI and then by PI. Each FI interviewed 10 primary care givers. Level of agreement of selected variables between two occasions was measured by using Cohen's Kappa co-efficient. The level of agreement between each FI and the PI was in the range of perfect agreement (Table 4.44).

Table 4.44 Inter interviewer reliability of selected variables of Risk Factor Questionnaire

Variable	Level of agreement between PI and Field Investigator (Measured by Kappa co-efficient)	
	FI 1[1]	FI 2[1]
History of subfertility	1.00	1.00
Marital status during delivery	1.00	1.00
Mode of delivery	1.00	1.00
Stay in Premature Baby Unit	1.00	1.00
Family type	1.00	1.00

[1]Number interviewed =10 by each interviewer,

4.3.1.3 Response rate of the study participants.

Of 141 cases only 137 maternal caregivers attended the interview. The response rate was 97%. The response rate of controls was 100%. As the case: control was set as 1:1, during analysis the respective control for each case was selected.

4.3.2 Risk factors of LD- Bivariate analysis

Bivariate analysis was done to assess the association of possible risk factors and LD. The risk of demographic, socio-economic, maternal perinatal, infancy related, developmental, early childhood, family level and child home environmental factors for LD was assessed in the bivariate analysis using SPSS 20.0. Chi square tests with p values were used to determine the statistical significance of the observed associations. Odds ratios with 95% confidence interval were used to assess the strength of the associations.

4.3.2.1 Demographic Factors

Based on 8 years as cut off value, the participants were divided in to two age categories as <8years and ≥ 8 years for comparison. The ethnic category "others" included all the other ethnic groups except Sinhalese and other religion categories included all the other religion

groups except Buddhists. Table 4.40 presents the association of demographic factors with LD.

Table 4.45 Association of demographic factors with LD

Characteristic	Status of the child				OR	95% CI	Sig.
	Cases		Controls				
	n=137		n=137				
	No.	%	No.	%			
Age (years)							
≥8	96	70.1	108	78.8	1.0		$\chi2$=2.76
<8	41	29.9	29	21.2	1.6	0.9-2.7	df=1
							p=0.13
Sex							
Female	26	19.0	71	51.8	1.0		$\chi2$=32.3
Male	111	81.0	66	48.2	4.6	2.7-7.9	df=1
							p<.001
Ethnicity							
Sinhalese	134	97.8	236	99.3	1.0		$\chi2$=1.01
Others	3	2.2	1	0.7	3.0	0.3-29.6	df=1
							p=0.6
Religion							
Buddhists	132	96.4	136	99.3	1.0		$\chi2$=2.72
Others	5	3.6	1	0.7	5.1	0.6-44.6	df=1
							p=0.2
Sector							
Urban	25	18.2	30	21.9	1.0		$\chi2$=0.57
Rural	112	81.8	107	78.1	1.3	0.7-2.3	df=1
							p=0.5

A higher proportion of cases (29.9%, n=41) belonged to the age category of less than 8 years, compared to the controls (21.2%, n=29). However, this age difference between cases and controls was not statistically significant (OR= 1.6; 95% CI= 0.9- 2.7; p= 0.1).

The proportion of males among cases (81%, n=111) was statistically significantly higher (OR= 4.6; 95% CI= 2.7-7.9; p<.001) compared to controls (48.2%, n=66). Although a

higher proportion of cases belonged to the other ethnic groups (2.2%, n=3) and other religious groups (3.6%, n=5) compared to controls (0.7% and 0.7% respectively), the difference in ethnic and religion distribution among cases and controls was not statistically significant (OR= 3.0; 95% CI= 0.3- 29.6; p= 0.6 and OR= 5.1; 95% CI= 0.6- 44.6; p= 0.2respectively). The proportion of children residing in rural areas was comparatively higher among cases (81.8%, n=112) than among controls (78.1, n=107), but this difference was not statistically significant (OR= 1.3; 95% CI= 0.7- 2.3; p= 0.5).

4.3.2.2 Socio economic factors

Table 4.46 presents the association of socioeconomic factors with LD. The highest level of education was categorized as <O/L and ≥O/L for analysis purposes. In analysis of the social class, leading and lesser professionals (social classes 1 and 2) were grouped together as "high" social class, whereas all others (social classes 3, 4 and 5) were grouped as "low" social class. Total monthly income was categorized in to 2 groups, based on Rs. 20,000.00 as the cut off. First and 2nd wealth quintiles were combined together as "poor" and 3rd – 5th quintiles were combined as "rich" wealth quintile category.

Higher proportion of cases had <O/L parental education compared to controls (57.7% verses 39.4%) and the difference in parental education among cases and controls was statistically significant (OR= 2.1; 95% CI= 1.3- 3.4; p= 0.004).

The proportion of cases whose parents were not employed (2.9%) was higher compared to controls (1.5%), but this difference was not statistically significant (OR= 2.0; 95% CI= 0.4- 11.3; p= 0.67).

It was noticed that 98.5% (n=135) of cases belonged to low social class while in controls it was 92% (n=126). This difference in social class distribution among cases and controls was statistically significant (OR= 5.9; 95% CI= 1.3- 27.1; p= 0.02).

In the group of parental income ≤Rs.20, 000, 70.1% (n=96) was cases while 59.1% (n=81) was controls. But the distribution of parental income among cases and controls was not statistically significant (OR= 1.6; 95% CI= 0.9- 2.7; p= 0.08).

A statistically significantly higher proportion of cases belonged to poor wealth quintile group compared to controls (61.3% verses 37.2%) (OR= 2.7; 95% CI= 1.6- 4.4; p< 0.001).

Table 4.46 Association of socioeconomic factors with LD

Characteristic	Status of the child				OR	95% CI	Sig.
	Cases		Controls				
	n=137		n=137				
	No.	%	No.	%			
Parent education							
≥ O/Level	58	42.3	83	60.6	1.0		$\chi2$=9.1
< O/Level	79	57.7	54	39.4	2.1	1.3-3.4	df=1
							p=0.004
Parent employment							
Employed	133	97.1	135	98.5	1.0		$\chi2$=0.68
Not employed	4	2.9	2	1.5	2.0	0.4-11.3	df=1
							p=0.67
Social class							
High	2	1.5	11	8.0	1.0		$\chi2$=6.54
Low	135	98.5	126	92.0	5.9	1.3-27.1	df=1
							p=0.02
Income (Rupees)							
> 20,000	41	29.9	56	40.9	1.0		$\chi2$=3.6
≤ 20,000	96	70.1	81	59.1	1.6	0.9-2.7	df=1
							p=0.08
Wealth quintile							
Rich	53	38.7	86	62.8	1.0		$\chi2$=15.9
Poor	84	61.3	51	37.2	2.7	1.6-4.4	df=1
							p<0.001

4.3.2.3 Maternal perinatal factors

Maternal perinatal factors were classified as maternal factors, delivery related factors and neonatal factors during the assessment of association with LD.

- Maternal factors (Table 4.47A and B)

Table 4.47A Association of maternal factors with LD

Characteristic	Status of the child				OR	95% CI	Sig.
	Cases		Controls				
	n=137		n=137				
	No.	%	No.	%			
Marital status at the time of delivery							
Married	128	93.4	135	98.5	1.0		χ2=4.6
Unmarried	9	6.6	2	1.5	4.7	1.0-22.3	df=1
							p=0.06
Pregnancy status							
Planned pregnancy	87	63.5	116	84.7	1.0		χ2=16.2
Unplanned pregnancy	50	36.5	21	15.3	3.2	1.8-5.7	df=1
							p<.001
Prior subfertility							
No	128	93.4	129	94.2	1.0		χ2=.06
Yes	9	6.6	8	5.8	1.1	0.42-3.0	df=1
							p=1.00
Prior pregnancy outcome							
Live	129	94.2	117	85.4	1.0		χ2=5.7
Other	8	5.8	20	14.6	0.4	0.15-0.85	df=1
							p=0.02
Parity of the child							
Low	93	67.9	100	73.0	1.0		χ2=0.86
High	44	32.1	37	27.0	1.3	0.76-2.2	df=1
							p=0.43

The proportion of unmarried mothers (from conception up to the delivery of the index child) was relatively higher among cases than controls (6.6%, n=9 verses 1.5%, n=2) but this difference was not statistically significant (OR= 4.7; 95% CI= 1.0- 22.3; p= 0.06).

According to Table 4.47A, the proportion of cases with a prior history of maternal subfertility (6.6%, n=9) and high parity of indexed child (32.1%, n= 44) was higher

compared to respective control group (5.8%, n= 8 and 27%, n=37 respectively). However, this difference among cases and controls was not statistically significant (OR= 1.1; 95% CI=0.42- 3.0; p= 1.00 and OR= 1.3; 95% CI= 0.76- 2.2; p= 0.43 respectively).

It was observed that, 36.5% (n=50) of cases were born after an unplanned pregnancy while only 15.3% (n=21) of controls. A statistical significant association was observed between unplanned pregnancy of index child and LD (OR= 3.2; 95% CI= 1.8- 5.7; p< 0.001

Table 4.47 B Association of maternal factors with LD

Characteristic	**Status of the child**				**OR**	**95% CI**	**Sig.**
	Cases		**Controls**				
	n=137		**n=137**				
	No.	**%**	**No.**	**%**			
Pregnancy related diseases							
No disease	104	75.9	116	84.7	1.0		$\chi2$=6.2
one or more diseases	33	24.1	21	15.3	1.7	0.9-3.2	df=1
							p=0.09
Violence during pregnancy							
No	110	84.7	131	95.6	1.0		$\chi2$=9.2
Yes	21	15.3	6	4.4	3.9	1.5-10.1	df=1
							p=.004
Mental health services							
Not received	131	95.6	135	98.5	1.0		$\chi2$=2.06
Received	6	4.4	2	1.5	3.0	0.6-15.6	df=1
							p=0.28
Perceived psychological wellbeing							
Good	101	73.7	119	86.9	1.0		$\chi2$=7.5
Bad	36	26.3	18	13.1	2.4	1.3-4.4	df=1
							p=.009
Age at delivery (years)							
20-35	83	60.6	125	91.2	1.0		$\chi2$=35.2
<20 and >35	54	39.4	12	8.8	6.7	3.4-13.4	df=1
							p<0.001

Violence during the pregnancy of index child (15.3%, n=21) was statistically significantly higher (OR= 3.9; 95% CI= 1.5- 10.1; p= 0.004 respectively) among cases than controls (4.4%, n=6).

The proportion of mothers who received mental health services during the pregnancy of index child was higher among cases (4.4%, n=6) than controls (1.5%, n=2), but the association was not statistically significant (OR= 3; 95% CI= 0.6- 15.6; p= 0.28). At the same time presence of one or more pregnancy related diseases (24.1%, n=33) did not show a statistical significant association with LD (OR= 1.7; 95% CI= 0.9- 3.2; p= 0.09).

Higher proportion of cases (26.3%, n=36) had mothers whose perceived psychological wellbeing during the pregnancy of indexed child was bad compared to controls (13.1%, n=18) and this difference was significant (OR= 2.4; 95% CI= 1.3- 4.4; p= 0.009).

During the assessment of maternal age, the age groups <20years and >35 years were amalgamated. This was compared with maternal age between 20-35 years. Significantly higher proportion of cases (39.4%, n=54) was found in the maternal age group <20 and >35 years compared to controls (8.8%, n=12) (OR= 6.7; 95% CI= 3.4- 13.4; p< 0.001).

- **Delivery related factors**

The association between delivery related factors and LD is presented in Table 4.48.

Table 4.48 Association of delivery related factors with LD

Characteristic	**Status of the child**				**OR**	**95% CI**	**Sig.**
	Cases		**Controls**				
	n=137		**n=137**				
	No.	**%**	**No.**	**%**			
Mode of delivery							$\chi2$=3.8 df=1 p=0.07
NVD	103	75.2	116	84.7	1.0		
Other modes of delivery	34	24.8	21	15.3	1.8	0.9-3.3	
Period of gestation							
≥ 37 weeks	98	71.5	123	89.8	1.0		$\chi2$=14.6
< 37 weeks	39	28.5	14	10.2	3.5	1.8-6.8	df=1 **p<0.001**

A comparatively higher proportion of cases (24.8%, n=34) were delivered by other modes of delivery compared to controls (15.3%, n=21). However, the mode of delivery of the indexed child was not statistically significantly associated with LD (OR= 1.8; 95% CI= 0.9- 3.3; p= 0.07). All NVD had cephalic presentation and this variable was not analyzed.

A higher proportion of prematurity was observed among cases (28.5%, n=39) compared to controls (10.2%, n=14). The difference in the proportion of prematurity among cases and controls was statistically significant (OR= 3.5; 95% CI= 1.8- 6.8; p<.001).

- **Neonatal factors**

The association of selected neonatal factors with LD was studied and results are presented in Table 4.49.

Table 4.49 *Association of selected neonatal factors with LD*

Characteristic	**Status of the child**				**OR**	**95% CI**	**Sig.**
	Cases		**Controls**				
	n=137		**n=137**				
	No.	**%**	**No.**	**%**			
Birth weight							$\chi2$=11.2
≥2500g	91	66.4	115	83.9	1.0		df=1
<2500g	46	33.6	22	16.1	2.6	1.5-4.7	**p=.**
							p=.001
Delivery or neonatal complications							
No	91	66.4	114	83.2	1.0		$\chi2$=10.2
One or more	46	33.6	23	16.8	2.5	1.4-4.4	df=1
							p=.002
Duration of PBU care							
≤3 days	99	72.3	124	90.5	1.0		$\chi2$=15.0
>3 days	38	27.7	13	8.5	3.7	1.8-7.2	df=1
							p<.001

A higher proportion of cases (33.6%, n=46) belonged to low birth weight category compared to controls (16.1%, n=22) and low birth weight was statistically significantly associated with LD (OR= 2.6; 95% CI= 1.5- 4.7; p=.001).

The proportion who had one or more delivery or neonatal complication was higher among cases (33.6, n=46) compared to controls (16.8%, n=23), and the association was statistically significant (OR= 3.7; 95% CI= 1.4- 4.4; p=.002).

The association between the duration of PBU stay and LD was assessed and found that a significantly higher proportion of cases (27.7%, n=38) than controls (8.5%, n=13) belonged to the category of PBU stay more than 3 days (OR= 3.5; 95% CI= 1.8- 3.2; p<.001). Apgar score was not analyzed due to lack of information in CHDR

4.3.2.5 Infancy related factors

Association between infancy related factors and LD is presented in Table 4.50.

Table 4.50 Association of infancy related factors with LD

Characteristic	**Status of the child**				**OR**	**95% CI**	**Sig.**
	Cases		**Controls**				
	n=137		**n=137**				
	No.	**%**	**No.**	**%**			
Child needed special attention							$\chi 2$=24.7 df=1
No	71	51.8	110	80.3	1.0		**p<0.001**
Yes	66	48.2	27	19.7	3.8	2.2-6.0	

Association between child who needed special attention during infancy and LD was examined in the present study. The proportion of cases (48.2%, n=66) who needed special attention during the infancy was significantly higher (OR= 3.8; 95% CI= 2.2- 6.0; p<0.001) compared to controls (19.7%, n=27).

4.3.2.6 Developmental factors

The association of selected developmental milestones with LD was assessed in the present study (Table 4.51). It was observed that 23.4% (n=32) cases and 8.8% (n=12) controls had a delayed motor developmental milestone.

The difference in the proportion of delayed motor milestones among cases and controls was significantly different (OR= 3.2; 95% CI= 1.5- 6.5; p=.002). At the same time a significantly (OR= 3.0; 95% CI= 1.3- 6.7; p=.009) higher proportion of cases (17.5%, n=24) were found in the group of children who had a speech developmental delay compared to controls (6.6%, n=9).

The association of handedness with LD was significantly different (OR= 2.9; 95% CI= 1.3-6.4; p=.007). It was noticed that a comparatively higher proportion of children who were left handed belonged to cases (19%, n=26) than control (7.3%, n=10).

Table 4.51 Association of developmental factors with LD

Characteristic	**Status of the child**				**OR**	**95% CI**	**Sig.**
	Cases		**Controls**				
	n=137		**n=137**				
	No.	**%**	**No.**	**%**			
Motor delay							$\chi2$=10.8
No	105	76.6	125	91.2	1.0		df=1 **p=.002**
Yes	32	23.4	12	8.8	3.2	1.5-6.5	
Speech delay							
No	113	82.5	128	93.4	1.0		$\chi2$=7.7
Yes	24	17.5	9	6.6	3.0	1.3-6.7	df=1 **p=.009**
Handedness							$\chi2$=8.2
Right	111	81	127	92.7	1.0		df=1 **p=.007**
Left	26	19	10	7.3	2.9	1.3-6.4	

4.3.2.7 Early childhood related factors

Table 4.52A and 4.52B present the association of selected factors related to early childhood with LD.

Febrile as well as non-febrile convulsion during early childhood was significantly associated with LD (OR= 5.4; 95% CI= 2.3- 12.9; p<.001 and OR= 13.6; 95% CI= 3.1- 59; p<.001respectively)). The proportion of cases (23.6%, n=31) with a history of early childhood febrile convulsion was relatively higher than the controls (5.1%. n=7). At the

same time proportion of non-febrile convulsion was also higher among cases 16.8%, n=23) than controls (0.7%, n=1).

It had been noticed that the presence of chronic otitis media with effusion did not have a significant association with LD.

A significantly higher proportion of cases (24.8%, n= 34) were found among children who had one or more sleep problems compared to controls (6.6%, n=9).

Table 4.52A Association of early childhood factors with LD

Characteristic	**Status of the child**				**OR**	**95% CI**	**Sig.**
	Cases		**Controls**				
	n=137		**n=137**				
	No.	**%**	**No.**	**%**			
Febrile convulsion							$\chi 2$=17.5
No	106	77.4	130	94.9	1.0		df=1
Yes	31	22.6	7	5.1	5.4	2.3-12.9	**p<0.001**
Non febrile convulsion							
No	114	83.2	135	98.5	1.0		$\chi 2$=19.4
Yes	23	16.8	2	0.7	13.6	3.1-59.0	df=1
							p<.001
Chronic otitis media with effusion							
No	130	94.9	113	97.1	1.0		$\chi 2$=0.85
Yes	7	5.1	4	2.9	1.7	0.5-6.2	df=1
							p=0.5
Presence of sleep problems							
No	103	75.2	128	93.4	1.0		$\chi 2$=17.2
Yes	34	24.8	9	6.6	4.7	2.1-10.2	df=1
							p<.002
Presence of allergic rhinitis							
No	113	82.5	123	89.8	1.0		$\chi 2$=3.0
Yes	24	17.5	14	10.2	1.9	0.92-3.78	df=1
							p=0.11

Table 4.52B shows that a higher proportion of children with Special Health Care Need (SHCN) belonged to cases (42.3%, n=58) compared to control (13.1%, n=18). The difference in the distribution of SHCN children among cases and controls was statistically significant (OR= 4.8; 95% CI= 2.6- 8.8; p=.007).

The proportion of cases with one or more life events during early childhood was not statistically significantly higher compared to controls with one or more life events during early childhood (p=0.5).

Type of primary caregiver (p=0.13), exposure to general anesthesia (p=0.46) and age at pre schooling (p=0.2) were not significantly associated with LD.

Table 4.52B Association of early childhood factors with LD

Characteristic	**Status of the child**				**OR**	**95% CI**	**Sig.**
	Cases		**Controls**				
	n=137		**n=137**				
	No.	**%**	**No.**	**%**			
Child with SHCN*							$\chi2$=29.1 df=1 **p<0.001**
No SHCN	79	57.7	119	86.9	1.0		
One or more SHCN	58	42.3	18	13.1	4.8	2.6-8.8	
Experience of life events							
No	90	65.7	96	70.1	1.0		$\chi2$=0.6
One or more	47	34.3	41	29.9	1.2	0.44-0.77	df=1 p=0.5
Primary care giver							
Maternal	111	81	121	88.3	1.0		$\chi2$=2.8
Non maternal	26	19	16	11.7	1.8	0.9-3.5	df=1 p=0.13
Exposure to anaesthesia							
No	126	92	130	94.9	1.0		$\chi2$=0.95
Yes	11	8	7	5.1	1.6	0.6-4.3	df=1 p=0.46
Age of pre schooling							
≤3.5 years	70	51.1	82	59.9	1.0		$\chi2$=2.1
>3.5 years	67	48.9	55	40.1	1.4	0.8-2.3	df=1 p=0.2

* Child with Special Health Care Need

4.3.2.8 Family level factors

Table 4.53 presents the relationship between family level factors and LD. It was noticed that type of present primary caregiver was not statistically significantly associated with LD (p=.07).

A higher proportion of cases (14.6%, n=20) had fathers working full time outside the house compared to control (6.6%, n=9). Type of fathers occupation was statistically significantly associated with LD (OR=2.4, 95%CI=1.1-5.6, p=.04).

A higher proportion of cases (66.4%, n=91) had one or more younger siblings at home compared to controls (57.7%,n=79). But the presence of one or more younger siblings was not statistically significantly associated with LD (OR=1.4, 95%CI=0.13-0.88, p=0.17).

Family history of LD, measured by the presence of reading, writing and math learning difficulty among mothers, fathers or siblings had shown a significant association with LD (OR= 6.4; 95% CI= 3.2- 12.4; p<.001). The proportion of children with a family history of LD was higher among cases (40.1%, n=55) compared to controls 9.5%,n=13).

Table 4.53 Association of family level factors with LD

Characteristic	Status of the child				OR	95% CI	Sig.
	Cases		Controls				
	n=137		n=137				
	No.	%	No.	%			
Primary caregiver							$\chi2$=3.8
Both Parents	113	82.5	124	90.5	1.0		df=1
Maternal only	24	17.5	13	9.5	2.0	0.9-4.1	p=.07
parental occupation type							
Type II	117	85.4	128	93.4	1.0		$\chi2$=4.7
Type I	20	14.6	9	6.6	2.4	1.1-5.6	df=1 p=0.04
Sibling category							
No younger sibling	46	23.6	58	42.3	1.0		$\chi2$=2.2
One or more younger siblings	91	66.4	79	57.7	1.4	0.13-0.8	df=1 p=0.17
Family history of LD							
No	82	59.9	124	90.5	1.0		$\chi2$=34.5
Yes	55	40.1	13	9.5	6.4	3.2-12.4	df=1 **p<.001**

4.3.2.9 Factors related to home environment

Table 4.54 presents association of LD with selected factors related to home environment.

Table 4.54 Association of home environmental factors with LD

Characteristic	Status of the child				OR	95% CI	Sig.
	Cases		Controls				
	n=137		n=137				
	No.	%	No.	%			
Family structure							$\chi2$=0.7
Nuclear family	77	58.2	84	61.3	1.0		df=1
Extended family	60	43.8	53	38.7	1.2	0.7-1.9	p=0.46
Total members							
≤5 members	92	67.2	112	81.8	1.0		$\chi2$=7.6
>5 members	45	32.8	25	18.2	2.2	1.25-3.8	df=1
							p=0.008
Father smoking							
Non frequent smoker	80	58.4	113	82.5	1.0		$\chi2$=0.6
Frequent smoker	57	41.6	24	17.5	3.6	1.9-5.8	df=1
							p<0.001
Father taking alcohol							
Non frequent user	84	61.3	112	81.8	1.0		$\chi2$=14.0
Frequent user	53	38.7	25	18.2	2.8	1.6-4.9	df=1
							p<.001
Home disagreement pattern							
Non violent	74	54.0	118	86.1	1.0		$\chi2$=33.6
Violent	63	46	19	13.9	5.2	2.9-9.5	df=1
							p<.001

A higher proportion of cases (43.8%, n=60) had an extended family structure compared to controls (38.7%, n=53). This difference in type of family structure and LD was not significantly associated with LD (OR=1.2, 95%CI=0.7-1.9).

However, the proportion of children belonged to families with family size of >5 members were higher among cases (32.8%, n=45) compared to controls (18.2%, n=25). And the relationship was statistically significant (OR= 2.2; 95% CI= 1.2- 3.8; p=.008).

Among cases 41.6% (n=57) and among controls 17.5% (n=24) fathers were frequent smokers. This difference in the distribution of father's smoking status and LD was statistically significantly (OR=3.6, 95%CI=1.9-5.8).

Among cases, 38.7% (n=53) of children had fathers who were frequent users of alcohol compared to controls18.2% (n=25). Children whose fathers were frequent alcohol users had a statistically significant association with LD compared to controls (OR= 2.8; 95% CI= 1.6-4.9; p<.001).

House member's behaviour during disagreement was assessed by pattern of disagreement. Proportion of violent disagreement pattern was comparatively higher among cases (46%, n=63) relative to controls (13.9%, n=19). And the association between violent disagreement and LD was statistically significant (OR= 5.2; 95% CI= 2.9- 9.5; p<.001).
Due to lack of cases and controls with fathers taking drugs and lack of controls with siblings needing special care, these variables were not analyzed.

Table 4.55 Association of insecticide storage and handling with LD

Characteristic	**Status of the child**				**OR**	**95% CI**	**Sig.**
	Cases		**Controls**				
	n=137		**n=137**				
	No.	**%**	**No.**	**%**			
Storage/ parents handling insecticides							$\chi2$=0.11 df=1
No	132	98.4	133	97	1.00		p=1.00
Yes	5	3.6	4	2.8	1.2	0.3-4.7	

Table 4.55 shows the association between insecticide exposure measured by a proxy measure of storage of insecticide at home or handling of insecticide by father or mother. A statistical significant relationship was not found between insecticide exposure and LD.

Table 4.56 List of variables with a significant unadjusted OR in bivariate analysis

Variable	Categories	Un-adjusted OR	95% CI
Sex	**Male**	**4.6**	**2.7–7.9**
Parent education	**<O/Level**	**2.1**	**1.3-3.4**
Social class	**Low**	**5.9**	**1.3-27.1**
Wealth quintile	**Poor**	**2.7**	**1.6-4.4**
Pregnancy status	**Unplanned**	**3.2**	**1.8-5.7**
Violence during pregnancy	Yes	3.9	1.5-10.1
Perceived psychological wellbeing	**Bad**	**2.4**	**1.3-4.4**
Maternal age at delivery	**<20 and >35 yrs.**	**6.7**	**3.4-13.4**
Period of gestation	**<37 weeks**	**3.5**	**1.8-6.8**
Birth weight	**<2500g**	**2.6**	**1.5-4.7**
PBU care	**Yes**	**2.5**	**1.4-4.4**
Duration in PBU	**>3 days**	**3.7**	**1.8-7.2**
Child needed special attention (infancy)	**Yes**	**3.8**	**2.2-6.0**
Motor delay	**Yes**	**3.2**	**1.5-6.5**
Speech delay	Yes	3.0	1.3-6.7
Handedness	**Left**	**2.9**	**1.3-6.4**
Febrile convulsion	Yes	4.2	1.9-9.1
Non-febrile convulsion	Yes	13.6	3.1-59.0
Presence of sleep disorder	Yes	4.7	2.1-10.2
Child with SHCN during early childhood	**Yes**	**4.8**	**2.6-8.8**
Parental occupation type	Type I	2.4	1.1-5.6
Total family members	**>5**	**2.2**	**1.2-3.8**
Family history of LD	**Yes**	**6.4**	**3.2-12.4**
Father smoking	**Frequent smoker**	**3.6**	**1.9-5.8**
Father taking alcohol	**Frequent user**	**2.8**	**1.6-4.9**
Home disagreement pattern	**Violent**	**5.2**	**2.9-9.5**

4.3.3 Risk factors for LD– Multivariate analysis

Multivariate analysis was carried out using logistic regression to identify the risk factors for LD while controlling the effect of confounding. At the end of the analysis a logistic regression model was developed with adjusted odds ratio to determine the risk factors for LD.

The dependent variable used in the analysis was the presence or absence of LD. Independent variables used for the analysis were associated factors of LD with a significant value of <.05. It is suggested that the minimum sample size should be 10 cases for every independent variable (Pallant, 2007); there is no multi-collinearity between predictor variables.

In the bivariate analysis 26 variables showed significant associations with LD. Of these 26 variables, only 19 variables were selected as predictor variables for the analysis. Following variables were excluded.

- The variables that were excluded due to limited number of controls (≤10) among the exposed group
    - Violence during pregnancy
    - Speech delay
    - Febrile convulsion
    - Non febrile convulsion
    - Sleep disorder
    - Father's occupation type
- As wealth quintile and social class both assess socio economic situation, only wealth quintile was selected to include in the model.

Omnibus test was used to assess the statistical significance of the full model against the constant model. In Omnibus Tests of Model Coefficients, the chi square value was 182.607 with 19 degrees of freedom. This value was highly significant ($p<0.001$). A well-fitting model is significant at the 0.05 level or better; indicate that at least one of the predictor variable is related to the dependent variable significantly.

Cox and Snell R Square (0.486) and Negelkerke R Square (0.649) values provided an indication of the amount of variation in the dependent variable explained by the model. This suggests, that 48.6% - 64.9% of the variability is explained by this set of variables.

Hosmer and Lameshow Goodness of Fit Test indicates a poor fit by a significance test value<.05. The chi square value for the Hosmer and Lameshow test was 8.58 (8 degree of freedom) with a significance level of 0.38, indicated that the present model was good.

The LR model correctly classified 82.5% of cases overall (% accuracy in classification). The sensitivity of the model was 84.7%, whereas the specificity of the model was 80.3%. Wald statistics was used to test the significance of the individual logistic regression coefficients. The Wald statistics test the null hypothesis that a particular logit coefficient is zero.

Table 4.57 shows the logistic regression model for identification of risk factors of LD.

Table 4.57 Logistic regression model for identification of risk factors of LD

Predictor variable	B	S.E.	Wald	df	Sig.	OR	95% C.I. for OR	
							Lower	Upper
Male sex	1.816	.421	18.557	1	.000	6.145	2.69	14.039
Poor wealth quintile	.971	.426	5.189	1	.023	2.639	1.14	6.08
Maternal age <20 &>35years	2.482	.612	16.446	1	.000	11.971	3.606	39.736
PBU stay >3days	1.850	.709	6.814	1	.009	6.360	1.586	25.512
Child needed special attention during infancy	1.143	.479	5.706	1	.017	3.137	1.228	8.013
Motor development delay	1.042	.522	3.981	1	.046	2.834	1.019	7.884
Child with Special Health Care Need during early childhood	1.658	.474	12.240	1	.000	5.250	2.074	13.293
>5 family members	1.468	.469	9.813	1	.002	4.341	1.732	10.877
Family history of LD	1.193	.549	4.715	1	.030	3.296	1.123	9.672
Home with violent disagreement pattern	1.450	.550	6.946	1	.008	4.262	1.450	12.525

β-regression coefficient SE (β)-standard error of β df-degrees of freedom

Factors related to the child

Male sex (OR: 6.1; 95% CI: 2.7-14.0, p<.001), poor wealth quintile (OR: 2.6; 95% CI: 1.1-6.0, p=.02) received PBU care for >3 days (OR: 6.4; 95% CI: 1.6- 25.5; p= .009), child needed special attention during infancy (OR: 3.1; 95% CI= 1.2- 8.0; p= 0.02), motor development delay (OR: 2.8; 95% CI: 1.02-7.9, p=.046), child with special health care need during early childhood (OR: 5.2; 95% CI: 2.1- 13.2; p< 0.001),

Factors related to parents of the child

High (>35) and low (<20) maternal age at delivery (OR: 11.9; 95% CI= 3.6- 39.7; p< .001).

Factors related to family and home environment

Family history of LD (OR=3.3; 95%CI= 1.2-9.6), Family with >5 members (OR: 4.3; 95% CI: 1.7- 10.8; p= .002) and home with violent disagreement pattern (OR: 4.3; 95% CI: 1.4-12.5; p= 0.008).

4.4 Component 4:

Psychological distress among parents (mothers) of children with LD

Focus group discussions were designed in order to get the opinion about day to day stressors they encounter and psychological impact they experience as mothers of children with LD.

4.4.1 Characteristics of the participants

Among the participants there were working mothers as well as non-working mothers. Majority of mothers were non-working (66.7%). Among working mothers there were mothers employed in private sector and public sector. Most of the participants were in the age group of ≥36 years.

Table 4.58 Distribution of participants of FGDs according to age, status of employment and educational level

Characteristic	n= 42	
	No.	%
Age in years		
29-35	16	38.1
≥36	26	61.9
Employment status		
Employed	14	33.3
Not employed	28	66.7
Educational level		
≥O/Level	25	59.5
<O/Level	17	40.5

Altogether five focus groups discussions had been carried out with an average partipation of 7-9 mothers. After analyzing thematic areas emerged from the discussions, following four major aspects could be identified.

- Opinion on life satisfaction and future expectations
- Difficulties experienced in parenting children with LD
- Impact on family functioning
- Experiences gained from school situation

4.4.2 Opinion on life satisfaction and future expectations

Most of the mothers were in the opinion that present day learning is very competitive. Schools, teachers and parents had made the learning in primary school a challenging period of a child's life. Majority of the children have got adapted to this situation. They are competent enough to face the challenges. Unfortunately the present day learning has become a psychological trauma for those who can't face this competition and who are not competent enough to take these challenges. They all were in a view that their children were in the second group. They accepted that their children were having a learning problem which is different from poor school performance. Mrs.T.R who is a house wife added her views,

"I know, there are children with different caliber. I don't mind if my child is an average child. But of course he had been labeled as a very weak child. This is my worry. I am not satisfied with his performance. He is far below the average. I am not comparing my child with others. But actually speaking performance wise he is very much behind the fellow mates."

Mothers had an idea that present day parents are sacrificing a lot for their children. They work hard for the betterment of their children's life. They spend their time, energy and money for their children. They were in the opinion that they did not get the return according to their expectation. When parents' role in children's education was discussed, Mrs. CW gave her opinion,

"Compared to our parents, we are very concerned about our child's education. Our parents did not give a big support for learning. I drop my child to school, pick him up from the school, take him to tuition classes, spend most of my time with him teaching and doing homework. But I can't satisfy myself from what I've gained. Everything has become hopeless."

Their expectation about their children's future is limited. They were in a worried situation about what their child is going to be. A wife of an engineer added her views,

"We both are in a desperate situation. My husband is an engineer in a reputed firm. I've completed my higher education, but I'm not working. I've resigned from a good job thinking about my child. We both did not have any learning difficulty. We are worried about our child's future. As educated parents we know that it is not his problem. I don't know why he had got this problem. But we are under stress when we think about the future of our child"

38year old Mrs. RK who is working in a private sector added another view,

"My child is an epileptic child. He has been getting this since the age of one year. He can't write properly. He is having a very poor memory. Not a good reader as well. I am very nervous. Some time I can't sleep at night. I am worried about his medical condition as well as his future carrier. When parents are talking about their children's performance, I feel so sad. I've passed my A/Level as well. I am in a distress situation when thinking about my child."

There were mothers who also had poor performance during their school life. They had a different view about their life satisfaction. Mrs. NS added her life experience

"I was not a bright child in my school days. I had learning problems. I was far below my class mates. Today I'm suffering because of that. I am working in a garment factory. I've got married to an average person who works as a labourer. We have got so many problems at home. My husband is a heavy alcoholic. We do get in to frequent disagreements that end up in violent situations. I am suffering today because I couldn't achieve much in my school day life. I don't want to make this repeat in my daughter's life. I am under stress when I think about her future."

Although these mothers were from different backgrounds their expectations were same. They all were unhappy and worried about present learning of their children. They were in a highly desperate situation when thinking about their children's future.

4.4.3 Difficulties experienced in parenting children with LD

During the discussion it was noticed that parenting children with LD was more difficult than parenting a normal child. Most of children had added behavioral problems. Their learning behaviour was different compared to other children. Mothers being the primary care giver of these children had to put more strength and effort when handling these children in daily schooling and learning activities. This was a major area that most mothers had their own problems.

Majority had the opinion that their children were having a very poor attitude towards learning and schooling. School is a place that most of these children loathe. Therefore, during preparation for schooling they undergo a very stressful moment, one non-working mother who is 42 years added her views,

"I hate morning hours. The most difficult task in my routine work is sending my son to school. He gets up with thousands of complains, Stomach ache, headache, a boy in the class is hitting him, teacher is rude to him and different other complains. I am really struggling in the morning. Some time I physically punish him. I shout at him. Of course some time I had to beg him. I feel very sorry about my son. I know that school is not a pleasant place for him."

Mothers expressed, daily caring of these children was harder than expected. Most of them get annoyed due to the bad behaviour of these children. One mother who had two children stated her personal experiences,

"I have a daughter and a son. Both go to the same school. My daughter doesn't bring any bad complains from school. This is totally different when my son is considered. He brings lot of complains from school. Every day he disturbs the class, doesn't concentrate in his work. Easily get distracted during the class hours. Sometime he goes out of the class and never returns for lessons. Teacher always speaks to me over the phone. I am fed up with this life. I am giving most time of my life trying to handle this child"

All the children with LD were not aggressive and over active, According to mothers some were totally different. They were calm and socially withdrawn. This has also made the mothers worried. This situation was explained by another mother,

"My daughter also had the same problem in learning. All learning aspects, reading, writing and math all not up to the grade level. She concentrates in the class. But she can't capture like others. She is a very calm child. She used to sit in one place and day dream. She doesn't have too many friends at school. For her age, I feel that her behaviour is unusual. She doesn't talk with people. She is so quiet. This different behaviour disturbs me a lot."

Mothers specially spend time in helping the children to complete their homework. According to the discussions mothers get over stressed during teaching hours and when doing homework. For majority of mothers this is the most stressful moment. Mrs. CJ 31 year old mother who devotes lot of time for her child added her personal experiences,

"I am a working mother. But I never neglect my child's school work. Actually it is very stressful. He can't write properly. He misses all the "pillam" when he writes. His letters are very big. His books are very untidy. He used to erase always. He won't concentrate on what he is doing. When he is doing the class work he does other things like putting the pencil down, biting the pencils, erasing and sharpening the pencil. All these annoy me so much. I used to punish him daily. Being a mother I'm going through a very stressful period when I teach him."

A mother who is a house wife added her views on teaching the child at home.

"I also have the same problem. Even simple math concept he can't remember. He is now in grade four. His class mates are preparing for the scholarship examination. He is in a very preliminary stage. I get angry when teaching him as he repeatedly makes the same mistakes. He forgets everything very easily. His math knowledge is worse than a grade two child. He can't express his views by writing. He is also having problem during application of "pillam". Life is much harder than expected. I can't even concentrate on other activities. I am really worried."

Some mothers had an idea that it is better to send the child for tuition classes rather than teaching at home. They were of the opinion that it can relieve their stress to some extent. At the same time some mothers had the idea that sending their children tuition classes would create a worse situation. Mrs. CP 31 year old mother added,

"I used to do the school work with my child. It was so stressful. Each and every time I get angry I punish him. When he is repeating the mistakes I become furious and violent towards him. Later on I regret about the way I behave. My child is very anxious when he is working with me. He goes blank and forgets everything. He doesn't like to work with me. He says that he forgets everything when I question him. Every day I determine that I'm not going to be rude to him anymore. But I really can't tolerate. Even teachers had advised me not to work with him. I've sent him some tuition. Still I'm facing the problems. But I can feel an obvious relief"

A working mother who was 44years had a completely different view about tuition classes. She stated,

"I am not sending my daughter for any tuition classes. She is already in a frustrated situation. She always says that she can't study like others. My daughter is so anxious in the class room. I think she'll become more anxious if I send her to more and more classes. Of course it might increase my headache. Situation will become more worse when that teacher also starts complaining".

A 29 year old mother who is sending her daughter for tuition stated

"My daughter is going for three tuition classes. We spend a lot of money on her, but I don't see any improvement in her work"

4.4.4 Impact on family functioning

Most of the mothers had an opinion that these stressful situations affect other members in the family and family functioning as well. Their view was that this situation affects caring of other children, psychological status of the siblings, quality time spent with others at home, concentration on day to day activities, and most of the time this stressful situation ends up in family conflicts. Most of the mothers expressed their views on this. A 42 year old mother of four children added her experiences,

"I have four kids. They all are schooling. This is my third child. I'm having a daughter who is sitting for the O/Level examination. But I don't spend much of my time with her. I am totally concentrating on this child. I didn't experience this much of stress with other

children. I always go behind this child. I personally feel that rest of my kids are being neglected"

A mother added to this, "*not only they get neglected, they are also under stress.*"

Mrs.PR who is 39 with three kids explained,

"Actually I accepted the statement that "other children are under stress". That happens in my home as well. Peaceful home environment have got disturbed because of this. When I start teaching this child, happiness of others also disappears. They don't like this moment. They don't want to see their brother getting hammered. The other kids were under stress as they know these teaching sessions are ending up in a fearful way. I can see the horror from their faces. They all are under pressure. I feel sorry about them."

All the parents are spending quality time together with their children. They maintain a good relationship with each other by sharing the ideas with each other. Most of mothers were in the opinion that they don't agree that they have got a quality time.

"We rarely have happy moments together with other kids. We are mainly worrying about this child. His behaviour is very different. He is not an obedient child. He makes my home very unpleasant. He makes all of us unhappy. Once I have taken him to a psychiatrist as well. We really don't have time to spend with others."

A 38 year old working mother added her views,

"This matter not only affects other children but also creates argument between me and my husband. Very often this teaching matter ends up in a conflict situation between me and my husband. His opinion is that my son will be ok with time. As he also had a learning problem during school days, this is not a big issue for him; His opinion is to allow time to solve the problem."

4.4.5 Experiences gained from school situation

During several discussions mothers had the opinion that school plays a big role in managing a child with LD. Teachers' role is as important as parents' role when handling children with LD. The way that the teachers look at problems and the manner they treat the children, all equally important to minimize the social consequences associated with LD. At

the same time friendly environment in the class room and support from the colleagues are some important aspects pertaining to psychological status of the children with LD.
A 41 year old mother (CW) explained her school experiences,

"My child is labeled as a weak child. He is kept in a corner in the class. Usually the teacher doesn't care for him. He doesn't get any opportunity. He is so worried about that. He feels that he is a different child. He seems to be isolated in the class. That's why he hates to go to school. It's a big worry for me as well. "

Mrs.CJ added a different view,

"My child is a very weak child. Still he is doing grade one and grade two work. The class teacher also makes a big effort to help my child to overcome this problem. She keeps my child after school and give extra work. I can't blame the teacher. She is doing her best."

However, most of the parents had an idea that these children are very unhappy in the class room. Mother (CW) explained further,

"My child always says that she doesn't have good friends. Children who can work well in the class group together. They neglect other children. My child always stays alone in the class."

Except few parents, most of the parents had an opinion that these children have been discriminated in the class. These children were harassed by other children. Most of the time, they were teased and bullied. The children who were overactive frequently get punished by the teachers. Overall idea was that their children's problems were not clearly identified by the teachers.

Opinion was that this problem had not been properly understood by the class teachers. School psycho social environment for these types of children was not satisfactory.

As caregivers of children, mothers have frequent interactions with the class teachers and school authorities. Majority of them had unhappy and unpleasant moments during these interactions. Mrs. RK added her experience,

"I generally don't like to participate in the class circle. I feel so nervous. The teacher used to criticizes my child in front of other parents. It's really embarrassing. Of course I get discouraged"

A mother who was a teacher added a different experience,

'I have another experience. My daughter also study in the same school that I teach. On the day of the class circle I do get very nervous. Of course class teachers won't make any bad comments in front of others. But when other parents inquire about my child I get nervous. I really get depressed when the class teacher admires the other children who work well in the class. Not because I feel jealous about other children, but I compare my child with them"

Majority of mothers were of the opinion that they get anxious when other parents inquire about their children. This always happens in the school and at tuition classes where parents get together and discuss about the progress of their children. All these bad experiences had demoralized them. Majority of the mothers had the opinion that present education system in our country and the attitude of teachers are all directed towards competent children while weak children get harassed and discouraged.

CHAPTER FIVE

DISCUSSION

The increasing trend of child survival rate due to massive improvement and advancement in medical technologies has predisposed to developmental disabilities with neurobiological origin which includes developmental disabilities of learning as well (Gray & Dean, 1991). Lack of a nurturing environment and continuous brain stimulation has also predisposed to the problem of learning among the group of socioeconomically deprived and disadvantaged community thus expanding the burden of overall problem (Aagard, 1986). This increasing trend of special learning problems identified as "learning difficulty" (LD) is an emerging challenge to the health and educational sectors.

Although the term "learning disability" has been used to describe the same problem, the term learning difficulty is preferred by many experts as a child cannot be labeled as "disabled" without incorporating extensive multi-sensorial teaching strategies in to the existing curriculum (Dilshad, 2006). The term 'learning difficulty' (LD) has been applied to those children who have significantly greater difficulty in learning to read, write or doing mathematical calculation than the majority of their age and this difficulty is out of proportion to their intellectual capacity (DSM IV).

Mastering the elementary academic skills in reading, writing and mathematics are essential pre requisites for a child to survive in the academic environment. Children with LD cannot master these basic academic skills and cope up with the existing curriculum compared to normal learning children. Struggling of these children within the academic environment will lead to an array of problems which starts from an individual level psychological problem. Then the problem extends up to the families, disturbing family functioning and parenting and up to the society involving anti-social behavior, thus making the scenario much more complicated.

A systematic focus had been placed on LD since the 1960s from the era that the concept of LD was introduced to the world. Increasing research evidences in these countries had improved the field by incorporating early detection and intervention programmes. In these countries several legislative measures and policy decisions had been taken to address the

problem and to minimize the social consequences attached to it. Even in most of South Asian countries including India this field had been researched and the extent of the problem had been studied.

Although the world had been focusing on LD during the last few decades, lack of research evidences about the magnitude of the problem in Sri Lanka has limited the concentration on LD by responsible authorities. When the issue of LD is considered, Sri Lanka is handling a tip of an iceberg where the magnitude of the problem has been restricted to clinically diagnosed cases in a child guidance clinic set up. Therefore, it is a timely need to initiate gathering research evidences in order to address the problem in a scientific and sensible manner.

The intention of the present research was to address certain lacking aspects with regard to LD which would help to form the foundation of LD specific strategic decisions in the country. The lack of a screening tool for early identification, lack of evidence to estimate the extent of LD, comorbid behavioral problems and factors known to contribute to LD were the salient issues that had been addressed in the present research study.

5.1 Component 1

5.1 Development and validation of LDSQ (PSC)

Component 1 of the study included the development and validation of LDSQ (PSC), a screening instrument which was used to measure the extent of LD among primary school children in grade three and grade four.

- **Development of LDSQ (PSC)**

During the literature search, four widely used screening instruments that had been developed according to different norms and definitions which measure varying aspects of the problem were identified. Although translation and validation of one of these existing instruments with appropriate modifications would have been the easier option, due to multiple constraints - financial, feasibility of application by the class teachers, cultural appropriateness, and requirement of a tool prepared under a clinical definition rather than

an educational definition - had changed the decision towards preparing a culture specific simple tool that can be administered by the class teacher in the local setting.

In response to this need the new instrument Learning Difficulty Screening Questionnaire for Primary School Children, LDSQ (PSC) was developed using a combination of several techniques (Streiner and Norman,2003; Vellis,2003). The instrument was developed as a teacher administered tool. Although development of a parent version of LDSQ (PSC) was suggested, it was not implemented as it would make the study more extensive.

- **The dimensional structure of LDSQ (PSC)**

A working definition as a basis for the development of the screening instrument and the assessment of LD was prepared after considering existing definitions and mainly based on the domains given in the DSM IV definition. However, the current definition did not include the ability achievement discrepancy criteria mentioned in the DSM IV definition as this criterion was criticized in the field (Restori, 2009). The definition itself excludes the group of children with subnormal IQ or mild mental retardation. The standard IQ test the study had been utilized was Toni 3. Being a language free IQ test, the Toni 3 would have contributed to valid estimation of IQ among children with LD. Although some studies had excluded children with borderline IQ as slow learners, the present study recruited all children with IQ>70 measured by Toni 3 as most of the present literature state that LD has replaced the group of slow learners and considered both groups as one category (Fletcher,2002).

The items chosen from existing screening tools on LD reflect the perceptions on various aspects of LD in other research settings. As the tool was planned to be developed in Sinhala language these selected items were translated in to Sinhala using translation and back translation method. As a method of pretesting, bilingual test was applied and agreement between items in English and Sinhala lists were assessed. Maneesriwongul (2004) suggested this as a valid method of instrument translation. The tool, incorporated items that are more culture appropriate reflecting the experiences of a group of diagnostic and supportive service providers in the local setting obtained via key informant interviews. Application of method triangulation for qualitative data gathered from key informant's interviews had increased the internal validity of the procedure. Measures were taken to

select key informants representing both educational and health personnel. Comparatively the items in LDES were developed on the basis of direct observation of learning disabled students' performance, a literature review, and the input from educational diagnosticians and special education personnel to assure content validity (McCarney, 1996; Mathew, 2001).

The content validity of the LDSQ (PSC) was also ensured as each procedure involved with the opinion of an expert panel which included experts in the field of education and health.

The combined list of variables in LD which included a collection of 55 items covering all the common areas related to LD were then assigned to four subscales as reading, writing, mathematics and general behaviour. The LD Evaluation Scale was developed under IDEA definition - an educational definition - and included seven subscales compared to LDSQ (PSC) which did not include the subscales, thinking, listening and speech (Mathew, 2001). The LDDI with six subscales and compared to LDSQ (PSC) included three additional subscales, listening, speaking and reasoning were included (Hammil,1995). Although the present study instrument mainly considered the types of functions impaired or type of difficulties, the CPI mainly addressed the type of information processing difficulty. When compared with LDSQ (PSC) which is for the age group of 7 to 9 years, the LDDI was developed for the age group of 8-17 years while LDES was for 5 to 18 years which was a comparatively wider age group.

- **The form of assessment in LDSQ (PSC): subjective vs. objective assessment**

LDSQ (PSC) presents each item as a difficulty statement rather than a question form. Therefore, an adjective scale was said to be preferred compared to categorical judgment (Streiner and Norman, 2003). When the subjective verses objective assessment issue was considered, as most of the teacher administered LD instruments in the literature adopt subjective scales, the current instrument was also planned as a subjective assessment scale. A teacher's perception about the learning behaviour of a particular child was considered as a better evaluation procedure than an objective assessment. As teacher ratings are based on the extended history with the child and on cumulative evidence, this was considered better in contrast to the static measures of a child at one point in time, by standardized tests (Coleman & Dover, 1993; McCarney, 1996). As the class teacher is the most experienced

person to comment on children's learning behaviour, priority was given to the teacher's perception during assessment of LD.

- **Qualitative validation and item selection**

The draft instrument was subjected to qualitative validation by the expert panel on face and content validity. The item reduction techniques - Content Validity Index (CVI) and item analysis - were applied to reduce the number of items in the instrument to a manageable size while preserving the content coverage. Content relevance was assessed by the expert panel; CVI was formulated from the rating given by the experts. During the assessment of CVI, nine items with CVI <1.00 were removed from the list. The items thus removed were mostly representing behaviour suggestive of hyperactivity. The items in the general behaviour domain were also removed as the present study planned to assess behavioral comorbidities as a separate entity. It was stated that assessment of CVI by an expert group was a valid method of item selection in test construction (Lynn, 1986; Hynes et al, 1995).

A sample of 62 children representing grade three and grade four was recruited as the sample for item analysis. It is stated that the developmental sample should be a large group of subjects where "large" means a minimum of 50 subjects (Streiner, 2003). Vellis (2003) stated that application of item analysis is vital to retain more appropriate items in the scale. Ten items that was recognized to impose a threat to homogeneity or internal consistency of the scale were deleted during item analysis.

- **Preparation of final version of LDSQ (PSC)**

During the assessment of factor structure, factor analysis was applied. Principal component and principal axis factoring with varimax and direct oblimin rotation method were applied until an appropriate factor structure was received. As recommendation was given to calculate sample size according to subject to variable ratio and the rule of thumb varied from 2: 1 to 20:1 (Tabachnick, 2007), this concept was applied during calculation of sample size. However, in the initial calculation with a 5:1 ratio, a better factor structure was not obtained and therefore the sample size was increased up to a ratio of 10:1 in order to get a good factor structure. A four factor structure was obtained from Eigen value >1 method and scree plot. All four components were rotated and an appropriate output could be obtained from the principal component with a direct oblimin rotation method. However the

fourth factor with only two items with highest loading and showing relatively poor correlation with other components was omitted while preserving the items. One item belonging to the subscale 3 but loaded on component 4 was omitted. Final analysis gave a three factor structure with a total of 36 items.

5.1.2 The psychometric properties of LDSQ (PSC)

- **The validity of the LDSQ (PSC)**

The face validity, content validity and consensual validity of LDSQ (PSC) was confirmed by identifying the items through an extensive literature search and an opinion survey of a panel of experts on the appropriateness and applicability of the items. This process was supplemented by development of new items through key informant interviews and subsequent qualitative validation. Comparatively in LDES, the content validity was ensured during initial development process (McCarney, 1996).

As DSM IV criteria for clinical diagnosis of LD is available, the criterion validity of LDSQ (PSC) was assessed using a validation study. A sample representing all types of schools was recruited for this part of the study. However in order make the study feasible, the bottom 15 students based on academic performance was enrolled as the study sample rather than a random sample. The purpose of this selection was to achieve the required number of clinically confirmed cases of LD thus minimizing the work load of the clinician and the teachers. However as the validation was done in a selected group, this would be a limitation of the study. Measures were taken to conduct teacher rating and clinical assessment in a parallel manner in order to reduce observation bias. Clinical assessment was done by a clinical psychologist recognized as an expert in identifying LD in the field. After the validation process, separate cut off values for each subscale was developed. When the development of cut off values is compared with other available instruments, it was noticed that in most of the instruments, cut off values were created after standardizing the instrument in a representative large population of a similar age group - the exact age group that the instrument is planned to be applied (McCarney, 1996; Hammil, 1995).

- **Reliability of the tool**

The analysis of internal consistency of the three subscales and the total LDSQ (PSC) was carried out using Cronbach's alpha. The results revealed that each subscale (reading, writing and math) and total scale had alpha values above 0.9 indicating a higher internal consistency. Comparatively, a higher value of >0.9 was observed in all scales of LDDI (Hammil, 1995) while in LDES the value was as >0.8 in all subscales (Mc Carney, 1996).

The stability of LDSQ (PSC) was ensured by comparison of test-retest scores of the study instrument two weeks apart, which showed that there was a higher correlation between the test and retest scores of the respondents on repeated administrations. Subscale as well as total scale correlation were found to be >0.8. When this is compared with LDES and LDDI, stability values were 0.9 and 0.8 respectively. However LDSQ (PSC) being a teacher

- **Acceptability of the tool**

The acceptability of the tool by the class teachers was satisfactory. None of the class teachers refused to participate. Acceptability was assessed during validation study where a single class teacher filled only 15 questionnaires in contrast to prevalence study during which a single class teacher assessed 20 children in the class. This can be considered as a limitation of the study.

5.2 Component 2

5.2.1 Methodological issues

The descriptive cross sectional study design that had been used by the present study to estimate the prevalence of LD is the most appropriate study design for a prevalence estimate. This design assesses the existing situation at a given point of time (Abramson and Abramson, 1999). Estimation of prevalence is considered to be important as it implies the magnitude of the problem which in turn could be used as guidance for strategic decisions in planning preventive programmes.

A school based descriptive cross sectional study was therefore carried out among grade three and grade four children in the Kalutara District for estimation of prevalence of LD and to describe comorbid behavioural problems.

Conducting the study in a familiar environment had minimized the logistic constraints and facilitated the data collection. Assistance from public health and educational staff contribute to the improvement of the quality of data. Kalutara District was chosen as the study setting mainly considering the feasibility of conducting the study by the PI.

The study was carried out among grade three and grade four children in the district. As the study was based on LD, grade-wise selection was preferred than age-wise selection. This particular study population was selected to represent the PSC considering the minimum age of reading and writing assessment as age seven and math assessment as age eight. This age group was represented among grade three and grade four children. Although a group of children in grade three were within the age group of < 8 years, this group was also recruited for math assessment as assessment was based on grade level education. Grade five children were not recruited due to the Scholarship examination.

The prevalence study adopted a multi-stage cluster sampling method with probability proportionate to size of grade three and grade four children. As taking a simple random sample of individuals across the district would be practically unfeasible, for this type of survey the best option for sampling is cluster sampling (Bennet, 1991). However, during calculation of sample size, measures were taken to make adjustment for clustering effect considering the roh value of socioeconomic variable as 0.2 thus multiplying the sample by a design effect of 4.8 (Bennet, 1991). Minimum cluster size was decided as 20 considering the work load of the teachers and minimum number of children in a type 3 school being 20. It is also stated that small cluster size (20) and large number of clusters (101) would increase the precision of the study compared to large cluster size with a small number of clusters (Bennet, 1991).

This research was carried out in randomly selected three educational divisions, selecting one division from each educational zone. Cluster allocation for the divisions was done according to population proportion of grade three and grade four children. Within each division, separate cluster allocation for grade three and four was done according to population proportion. Final cluster allocations for schools were done separately for grade three and grade four children by PPS. All these measures were taken to minimize the bias in selecting the sample and to ensure adequate study subjects representing grade three and four children in the district.

Screening for vision, hearing and IQ was carried out prior to data collection proper. IQ measurement was done among the children who got <30marks for Sinhala and Math during the previous term test. This method was adopted as measuring the IQ of the entire sample was not practically feasible. The PI had received training on measurement of IQ at the Mental Health Unit, NIHS. Screening for vision and hearing was done by two pre intern medical officers who were trained for a particular measurement. Written guidelines were prepared separately to minimize the variation during assessment. One pre intern medical officer was occupied for one type of measurement, either hearing or vision. By adopting this method inter observer variation could be minimized. Cut off for vision test was decided as 6/9 after considering the expert opinion.

A Teachers' Manual was prepared with clear instructions for completing the LDSQ (PSC). Expert opinion was obtained during preparation of the manual and judgment validity was ensured. The manual includes situational examples to simplify the administration procedure. The aim of preparing a manual was to minimize variation during class room assessment. At the beginning of data collection selected class teachers were gathered to one place, verbal instructions with demonstration sessions were carried out. Adequate time period was given to teachers to complete the questionnaire by observing learning behaviour of the children.

As caregivers represent varying levels of education the questionnaire was prepared to be administered as an IAQ. Preparation of the IAQ to assess demographic and socioeconomic characteristics was carried out with expert opinion. All necessary measures related to demographic and socioeconomic aspects were incorporated in to the questionnaire. Socioeconomic status was assessed by wealth index (Thalagala, 2004) which is a recognized measure of socio economic status and used in Demographic and Health Survey (DHS, 2006-7). However, the information on assets was obtained by interviewing the parents and not by observing the assets in the house setup. This can be considered as a limitation of this part of the study.

An interviewer guide was prepared to minimize variation during interviews. Four sociology graduates were selected and trained as field investigators to collect demographic and socioeconomic information from caregivers. As the educational divisions were situated in different locations, after considering feasibility of planning and organization of caregiver

interviews, it was decided to occupy four interviewers. However, the threat to the inter interviewer reliability by occupying more number of FIs was questioned. This was clarified by assessing inter interviewer reliability comparing measurements of the FIs with the PIs. All four inter interviewer reliability measures were found to be high. The demographic and socio economic IAQ consist of questions which were less sensitive and direct. Therefore, it can be assumed that administration of the questionnaire as IAQ by four FIs would not cause any harm to the validity of the responses.

Behavioural comorbidities were assessed using SDQ. After considering the brief nature, availability of a Sinhala translation (Perera, 2004), common usage in local setup, availability of a teacher version it was decided to adopt SDQ for this part of the study. However only self-reported version of SDQ had been validated to the local setting, selection of an un-validated version would be a limitation of the study. Any way it is worth to note that even in the validated version the cutoff for each difficulty and total difficulty had not been changed (Perera, 2004)

Data collection on SDQ was done concurrently with the demographic and socioeconomic IAQ. Only teacher form was selected as it is being administered as a SAQ. Teacher form of SDQ was given together with LDSQ (PSC) as a SAQ. As the questionnaire statements were prepared in such a way to use it as a self-administered questionnaire, after considering varying level of reading ability of the caregivers it was decided not to use parent version.

5.2.2. Prevalence of LD

Prevalence of reading, writing and math learning difficulty in the present study was 12.6% (n=235; 95% CI=11.1-14.1), 13.5% (n=251; 95% CI=12.0-15.1) and 13.3% (n=248; 95% CI=11.7-15.0) respectively. Prevalence of LD in the sample was 18% (n=336; 95% CI=16.3-19.8). Proportion of children with all three types of LD (reading, writing and math) was 7.8% (n=145; 95% CI=6.6-9.1). The prevalence of writing difficulty was higher among the study population compared to reading and math learning difficulty. However, after application of validity measures of each subscale, the adjusted prevalence of math

learning difficulty was higher (14.5%) compared to reading (12.3%) and writing learning difficulty (13.0%).

In a research study by CDC (USA) using NHIS data and adopting a multistage probability sampling method found that prevalence of LD among children in the age group of 3 to 17 years was 7.7%. The assessment method adopted was interviewing the parents and inquiring about the diagnosis of children with LD by any school health professionals. The prevalence was 5.07% among the age group of 3-10 years and 9.27% among age group of 11-17 years (Boyle et al, 2008). The low prevalence of LD in this study compared to the present study may be due to the method adopted for assessment where prevalence was based on already diagnosed children. The study however did not indicate that there was an ongoing screening programme in the school setup to identify children with LD. If this diagnosis is not made from a routine screening programme the estimated prevalence cannot be a valid measure of the actual prevalence. A higher proportion of LD children were in the age group 11 to 17 years compared to younger age which also supports that this cannot be from a routine screening programme, as more children are any way diagnosed with advancing age.

Altarac (2007) carried a study to assess lifetime prevalence of LD in USA using NSCH data and reported that the prevalence of LD was 9.7%.

When the present study was compared with the Indian study conducted among the age group of 8-11 years from third to fourth grade using similar method of sampling, it was noted that prevalence of LD was 15.2%, whereas 12.5%, 11.2% and 10.5% had dysgraphia (writing difficulty), dyslexia (reading difficulty) and dyscalculia (math learning difficulty) respectively (Mogasale,2012). The results of this study are different to that of the present study findings (LD 18%, writing difficulty 13.5%, reading difficulty 12.6% and math difficulty 13.3%). The study among Indian children selected scholastic backward children as the sample and exclusionary criteria were applied step wisely for vision, hearing and subnormal IQ. Remaining children were subjected to specific tests for reading comprehension, writing and math. The study had used the same exclusionary criteria of the present study. The study has selected only scholastic backwardness as the sample but the present study utilized a random sample of children as the sample. This study also revealed that writing difficulty was higher compared to other difficulty, the same finding of present

study. But the prevalence of math difficulty was comparatively higher (13.3% versus 10.5%) in the present study which needs to be researched in the future.

Prevalence of LD was found to be 13.7% in a cross sectional study conducted among PSC (n=423) in Jakarta, Indonesia (Wiguna, 2012). In this study after excluding physical, sensory and intellectual impairment LD was diagnosed by checking the discrepancy between their intellectual functioning and academic achievement. Children with below average academic achievement compared to their class mate's achievement (which was assessed by previous semester report card) were categorized as LD. The method of assessment included IQ achievement discrepancy method compared to present study. However diagnosing LD depending on the marks of a single semester is a questionable issue in this study.

Yao and Wu (2003) in their study found that prevalence of LD was 10.3%. The study was conducted among 1151 primary school children. Study instrument used was Pupil Rating Scale Revised screening for LD. Prevalence was estimated after the diagnosis was confirmed according to criteria set by ICD-10. The methodological difference in this study compared to the present study was that the present study estimated the prevalence based on screening criteria whereas in this study the prevalence estimation was done after the diagnosis.

Prevalence studies related to LD as such is limited compared to studies on reading difficulty. As the most common type of LD in western countries is reading difficulty it had been researched more than LD (Jenson, 2005, Molfese, 2006). It was found that prevalence of reading difficulty was 17% to 18% (Jenson, 2005) and accounting for 80% to 90% of all LD. When the type of LD is considered, the result of the present study on reading difficulty is similar to the Indian study than any other study (Mogasale, 2012).

The prevalence of math LD has been estimated to be 5%-6% in western countries (Jensen, 2005). Studies on math LD had been done mainly in the adolescent age groups. Similarly epidemiological data on writing difficulty is also lacking. Jensen (2005) stated that writing difficulty is estimated as 15% to 25% among school age population. Lyon estimated that 8% to 15% of school children are having writing difficulty. When the results of current

study is analyzed, more or less equal prevalence of writing LD and math LD can be observed.

Boyle et al (2008) found that the prevalence of LD was significantly high among children in the age group of 11-17 years compared to 3-10 years. But the present study revealed that LD was significantly higher (p=.02) among younger age group of <8years (22.3%) compared to ≥8years (17.1%). It was also stated that among the age group of 11-17 years a significantly (p<01) higher proportion of boys (8.97%) had LD compared to girls (5.01%).

Altarac (2007) found a significantly (p<.001) higher prevalence of LD among boys (12.2%) compared to girls (7.1%). The present study also found the same associations of sex with LD. Significantly (p<.001) more boys (23.3%) were found to have LD than girls (12.3%).

It was also found that there was a significant difference (p<.001) in LD among the groups of highest education in the household less than high school (13.4%), high school (12.3%) and more than high school (8.3%). The present study also found that LD was significantly higher (p<.001) among children with parental education <O/Level (27.2%) than >O/Level (11.2%) (Altarac, 2007).

(Altarac, 2007) found that LD differs significantly (p<.001) between groups of poverty <100% (14.8%) and >100% (68.1%). Present study found that LD was significantly higher among (p=<.001) <Rs.20, 000 (20.8%) parental income group compared to >Rs.20, 000 (12.5%) parental income; among 1st to 2nd wealth quintile (26.9%) compared to 3rd to 5th wealth quintile (11.4%).

5.2.3 Behavioural comorbidities of LD

During the review of psychometric properties of the parent and teacher form of SDQ for 4- to 12-year-olds using the results of 48 studies (N = 131,223h) it was found that internal consistency, test–retest reliability, and inter-rater agreement are satisfactory for the parent and teacher versions. At subscale level, the reliability of the teacher version seemed stronger compared to that of the parent version (Stone, 2010).

The present study considered only teacher form of SDQ to decide on behavioral problems. Based on the study finding of Stone (2010) and considering the varying level of parental education compared to the teacher, the decision was made towards using teachers' form as more informative compared to parents.

Mc Gee (1984) and Scachter (1991) found that prevalence of comorbid behavioural problems among children with LD ranged from 24% to 54%. In a retrospective study conducted at the Child and Adolescent Unit in NIMH in Bangalore, India, it was found that 79% of children with LD had comorbid psychological disorder. However the present study revealed that nearly 75% of children with LD had comorbid behavioural problems. Also it was noted a significant association between comorbid emotional and behavioural problems and LD measured by total difficulty score of SDQ ($p<.001$).

A study was conducted in UK among 5-15 year old children using data derived from the National Survey of Child Mental Health (Caroll, 2004). Specific literacy difficulties were measured using specific literacy scales and behavioural problems were assessed using SDQ parent and teacher ratings. Significant associations were noted between presence of literacy difficulties and scores of the SDQ subscales - hyperactivity (OR= 3.82, CI=2.37- 6.14), and conduct disorder (OR=2.40, CI=1.63-3.52). The present study also revealed that there was a significant association between all the subscales of SDQ and LD, namely emotional difficulties ($p<.001$), conduct problems ($p<.001$), peer problems ($p<.001$) and hyperactivity ($<.001$). As this component of the study was conducted as descriptive study strength of association of LD with each behavioural problem was not analyzed.

A study conducted among diagnosed LD children attending the Lady Ridgeway Hospital, found that, out of all children 60% had symptoms suggestive of ADHD (Wijerathne, 2003). The present study revealed that 68.8% children with LD had comorbid hyperactivity. The reason for this difference may be due to the exact diagnosis made in the clinic setup compared to teacher or parent rating where the number of borderline cases was higher. Kariyawasam (2002) found that LD was a common neuropsychiatric manifestation among children diagnosed to have ADHD.

5.3 Component 3

5.3.1 Methodological issues

A case controls study was carried out to determine the risk factors of LD. Although a prospective cohort study would be the best option to evaluate the temporal relationship of the risk factors of LD, it is not feasible in this situation as it needs at least a birth cohort to be followed until a minimum age of 7 to 8 years at which a possible diagnosis of LD can be made. It has been shown that a case-control method would provide the same results in addition to high efficacy and low cost, compared to a follow-up method (Maruti et al., 2009).

An unmatched case control study was carried out as the risk variables for LD were adjusted for confounders by performing a logistic regression analysis. In a case-control study, the main purpose of matching is to permit the use of efficient analytical methods to control confounding by the factors matched for (Snyder et al., 2009).

Data collection for the case control study was carried out once the data collection and preliminary analysis of the prevalence study was completed. This had facilitated the data collection of the case control study which needed time and effort to cross check information with the secondary data available with mothers. It also minimized the data wasting that would have occurred if data collection was done concurrently with the prevalence study.

During case selection, measures were taken to confirm extreme cases and extreme controls by the MO Mental Health. Therefore children with all three problems were selected as cases. Since both cases and controls underwent the same diagnostic criteria, it helped in minimizing misclassification bias (Snyder et al., 2009). As MO Mental Health had been trained on diagnosing LD the clinical diagnosis by the MO Mental Health can be considered as a valid method. This strategy was adopted as taking a Consultant Psychiatrist or a Clinical Psychologists to each and every school was not practically feasible.

Selection bias, a major limitation in case-control study designs was overcome by ensuring comparability between cases and controls. Controls were selected from the same school and grade from which cases were confirmed. Although increase of case control ratio would

improve the power of the study, the present study utilized case: control as 1:1 as this part involved a separate data collection secondary to prevalence study.

Measures were taken to prepare the risk factor questionnaire based on literature and expert opinion. Some variables which have an association, but no obvious temporal relationship with LD were not incorporated in to the questionnaire.

Mothers were contacted using contact information obtained during prevalence study and this had minimized the non-response rate. An interviewer-administered-questionnaire was used since the mothers were from different educational backgrounds. Pre intern medical officers were selected for the data collection of this part of the study as a majority of questions needed revision of medically related secondary data.

A major limitation in case-control study designs is recall bias, which prevents the establishment of temporal relationship. Every possible measure was taken in this study to minimize this error. Maternal and perinatal factors were reconfirmed after comparing with the documents available such as CHDR, diagnosis cards, and antenatal records. Prior to perception questions, mothers were inquired whether they can remember the incidence. In some situations, a response of "can't remember" was incorporated in to the questionnaire. However, most of the questions formed were related to major issues in a mother's life which she was able to remember.

As information such as Apgar score was collected using secondary data alone, this information could not been obtained due to the fact that 98% of CHDR did not carry information on Apgar score. At the same time all the CHDR had information on birth weight and this could be considered as a strength.

5.3.2 Risk factors of LD

Of the 141 confirmed cases, 137 mothers participated for the interview giving a response rate of 97%.

The present study revealed a statistically significant association between male sex and LD after application of multiple logistic regression analysis (OR=6.1, 95% CI=2.7-14.; p<.001). Corrigon (1996) also found that male sex (OR 1.6; 95% CI=1.3-2.0) was a risk factor when predicting LD from preschool surveillance data. Jennifer (2001) who studied

the boy/girl difference in risk for reading difficulty also identified that male children had 2.5 times higher risk for reading difficulty compared to girls.

The effect of socio economic variables on LD was initially assessed using bivariate analysis. Parent education <O/Level (OR=2.1, 95%CI= 1.3-3.4, p=.004), low social class (OR=5.9, 95%CI= 1.3-27.1, p=.02) and poverty measured by poor wealth quintile (OR=2.7, 95%CI= 1.6-4.4, p<.001) were significantly associated with LD. As the socio economic status was assessed by the variables, social class and wealth quintile, the latter was selected as a predictor variable for the regression model. Although lower social class is a significant variable, having a wide 95% CI indicates OR estimate is less precise. After multiple logistic regression analysis, poor wealth quintile was identified as a risk factor in the model (OR=2.6, 95% CI= 1.1-6.0, p=.02). Altarac (2007) in his study to assess life time prevalence of LD in US children found that poverty <100% (poverty was expressed as a percentage of federal poverty level (OR= 1.88, 95% CI=1.55-2.29) and parental education <high school (OR=1.4; 95% CI=1.13-1.8) and high school (OR= 1.37; 95% CI=1.21-1.55) were significant predictors of LD.

A significant association between several maternal factors and LD was noticed during bivariate analysis of present study. Unplanned pregnancy (OR=3.2; 95% CI=1.8-5.7;p<.001), violence during pregnancy (OR=3.9; 95% CI=1.5-10.1;p=.004), perceived bad psychological wellbeing during antenatal period (OR=2.4; 95% CI=1.3-4.4;p=.009), <20 and >35 maternal age (OR=6.7; 95% CI=3.4-13.4;p<.001), were the variables that showed a significant association. Out of all maternal factors maternal age <20 and >35was recognized as a significant predictor (OR 11.9; 95% CI=3.6-39.7) in the model.

Ralitza (2001) reported that after controlling the confounding effect of low maternal education and poor socioeconomic status, effect of teenage pregnancy on LD disappeared (OR 0.69, 95%CI=.56-.85) and effect of high maternal age (>36 yrs.) increased (OR=1.2; 95%CI=0.96-1.5).

In contrast to the findings of the present study, where perceived psychological wellbeing during pregnancy was not a significant predictor, Christian Hill (1998) found that stress during pregnancy (RR 2.8) was an indicator in maternal perinatal scale that was significantly associated with long term learning and educational disability in offspring.

When the delivery related factors were assessed, period of gestation <37 weeks had a significant association (OR= 3.5, 95% CI= 1.8-6.8, p<.001) with LD during bivariate analysis while mode of delivery did not show a significant association. But gestation <37 weeks was not identified as having a significant association with LD in the logistic regression analysis model.

Corrigon (1996) found that prematurity less than 35 weeks (OR 3.0, 95%CI=1.4-5.1) was significantly associated with LD after multiple logistic regression. Chapmon (2001) found that gestational age <37weeks was a risk factor in predicting learning difficulty in childhood (RR=1.6; 95%CI=1.5-1.7).

It was stated that infants presenting in the breech position during labor have been shown to have learning difficulties requiring treatment later in life (Muller *et al.,* 1971). But the present study did not show a significant association with mode of delivery.

Bivariate analysis for neonatal factors were performed and birth weight <2500g (OR= 2.6, 95% CI= 1.5-4.7, p<.001), delivery or neonatal complications (OR= 2.5, 95% CI= 1.4-4.4, p=.002) and receipt of PBU care for >3days (OR= 3.7, 95% CI= 1.8-7.2, p<.001) have shown a significant association with LD. However duration of PBU stay >3 days has turned up as a significant predictor (OR= 6.4, 95% CI= 1.6-25.5, p=0.04) in the model. Comparatively, it was found that the presence of a medical condition at birth needing NICU was significantly associated with SLD in later life (OR; 1.28, 95% CI; 1.03-1.59) (Resnick et al, 1998). Several studies have shown that low birth weight was a significant risk factor of LD (Klebanov, 1994; Avchen, 2001; Lynn, 2011). Chapman et al (2001) found that VLBW (Very Low Birth Weight) (RR=2.5, 95%CI= 2, 1-3, 0) was significantly associated with LD.

During the analysis, neonatal and delivery complications were amalgamated and analyzed. Although major complications like fetal distress, neonatal meningitis and sepsis were found among cases, due to lack of controls on these variables, individual level analysis was not done. Therefore, the study limited comparison with other studies in which neonatal encephalopathy and sepsis produced significant association with LD (Maura, 2006; Robertson, 1989).

Infancy related factors such as meningitis, anesthesia exposure and convulsions were noted as risk factors of LD (Murray et al, 2006; Louvois 2006, Bong, 2013 respectively). The present study assessed several infancy related factors together as "special attention during infancy". Special attention during infancy was a significant variable in predicting LD (OR=3.1, 95% CI; 1.2-8.0).

Developmental delay is a known factor that had been studied in other countries during prediction of LD. The present study revealed significant association of motor developmental delay (OR=3.2, 95% CI; 1.5-6.5;p=.002) and speech delay (OR=1.3, 95% CI; 1.3-6.7;p=.009) with LD. Left handedness also showed a significant association with LD (OR=2.9, 95% CI; 1.3-6.4,p=.007). Motor delay and handedness were included in the model and motor development delay was identified as a significant predictor of LD (OR=2.8, 95% CI; 1.02-7.8; p=.008).

Murray et al (2006) found that the associations between age at first standing and talking and achievement and IQ at age 8 remained statistically significant after regression analysis (standing: $p = 0.02$, speech: $p = 0.001$).

Corrigon (1996) found that speech delay (OR 3.3; 95%CI=2.1-5.2) was significantly associated with LD after multiple logistic regressions. However in the present study due to <10events for predictor variable this factor was not included in the model.

Significant early childhood factors identified in the bivariate analysis were febrile convulsion (OR 5.4; 95%CI=2.3-12.9; p<.001), non-febrile convulsion (OR 13.6; 95%CI=3.1-59.0, p<.001), one or more sleep problems (OR 4.7; 95%CI=2.1-10.2, p<.002) and child with Special Health Care Need (OR 3.8; 95%CI=2.2-6.0). However, non-febrile convulsion which had only two controls for predictor variable and produced a very wide confidence interval was not included in the model. Febrile convulsion was also excluded as it contained 7 controls. The model identified child with SHCN as a significant predictor (OR=5.2; 95%CI=2.1-13.2, p<.001).

Comparatively Altarac (2007) found that children with special health care need was significantly associated with LD. Risk had increased with increasing number of criteria -

single criteria (OR=2.9; 95%CI=2.6-3.4), two criteria (OR 5.6; 95%CI=4.7-6.6) and three criteria (OR 5.5; 95%CI=7.8-11.5).

Several studies had shown that sleep disorder is a significant risk factor for LD (Corrigon, 1996; Fensterseifer, 2013 and Guenther, 2003).

Studies revealed that anesthesia exposure (Wilder, 2009) and child life events (Jorgen, 1986) were significant risk factors for LD while the present study did not reveal a significant association during bivariate analysis.

Philip (2008) found that epilepsy was a risk factor when predicting LD among children (OR 3.85; 95%CI=1.02-14.29). Due to lack of an adequate number of events for predictor variable this factor was not included in the model.

During the analysis of family level factor, family history of LD was identified as a significant predictor variable (OR=3.3; 95%CI=1.1-9.6, p=.03). Snowling et al (2003) and Scarborough (1990) had also found an association between LD and family history of LD.

During analysis of factors related to home environment ≥5 family members (OR=2.2; 95%CI=1.2-3.8, p=.008), father frequent smoker (OR=3.6; 95%CI=1.9-5.8, p<.001), father frequent alcohol user (OR=2.8; 95%CI=1.6-4.9, p<.001) and violent disagreement pattern in the household (OR=5.2; 95%CI=2.9-9.5,p<.001) showed a significant association with LD. However, violent disagreement pattern (OR=4.3; 95%CI=1.4-12.5,p=.008) and ≥5 family members (OR=4.3; 95%CI=1.7-10.8) was identified as significant predictors of LD.

Altarac (2007) found that, families never/rarely/sometimes discuss serious disagreement calmly, was a predictor for LD (OR=1.16; 95%CI=1.03-1.29). He also found that anyone in the household smoking was a significant predictor for LD (OR=1.16; 95%CI=1.04-1.30).

5.4 Component 4

Maternal concern towards parenting children with LD was assessed by a qualitative study. As this part of the study involved in taking very sensitive information, detail information and aspects of maternal concerns a qualitative study was said to be more appropriate than a quantitative analysis. Further, in the local setting, mothers of primary school children are very much concerned and relatively under stress due to the Scholarship Examination.

Therefore the mothers of children without any type of LD are also undergoing a stressful situation. Therefore even a comparative study may not be able to produce a valid result on maternal concern towards parenting children with LD.

In the present study the maternal concern towards parenting children with LD was assessed by having FGDs with the mothers of affected children. In the local culture, the mother takes most of the responsibilities of child rearing activities. At the same time she faces lot of stressful situations while parenting these children. Therefore the mothers were selected as the participants for this component of the study. Al Issa (1982) found that women have higher rates of worries than men in relation to parenthood.

Dyson (2003) found that higher level of parental stress was associated with having children with LD and less socially competent or hyperactivity. The present study also revealed that mothers were more stress when the children were having comorbid behavioural problems.

Karande (2009) found that 75% of mothers who had children with LD had mild anxiety. Majority, 90% of mothers' common worry was related to child's future. However, present study revealed that the mothers get nervous when they attending parents meetings and during teaching the children with LD.

CHAPTER SIX
CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

1. The LDSQ (PSC) is a culture specific, valid and a reliable instrument that can be utilized as a teacher administered tool to measure LD among primary school children in grade three and grade four.

2. Prevalence of LD among grade three and grade four primary school children was 18%. The prevalence of reading, writing and math LD was 12.6%, 13.5% and 13.3% respectively.

3. LD exists as overlapping problems than mutually exclusive problems. The prevalence of single type of LD was 4.4%, two types of LD 5.8% and all three types of LD 7.8%.

4. Prevalence of LD was significantly high among the males, children studying in schools other than 1AB, children with parental monthly income of ≤Rs. 20,000, children of social class III-V and 1st and 2nd wealth quintile.

5. Behavioural problems were significantly associated with LD. Emotional difficulties, conduct problems, hyperactivity, peer problems and behavioural problems as a whole revealed a significant relationship with LD ($p<.001$).

6. Of the potential risk factors, male sex, poor wealth quintile, maternal age at delivery <20 & >35years, PBU stay >3days, child needed special attention during infancy, motor development delay, Child with Special Health Care Needs in early child hood, family

history of LD, family with >5 members, home with violent disagreement pattern were identified as significant predictors of LD by the LR model.

7. According to mothers of children with LD, uncertainty about future expectations, difficulties experienced in parenting children with LD and with superadded behavioural problems, stressful events experienced in family functioning, and negative experiences gained during school involvement had imposed a psychologically stressful situation during daily caring and rearing of the child.

6.2 Recommendations

1. LD among primary school children is a school health problem and should be brought to the notice of the Ministry of Education as well as the Ministry of Health.

2. A comprehensive screening program should be utilized at primary grade level for early identification of problems to facilitate initiation of intervention programs.

3. Teachers training programmes should be organized to introduce the concept of LD and to understand the overall problem and its consequences.

4. Mental health services should be incorporated in to the school system in order to address LD children with comorbid behavioural problems.

5. A practical intervention programme can be organized using Multi sensorial teaching methods, one to one teaching methods, daily support via learning support units are some form of interventions which can be incorporated in to the system.

6. The risk factor model developed in the study could be validated for preschool children. After validation a risk screening system could be integrated at pre-school level for early identification of high risk children before commencing schooling.

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LEARNING DISABILITY EVALUATION SCALE - RENORMED Second Edition (LDES-R2)

Stephen B. McCarney, Ed.D.
&
Tamara J. Arthaud, Ph.D.

The *Learning Disability Evaluation Scale - Renormed Second Edition* **(LDES-R2)** was developed to enable in-uctional personnel to document those performance behaviors most characteristic of learning disabilities in children d youth. The instrument is designed to provide a profile based on the most commonly accepted definition of learn- disabilities (IDEA, 2004).

The **LDES-R2** subscales are

- Listening,
- Thinking,
- Speaking,
- Reading,
- Writing,
- Spelling, and
- Mathematical Calculations.

The **LDES-R2** was standardized on a total of 4,473 students, ages 6 through 18 years and grades 1-12. Demo-aphic characteristics of the standardization sample approximate national percentages for gender, residence, race, ographic area, and occupation of parents.

Internal consistency of the **LDES-R2** fell at or above .41 for each item to its subscale. Test-retest reliability yielded rrelation coefficients ranging from .60 through .70, indicating substantial reliability for each of the 7 subscales. efficients for inter-rater reliability for the subscales ranged from .68 to .83 for all age levels. Content validity was tablished through the initial development process. The scale was compared to the *Learning Disabilities Diagnostic ventory* (LDDI) as a measure of concurrent validity. All subscales of the **LDES-R2** correlated significantly with the DI subscales to which they were compared. The construct validity of the scale supports strong diagnostic validity.

The **LDES-R2** uses frequency-referenced quantifiers. Each item on the **LDES-R2** is rated on a four-point scale OT DEVELOPMENTALLY APPROPRIATE FOR AGE, RARELY OR NEVER, INCONSISTENTLY, CONSISTENTLY). llowing administration, four types of scores may be obtained: frequency rating for each item (reflecting the severity the learning difficulty), subscale raw score (the sum of the frequency ratings for each subscale), subscale quotient ore, and subscale percentile. Standard errors of measurement (SEM) are provided for each subscale quotient.

The **LDES-R2** takes approximately 20 minutes to complete by anyone familiar with the student: the classroom acher, clinical personnel, or other school personnel. The **LDES-R2** complete kit consists of a technical manual, ting forms, and the *Learning Disability Intervention Manual-Revised.*

The *Learning Disability Intervention Manual - Revised* **(LDIM-R)** includes goals, objectives, and intervention ategies for all behaviors on the scale and was designed for the convenient development of the student's IEP, as ell as classroom intervention. The *Learning Disability Intervention Manual - Revised* used in conjunction with the **DES-R2** provides an assessment and intervention program for learning disabled children and youth. The *Parent's uide to Learning Disabilities* **(PGLD)** contains interventions for parents to implement in the home to help their arning disabled child.

H A W T H O R N E
Phone: (800) 542-1673 FAX: (800) 442-9509

PRE-REFERRAL
LEARNING PROBLEM CHECKLIST

Date: _____

ame of student: _____ Birthdate: _____ Age: _____ Gender: _____

hool: _____ Grade: _____

ty: _____ State: _____ Observed by: _____

server's position: _____ Student know to observer: _____ _____
(from) (to)

ngth of time each day with student: _____ _____
(hours) (minutes)

TO OBSERVER: Check each behavior you have observed the student demonstrate during the past month.

LISTENING

1. Does not hear all of what is said (e.g., misses word endings, misses key words such as "do not," etc.)
2. Does not direct attention or fails to maintain attention to important sounds in the immediate environment (e.g., teacher directions, public address system, etc.)
3. Has difficulty differentiating speech sounds heard (e.g., does not tell the difference between /ch/ and /sh/ sounds, similar vowel sounds, similar consonant sounds, rhyming words, etc.)
4. Is unsuccessful in activities requiring listening (e.g., games, following oral directions, etc.)
5. Needs oral questions and directions frequently repeated (e.g., student says, "I don't understand;" needs constant reminders, etc.)
6. Attends more successfully when close to the source of sound (e.g., when seated close to the teacher
7. Requires eye contact in order to listen successfully (e.g., one-to-one situation)

THINKING

8. Fails to demonstrate short-term memory skills (e.g. does not remember two- or three-step directions, does not remember materials needed for a task, does not memorize words to a poem or song, etc.)
9. Fails to remember sequences (e.g., events in daily routine, days of the week, months of the year, etc.)
10. Does not demonstrate an understanding of spatial relationships (e.g., above-below, near-far, over-under, etc.)
11. Demonstrates difficulty with visual memory (i.e., does not remember information received visually)
12. Demonstrates difficulty with auditory memory (i.e., does not remember information received auditorily)
13. Does not demonstrate an understanding of directionality (e.g., left-right, forward-backward, east-west, etc.)
14. Has difficulty concentrating (e.g., staying on an assigned task, following a conversation, etc.)
15. Perseverates - does the same thing over and over (e.g., has difficulty changing activities, routines, etc.)

SCHOOL VERSION RATING FORM

Stephen B. McCarney

COVER SHEET

RATING GUIDELINES

The student should be rated by educational personnel with primary observational opportunities who work directly with the student during instructional situations.

The LDES-R2 does not require a performance demonstration for each item on the scale. The rater should rely on his/her observations of the student's ability to perform the behaviors on the scale as those behaviors occur naturally in the educational environment.

Should an educator rating a student have no knowledge of the student's ability to perform a particular item on the scale, it is recommended that another educator be consulted to provide information for that item. No boxes can be left blank.

At the secondary level, or in departmentalized elementary programs, educational personnel may rate only those areas (subscales) which they have had the opportunity to observe.

Any number of persons may rate the student. Each person should independently rate the student using a separate rating form.

It is not necessary to complete the rating of a student in one day. Several days may elapse before the rater is able to complete the scale.

- It is recommended that the rater read each quantifier with the item, before rating the item. Using item 25 as an example, the rater would first read, "Is not developmentally appropriate for age to imitate speech sounds," then "Rarely or never demonstrates imitating speech sounds," "Inconsistently imitates speech sounds," and finally "All or most of the time imitates speech sounds."

- If the behavior or skill is developmentally beyond what is expected for the student's age, the rating should be **0**

  NOT DEVELOPMENTALLY APPROPRIATE FOR AGE.

- If the student does not exhibit or rarely exhibits the learning or performance item indicated on the scale, the rating should be **1**

  RARELY OR NEVER.

- If the student often, but not always, demonstrates the learning or performance item on the scale, the rating should be **2**

  INCONSISTENTLY.

- If the student consistently demonstrates the learning or performance item on the scale, the rating should be **3**

  CONSISTENTLY.

H A W T H O R N E
Phone: (800) 542-1673 FAX: (800) 442-9509

TO RATER: Rate every item using the quantifiers (0-3) provided. Every item must be rated. Do not leave any boxes blank.

NOT DEVELOPMENTALLY APPROPRIATE FOR AGE	RARELY OR NEVER	INCONSISTENTLY	ALL OR MOST OF THE TIME
0	1	2	3

LISTENING

1. Does not hear all of what is said (e.g., misses word endings, misses key words such as "do not," etc.)
2. Does not direct attention or fails to maintain attention to important sounds in the immediate environment (e.g., teacher directions, public address system, etc.)
3. Has difficulty differentiating speech sounds heard (e.g., does not tell the difference between /ch/ and /sh/ sounds, similar vowel sounds, similar consonant sounds, rhyming words, etc.)
4. Is unsuccessful in activities requiring listening (e.g., games, following oral directions, etc.)
5. Needs oral questions and directions frequently repeated (e.g., student says, "I don't understand;" needs constant reminders, etc.)
6. Attends more successfully when close to the source of sound (e.g., when seated close to the teacher)
7. Requires eye contact in order to listen successfully (e.g., one-to-one situation)

2 Raw Score

THINKING

8. Fails to demonstrate short-term memory skills (e.g., does not remember two- or three-step directions, does not remember materials needed for a task, does not memorize words to a poem or song, etc.)
9. Fails to remember sequences (e.g., events in a daily routine, days of the week, months of the year, etc.)
10. Does not demonstrate an understanding of spatial relationships (e.g., above-below, near-far, over-under, etc.)
11. Demonstrates difficulty with visual memory (i.e., does not remember information received visually)
12. [1] Demonstrates difficulty with auditory memory (i.e., does not remember information received auditorily)
13. [1] Does not demonstrate an understanding of directionality (e.g., left-right, forward-backward, east-west, etc.)
14. [2] Has difficulty concentrating (e.g., staying on an assigned task, following a conversation, etc.)
15. [1] Perseverates - does the same thing over and over (e.g., has difficulty changing activities, routines, etc.)
16. [2] Fails to demonstrate organization (e.g., does not organize time, assignments, materials, etc.)
17. [2] Fails to demonstrate logical thinking (e.g., making decisions, solving problems, making inferences, etc.)
18. [1] Has difficulty retrieving, recalling, or naming objects, persons, places, etc. (i.e., does not think of them at all or is slow to respond)
19. [1] Demonstrates visual perception problems (e.g., visual closure, visual memory, visual figure-ground discrimination, etc.)
20. [1] Has difficulty classifying (e.g., does not recognize similarities, differences, etc.)
21. [1] Fails to generalize knowledge from one situation to another (e.g., identifies the word "house" on a flash card, but fails to identify it in a sentence; does count by fives, but does not count nickels; knows that 6 × 8 = 48, but does not understand that 48 ÷ 6 = 8; etc.)
22. [1] Demonstrates confusion (e.g., walks into the wrong classroom or area)
23. [2] Remembers information one time but not the next
24. [1] Requires slow, sequential, substantially broken-down presentation of concepts

21 Raw Score

SPEAKING

25. Has difficulty imitating speech sounds

26. Omits, adds, substitutes, or rearranges sounds or words when speaking

27. Distorts or mispronounces words or sounds when speaking (not attributed to dialect or accent)

28. Does not use appropriate subject-verb agreement when speaking (e.g., says, "It don't matter to me;" instead of "It doesn't matter to me.")

29. Does not carry on conversations with peers and adults

30. Has a limited speaking vocabulary

31. Fails to use verb tenses correctly when speaking (e.g., past, present, future)

32. Speaks dysfluently (e.g., runs words and sentences together, speaks too fast or slow, pauses at incorrect places, etc.)

33. Does not complete statements or thoughts when speaking (e.g., speaks in incomplete sentences, fails to think of correct words to express ideas, etc.)

10 Raw Score

READING

34. Fails to demonstrate word attack skills (e.g., phonics, context clues, picture clues, etc.)

35. Fails to recognize words on grade level

36. Fails to correctly answer comprehension questions from reading activities

37. Loses place when reading (e.g., leaves out words, lines, or sentences when reading)

38. Has difficulty with sound-symbol relationships (e.g., does not know that the letter "d" makes the /d/ sound)

39. Has difficulty with phonics skills when reading (i.e., fails to sound out words correctly or blend sounds into words)

40. Omits, adds, substitutes, or reverses letters, words, or sounds when reading

41. Fails to demonstrate word comprehension (i.e., does not know the meaning of words read)

[1] 42. Reads words correctly in one context but not in another (e.g., does read a word from a flash card but not in a sentence)

[3] 43. Does not read independently (i.e., does not choose reading as an independent activity, avoids reading, etc.)

[1] 44. Does not discriminate between similar letters and words (e.g., "m" and "n," "cat" and "cap," etc.)

[1] 45. Does not know all the letters of the alphabet

[3] 46. Understands what is read to him/her but not what he/she reads silently

[2] 47. Fails to finish assignments because of reading difficulties (i.e., reads too slowly to finish on time)

22 Raw Score

WRITING

[1] 48. Fails to copy letters, words, sentences, and numbers from a model at a close proximity (e.g., does not copy from a textbook)

[1] 49. Fails to copy letters, words, sentences, and numbers from a model at a distance (e.g., does not copy from the chalkboard)

[1] 50. Fails to use capitalization correctly when writing

[1] 51. Uses inappropriate spacing between words or sentences when writing

[1] 52. Reverses letters and numbers when writing

[1] 53. Fails to write within a given space (e.g., writes off of the page, does not write on a line, etc.)

[2] 54. Fails to punctuate correctly when writing

[2] 55. Does not use appropriate subject-verb agreement when writing

[2] 56. Does not compose complete sentences or express complete thoughts when writing

[1] 57. Fails to correctly organize writing activities (e.g., does not sequence events, develop a paragraph, use correct word order, etc.)

[1] 58. Omits, adds, or substitutes words when writing

[1] 59. Fails to form letters correctly when printing or writing (e.g., a's do not look like a's, b's do not look like b's, does not connect letters, etc.)

60. Fails to use verb tenses correctly when writing (e.g., past, present, future)

61. Uses inappropriate letter size when writing (i.e., too large or too small)

8 Raw Score

SPELLING

62. Fails to use spelling rules (e.g., "i before e except after c," rules for changing words to plural form, etc.)

63. Has difficulty with phonetic approaches to spelling (i.e., does not spell words the way they sound)

64. Omits, substitutes, adds, or rearranges letters or sound units when spelling words

65. Has difficulty spelling words that do not follow the spelling rules

66. Does not use word endings correctly when spelling or omits them (e.g., -ed, -ing, -ly, -er, etc.)

67. Spells words correctly in one context but not in another (e.g., does spell the word on a quiz but not in a sentence, does not spell the word from dictation but does spell it correctly in a sentence, etc.)

68. Requires continued drill and practice in order to learn spelling words (i.e., takes much longer to learn words than other students)

___ Raw Score

MATHEMATICAL CALCULATIONS

69. Has difficulty solving math word problems

70. Fails to change from one math operation to another (e.g., starts with addition and does not change to subtraction)

71. Does not understand abstract math concepts without concrete examples (i.e., must have manipulatives in order to work math problems)

72. Fails to correctly solve math problems requiring regrouping (i.e., borrowing and carrying)

[1] 73. Works math problems from left to right instead of right to left

[1] 74. Fails to follow necessary steps in math problems (e.g., does steps in the wrong order, omits a step, etc.)

[1] 75. Fails to correctly solve math problems involving fractions or decimals (e.g., understanding parts of the whole, recognizing fractional values, performing operations, etc.)

[1] 76. Fails to demonstrate knowledge of place value

[1] 77. Confuses operational signs when working math problems (e.g., +, -, ÷, ×)

[1] 78. Has difficulty understanding abstract concepts (e.g., dimensionality, size, space, shape, etc.)

[1] 79. Fails to correctly solve problems involving money (e.g., coin recognition and value, counting money, making change, etc.)

[1] 80. Fails to correctly solve problems using measurement (e.g., length, volume, weight, etc.)

[1] 81. Fails to correctly solve math problems requiring division

[1] 82. Does not understand the concept of time (e.g., does not know how to tell time, does not use a calendar, does not work problems involving time, etc.)

[1] 83. Fails to correctly solve math problems requiring addition

[1] 84. Fails to correctly solve math problems requiring subtraction

[1] 85. Fails to correctly solve math problems requiring multiplication

[1] 86. Does not understand the concept of skip counting (e.g., may be able to count by fives, but does not know that five is being added to each consecutive number)

[1] 87. Does not remember math facts

[1] 88. Does not make use of columns when working math problems (e.g., puts numbers in wrong columns, adds across columns, etc.)

20 Raw Score

The Cognitive Processing Inventory (CPI)

for ages 7-adult

me of person being rated:_____ Date of Rating:_____

ool or Organization:_____ Age:_____

/Gender (circle): M F Grade (if in school):_____

ng Completed by:_____

ationship (circle): self mother father other guardian:_____

teacher counselor other school staff:_____

(if more than one person is completing this form, use different colored pens)

RT I:

following questions may provide valuable information which can help in the interpretation of the ratings obtained on e 2. Please answer each of these questions to the best of your ability by circling the correct response as it applies to the son being rated.

Are there other family members with learning difficulties? Yes No (if yes, circle below)

Parent Sibling Aunt/Uncle Grandparent Cousin

Were there any complications before or during birth?	Yes	No	?
Has there ever been a serious head injury?	Yes	No	?
Has there ever been any medical issue that may have affected the brain?	Yes	No	?
Did this person have many ear infections during infancy or childhood?	Yes	No	?
s there an identified or suspected attention deficit disorder (ADD or ADHD)?	Yes	No	?
Does this person have an identified or suspected Learning Disability?	Yes	No	?
In your opinion, are there any behavior problems which may interfere in school?	Yes	No	?
Is there a visual problem that is not fully correctable with glasses?	Yes	No	?
Is there any hearing problem that is not fully corrected?	Yes	No	?

RT II:

the following 50 items rate yourself (your child/student) based upon information from any reliable source (i.e. direct ervation, interview, assessment data, etc.). Use the following scale to circle a number from 1 to 5 to the right of each item. "3" if uncertain.

Obvious Difficulty 1	Apparent Weakness 2	Average or Uncertain 3	Not a Problem 4	Obvious Strength 5

Ability to understand or remember questions, directions, or verbal instructions. Like when a teacher is just lecturing or without any charts pictures.	1	2	3	4	5	4. Ability to remember or understand the basic idea of what happened in a movie or story - general information rather than specific details.	1	2	3	4	5
Ability to quickly think through a difficult problem or situation. Does a better answer come later in the day or even the next day?	1	2	3	4	5	5. Ability to remember the names of characters or other specific details in a story or movie.	1	2	3	4	5
Ability to remember new phone numbers and/or addresses.	1	2	3	4	5	6. Ability to get or stay organized. Does organization come easily?	1	2	3	4	5

Obvious Difficulty 1	Apparent Weakness 2	Average or Uncertain 3	Not a Problem 4	Obvious Strength 5

Ability to pay attention to instruction and lectures.	1 2 3 4 5
Ability to remember or follow complex directions or requests (involving 3 or more steps). Does the request need to be repeated?	1 2 3 4 5
Ability to read quickly and fluently.	1 2 3 4 5
Ability to quickly sound out new words.	1 2 3 4 5
Ability to understand what is read just using the "context" (without pictures).	1 2 3 4 5
Ability to understand what is read when there are pictures for clues.	1 2 3 4 5
Handwriting neatness.	1 2 3 4 5
Writing mechanics (spelling, punctuation, capitalization, etc.).	1 2 3 4 5
Writing content. Ability to express ideas in writing when the mechanics don't matter.	1 2 3 4 5
Letter/word orientation. This is a "difficulty" if letters are ever reversed (b/d, etc.), out of order in words or starting words with the wrong letter.	1 2 3 4 5
Ability to remember specific formulas for solving math problems.	1 2 3 4 5
Ability to estimate or figure out the answer to math problems without using a specific formula.	1 2 3 4 5
Verbal speed - ability to talk quickly and clearly.	1 2 3 4 5
Verbal fluency without noticeable pauses or groping for words. Is it difficult to come up with the right words to express a thought?	1 2 3 4 5
Ability to solve visual or mechanical puzzles or problems.	1 2 3 4 5
Ability to recognize voices (like on the telephone).	1 2 3 4 5
Ability to stay focused and recheck tasks without making careless mistakes.	1 2 3 4 5
Ability to be creative and come up with new ideas or new ways of doing something.	1 2 3 4 5
General sense of humor. Do you (does he/she) see humor in lots of situations or have difficulty understanding what others think is funny?	1 2 3 4 5
Rhythmic or musical skills (even if an instrument is not played).	1 2 3 4 5
Ability to "plan" and to break large tasks into smaller parts or steps.	1 2 3 4 5

28. Arts and crafts skills (drawing, painting, sculpture, etc.).	1 2 3 4 5
29. Ability to visualize and imagine things in your (his/her) head (pictures, faces, words, numbers, etc.).	1 2 3 4 5
30. Ability to accomplish long-term goals or projects.	1 2 3 4 5
31. Directional skills (right/left, north/south, etc.).	1 2 3 4 5
32. Ability to complete jigsaw puzzles.	1 2 3 4 5
33. Ability to remember the words of new popular songs.	1 2 3 4 5
34. Ability to remember the tunes to new popular songs.	1 2 3 4 5
35. Ability to cope with an unexpected change in plans.	1 2 3 4 5
36. Ability to cope with transitions from one activity to another.	1 2 3 4 5
37. Ability to remember the rules to games.	1 2 3 4 5
38. Ability to keep up with activities. Are you (is he/she) the first to start and/or finish something (4 or 5) or are others kept waiting (1 or 2)?	1 2 3 4 5
39. Ability to sit still for long periods of time in school.	1 2 3 4 5
40. Ability to control emotions and avoid overreacting to situations.	1 2 3 4 5
41. Ability to cope with disappointment.	1 2 3 4 5
42. Ability to begin tasks without being told or reminded.	1 2 3 4 5
43. Ability to keep busy to avoid being bored.	1 2 3 4 5
44. Ability to follow a schedule for homework or chores.	1 2 3 4 5
45. Awareness of homework assignments. Do you (does he/she) come home knowing what to do?	1 2 3 4 5
46. Ability to find necessary materials to complete chores or assignments.	1 2 3 4 5
47. Ability to keep room or desk clean and organized.	1 2 3 4 5
48. Awareness of how your (his/her) behavior affects others.	1 2 3 4 5
49. Sensitivity to the feelings of others.	1 2 3 4 5
50. Ability to stick with a difficult or unpleasant task.	1 2 3 4 5

Annexure III Format for Delphi technique for selection of a working definition (A), Selection of item from existing instrument (B)

Prof / Dr. .....

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Dear Sir/Madam,

I am a postgraduate trainee in Community Medicine attached to the Department of Community Medicine, Faculty of Medical Sciences, University of Sri Jayawardanapura, Nugegoda.

As a requirement for the completion of the MD degree in Community Medicine, I am carrying out a research study titled ""**Learning difficulty among primary school children in the district of Kalutara: Prevalence, behavioural comorbidities, risk factors and parental psychological distress**", under the supervision of Prof. Pushpa Fonseka, Former Professor in Community Medicine, Faculty of Medical Sciences, University of Sri Jayewardenepura and Prof. Samudra T. Kathriarrchchi, Professor of Psychiatry, Faculty of Medical Sciences, University of Sri Jayewardenepura.

Following are the objectives of the study,

1. To develop and validate an instrument to assess learning difficulty among primary school children in grades three and four.

2. To determine the prevalence of learning difficulty among primary school children in grades three and four in the district of Kalutara.

3. To describe the behavioral comorbidities of learning difficulty among these primary school children.

4. To determine selected risk factors for learning difficulty among primary school children in grades three and four

5. To describe learning difficulty specific psychological distress among parents of children with learning difficulty.

I am planning to develop a Learning Difficulty screening instrument to screen primary school Children for Learning Difficulty. Opinion of experts in the field of Psychiatry, Psychology and Education is highly needed during the phase of

development of the questionnaire. Therefore an opinion survey has been planned to get expert opinion for the following areas during development of the instrument.

1. Selection of a working definition for Learning Difficulty (Section A)
2. Item selection from the existing instrument of LD (Section B)
3. Assessment of Content relevance of generated items through key informants interviews (Section C)

Selection of a working definition for Learning Difficulty (Section A)

Different definitions of Learning Difficulty had been developed and used in the field of education, psychology and psychiatry during research. Most of these definitions used in international studies were based on the definitions given in Diagnostic and Statistical Manual for Mental Disorders (DSM IV) and Individual with Disabilities Education Act (IDEA). Following definitions were prepared after considering already available definitions, the aspects that the current study intends to cover and main exclusionary criteria. The definitions were worded differently to select a more appropriate definition.

- I would kindly request; the experts to go through following definitions and rate it 1 to 5 according to your opinion from most appropriate (1) to least appropriate (5) definition in given boxes.
- Please give your valuable comments in the space provided for wording, any addition and or any omission.
- The altered version with the best selected definition will be circulated again to obtain the consensus of the group of expert.

1. Learning difficulty is defined as significant difficulties in the acquisition and use of reading, writing and mathematics without a significant general impairment of intelligence and without any physical disabilities. ☐

2. Learning difficulty is defined as significant difficulties in reading, writing and mathematics compared to chronological age and grade of an individual who does not have hearing, visual disabilities and emotional disturbances and

☐

who does not show a significant general impairment of intelligence measured by a standard intelligence test

3. Learning difficulty is defined as significant difficulties in learning achievements in reading, writing and mathematics compared to chronological age and education grade of an individual who does not have any physical disabilities that directly impair learning and who does not show a significant general impairment of intelligence measured by a standard intelligence test

4. Significant difficulties in reading, writing and mathematical achievements than expected age and grade of an individual whose general intelligence measured by a standard intelligence test is 70 or above and who does not have hearing and visual impairment.

5. Learning difficulty is defined as substantially below reading, writing and mathematical abilities when compared to chronological age and grade of an individual whose intelligence measured by a standard intelligence test is 70 or above and who does not have any physical disabilities that directly impair learning

Comments

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2. Item selection from the existing instrument of LD (Section B)

During literature survey I have identified few already existing instruments that can be used for item selection during the development of the screening instrument, of which Learning Disability Evaluation Scale (LDES) contains more appropriate items related to working definition of present study. Therefore items from the subscales of LDES; reading, writing and mathematics were selected to include in preliminary item list I. Please be kind enough to go through the item list provided and review following aspects in order to select items to be included in the instrument going to be developed.

- Whether the selected item is suitable to measure Learning Difficulty
- Whether the selected item is applicable to Sri Lankan primary education system
- Whether the selected item is suitable to be included in a teacher administered screening tool
- Whether the selected behaviour in learning is easy to observe in a class room set up
- Whether rewording is necessary to simplify the presentation and understanding of the items. If yes, please write in the space given

Please follow the rating scale given below when selecting the items to be included in the questionnaire. It is rated in a 9 point rating scale where,

9 – Denotes that you are fully agreed that this item is appropriate to be included in the questionnaire after considering above criteria.

1 – Denotes that you are completely disagreed that this item is appropriate to be included in the questionnaire after considering above criteria.

Totally Disagree								Fully Agree
1	2	3	4	5	6	7	8	9

1.	Fails to demonstrate word attack skills (e.g., phonics, context clues, picture clues, etc.)	1	2	3	4	5	6	7	8	9
2.	Fails to recognize words on grade level	1	2	3	4	5	6	7	8	9
3.	Fails to correctly answer comprehension questions from reading activities	1	2	3	4	5	6	7	8	9
4.	Loses place when reading (e.g., leaves out words, lines, or sentences when reading)	1	2	3	4	5	6	7	8	9
5.	Has difficulty with sound-symbol relationships (e.g., does not know that the letter "d" makes the /d/ sound)	1	2	3	4	5	6	7	8	9
6.	Has difficulty with phonics skills when reading (i.e., fails to sound out words correctly or blend sounds into words)	1	2	3	4	5	6	7	8	9
7.	Omits, adds, substitutes, or reverses letters, words, or sounds when reading	1	2	3	4	5	6	7	8	9
8.	Fails to demonstrate word comprehension (i.e., does not know the meaning of words read)	1	2	3	4	5	6	7	8	9
9.	Reads words correctly in one context but not in another (e.g., does read a word from a flash card but not in a sentence)	1	2	3	4	5	6	7	8	9
10.	Does not discriminate between similar letters and words (e.g., "m" and "n," "cat" and "cap," etc.)	1	2	3	4	5	6	7	8	9
11.	Does not know all the letters of the alphabet	1	2	3	4	5	6	7	8	9
12.	Understands what is read to him/her but not what he/she reads silently	1	2	3	4	5	6	7	8	9
13.	Fails to finish assignments because of reading difficulties (i.e., reads too slowly to finish on time)	1	2	3	4	5	6	7	8	9
14.	Does not read independently (i.e., does not choose reading as an independent activity, avoids reading, etc.)									

		1 2 3 4 5 6 7 8 9
15.	Fails to copy letters, words, sentences, and numbers from a model at a close proximity (e.g., does not copy from a textbook)	1 2 3 4 5 6 7 8 9
16.	Fails to copy letters, words, sentences, and numbers from a model at a distance (e.g., does not copy from the chalkboard)	1 2 3 4 5 6 7 8 9
17.	Fails to use capitalization correctly when writing	1 2 3 4 5 6 7 8 9
18.	Uses inappropriate spacing between words or sentences when writing	1 2 3 4 5 6 7 8 9
19.	Reverses letters and numbers when writing	1 2 3 4 5 6 7 8 9
20.	Fails to write within a given space (e.g., writes off of the page, does not write on a line, etc.)	1 2 3 4 5 6 7 8 9
21.	Fails to punctuate correctly when writing	1 2 3 4 5 6 7 8 9
22.	Does not use appropriate subject-verb agreement when writing	1 2 3 4 5 6 7 8 9
23.	Does not compose complete sentences or express complete thoughts when writing	1 2 3 4 5 6 7 8 9
24.	Fails to correctly organize writing activities (e.g., does not sequence events, develop a paragraph, use correct word order, etc.)	1 2 3 4 5 6 7 8 9
25.	Omits, adds, or substitutes words when writing	1 2 3 4 5 6 7 8 9
26.	Fails to form letters correctly when printing or writing (e.g., a's do not look like a's, b's do not look like b's, does not connect letters, etc.)	1 2 3 4 5 6 7 8 9
27.	Uses inappropriate letter size when writing (i.e., too large or too small)	1 2 3 4 5 6 7 8 9
28.	Has difficulty solving math word problems	1 2 3 4 5 6 7 8 9

29.	Fails to change from one math operation to another (e.g., starts with addition and does not change to subtraction)	1	2	3	4	5	6	7	8	9
30.	Does not understand abstract math concepts without concrete examples (i.e., must have manipulative in order to work math problems)	1	2	3	4	5	6	7	8	9
31.	Fails to correctly solve math problems requiring regrouping (i.e., borrowing and carrying)	1	2	3	4	5	6	7	8	9
32.	Works math problems from left to right instead of right to left	1	2	3	4	5	6	7	8	9
33.	Fails to follow necessary steps in math problems (e.g., does steps in the wrong order,	1	2	3	4	5	6	7	8	9
34.	Fails to correctly solve math problems involving fractions or decimals (e.g., understanding parts of the whole, recognizing fractional values, performing operations, etc.)	1	2	3	4	5	6	7	8	9
35.	Fails to demonstrate knowledge of place value	1	2	3	4	5	6	7	8	9
36.	Confuses operational signs when working math problems (e.g., +, -, ÷, ×)	1	2	3	4	5	6	7	8	9
37.	Fails to correctly solve problems involving money (e.g., coin recognition and value, counting money, making change, etc.)	1	2	3	4	5	6	7	8	9
38.	Fails to correctly solve problems using measurement (e.g., length, volume, weight, etc.)	1	2	3	4	5	6	7	8	9
39.	Fails to correctly solve math problems requiring division	1	2	3	4	5	6	7	8	9
40.	Does not understand the concept of time (e.g., does not know how to tell time, does not use a calendar, does not work problems involving time, etc.)	1	2	3	4	5	6	7	8	9
41.	Fails to correctly solve math problems requiring addition	1	2	3	4	5	6	7	8	9
42.	Fails to correctly solve math problems requiring subtraction	1	2	3	4	5	6	7	8	9

43.	Fails to correctly solve math problems requiring multiplication	1 2 3 4 5 6 7 8 9
44.	Does not understand the concept of skip counting (e.g., may be able to count by fives, but does not know that five is being added to each consecutive number)	1 2 3 4 5 6 7 8 9
45.	Does not remember math facts	1 2 3 4 5 6 7 8 9
46.	Does not make use of columns when working math problems (e.g., puts numbers in wrong columns, ads across columns, etc.)	1 2 3 4 5 6 7 8 9

Please give the suggested rewording

Q	Suggestions

I shall be thankful for all the experts for your valuable comments and kind cooperation that extend to make this a success.

Thank you,

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Annex IV

Items generated through literature search of standard questionnaires.

1. Losses place while reading
2. Omit, add or distort the reading matter while reading
3. Doesn't differentiate between similar looking letters and words
4. Reverses words while reading
5. Fails to finish work on time due to reading difficulty
6. Fails to correctly answer the comprehension questions from reading activities
7. Uses inappropriate letter size when writing (i.e., too large or too small)
8. Has trouble in staying "on the line" while writing
9. Uses uneven spacing between letters and words while writing
10. Miss out / substitute letters while writing
11. Reverses letters/ numbers and symbols while writing
12. Confuses similar looking words while writing
13. Finds difficulty/ delay in copying work from a blackboard or from a text book
14. Reverses numbers when writing
15. Confuses similar looking numbers (0 and 9, 3 and 5)
16. Confuses operational signs when working with math problems (+/-/x/÷)
17. Works math problems from left to right instead of right to left
18. Fails to correctly solve math problems requiring addition
19. Fails to correctly solve math problems requiring subtraction
20. Has difficulty in solving math problems requiring borrowing
21. Has difficulty in solving math problems requiring carrying over
22. Has difficulty in solving math word problems

Annex V

Items generated through literature search of standard questionnaires – Sinhala translation.

1. කියවමේදී බොහෝවට තමා කියවන ස්ථානය මගහැරේ
2. කියවමේදී වචන අඩුකර කියවීම/ අළුතෙන් වචන එකතු කිරීම/ අන්තර්ගතය වෙනස් කිරීම සිදුකරයි
3. එක හා සමාන අකුරු හා වචන හඳුනා නොගනී
4. වචන අනෙක් පැත්ත හරවා කියවයි
5. කියවමෙ අපහසුතාවය නිසා නියමිත කාලය තුළ වැඩ නිම නොකරයි
6. ජේද ඇසුරින් අසන ලද ප්‍රශ්න වලට නිවැරැදිව පිළිතුරු නොදෙයි
7. ලිවිමේදී නුසුදුසු අකුරු ප්‍රමාණ භාවිතා කරයි (ඉතා විශාල හෝ ඉතා කුඩා අකුරු ලියයි)
8. රැල මත අකුරු ලිවීමට අපහසු බවක් පෙන්වයි
9. ලිවිමේදී අකුරු අතර හා වචන අතර අසමාන පරතර තබයි
10. ලිවිමේදී අකුරු අඩු කරයි/ අළුතින් අකුරු එකතු කරයි
11. ලියන විට අකුරු/ ඉලක්කම්/ සංකේත අනෙක් පැත්ත හරවා ලියයි
12. එක හා සමාන සේ පෙනෙන වචන පටලවා ලියයි
13. කළුලැල්ලේ හෝ පාඩම් පොතෙහි ඇති දෑ පිටපත් කිරීමේදී අපහසුතාවයක්/ ප්‍රමාදයක් පෙන්වයි
14. සංඛ්‍යා අනෙක් පැත්ත හරවා ලියයි
15. සමාන පෙනුමක් ඇති සංඛ්‍යා පටලවා ගනියි (0 සහ 9, 3 සහ 5)
16. ගණිත ගැටළු විසඳීමේදී සංකේත (+/-/x/÷) පටලවා ගනී
17. ගණිත ගැටළු විසඳීමේදී දකුණේ සිට වමට විසඳීම වෙනුවට වමේ සිට දකුණට විසඳයි
18. එකතු කිරීම් අවශ්‍ය ගණිත ගැටළු විසඳීමට අසමත් බවක් පෙන්වයි
19. අඩු කිරීම් අවශ්‍ය ගණිත ගැටළු විසඳීමට අසමත් බවක් පෙන්වයි
20. ගෙනඒම් සහිත ගැටළු විසඳීමට අපහසුතාවක් දක්වයි
21. ගෙනයාම් සහිත ගැටළු විසඳීමට අපහසුතාවක් දක්වයි
22. වගන්ති සහිත ගණිත ගැටළු විසඳීමට අපහසුතාවක් දක්වයි

Annex VI

Results of bilingual test showing item to item agreement of English and Sinhala item list 1

No		No: agreed	Kappa value
1	Losses place while reading	24	0.912
2	Omit, add or distort the reading matter while reading	25	1.00
3	Doesn't differentiate between similar looking letters and words	25	1.00
4	Reverses words while reading	23	0.828
5	Fails to finish work on time due to reading difficulty	25	1.00
6	Fails to correctly answer the comprehension questions from reading activities	25	1.00
7	Uses inappropriate letter size when writing (i.e., too large or too small)	24	0.912
8	Has trouble in staying "on the line" while writing	25	1.00
9	Uses uneven spacing between letters and words while writing	25	1.00
10	Miss out / substitute letters while writing	25	1.00
11	Reverses letters/ numbers and symbols while writing	25	1.00
12	Confuses similar looking words while writing	25	1.00
13	Finds difficulty/ delay in copying work from a blackboard or from a text	24	0.912
14	Reverses numbers when writing	25	1.00
15	Confuses similar looking numbers (0 and 9, 3 and 5)	25	1.00
16	Confuses operational signs when working with math problems (+/-/x/÷)	25	1.00
17	Works math problems from left to right instead of right to left	25	1.00
18	Fails to correctly solve math problems requiring addition	25	1.00
19	Fails to correctly solve math problems requiring subtraction	25	1.00
20	Has difficulty in solving math problems requiring borrowing	25	1.00
21	Has difficulty in solving math problems requiring carrying over	25	1.00
22	Has difficulty in solving math word problems	25	1.00

Annex VIIA

Key informant interviews with diagnostic service providers in phase I of development of LDSQ (English)

Interviewer guide for service providers – English

1. Give me a brief description about your experience as a service provider for children with learning difficulty

2. What sort of behaviour do they exhibit towards reading?
   - Speed/fluency of reading
   - Accuracy of reading
   - Willingness to read

3. What sort of behaviour do they exhibit towards writing?
   - Willingness, positioning of pencil while writing
   - Neatness/ letter size/ incomplete writing/ frequent erasing
   - Ability of copying correctly

4. What is their behaviour towards mathematical calculation
   - Willingness towards the subject
   - Accuracy
   - Difficult areas

5. What is their perception regarding relationship with friends

6. What do they say about their willingness to learn, future ambitions

Key informant interviews with diagnostic service providers in phase I of development of LDSQ (English)

Interviewer guide for service providers – Sinhala

01.ඉගෙනීමේ දුර්වලතාවලින් පෙළෙන ළමුන් සම්බන්ධයෙන් ඔබේ සේවා අත්දැකීම පිළිබඳ කෙටි විස්තරයක් ලබාදෙන්න.

02. කියවීම සම්බන්ධව ඔවුන් දක්වන හැසිරීම් රටාව කෙබඳු වේද?

- කියවීමේ වේගය/වතුර බව
- කියවීමේ නිවැරදි බව
- කියවීමට ඇති කැමැත්ත

03. ලිවීම සම්බන්ධව ඔවුන් දක්වන හැසිරීම් රටාව කෙබඳු වේද?

කැමැත්ත/ලියනවිට පැන්සල තබාගන්න ආකාරය/පිළිවෙල බව/ අකුරු ප්‍රමාණය/අසම්පූර්ණ ලිවීම්/නිතර මැනීම/නිවැරදිව බලා ලිවීමට ඇති හැකියාව.

04. ගණිතය සම්බන්ධයෙන් ඔවුන් දක්වන හැසිරීම් රටාව කෙබඳුද?

රටාව කෙබඳුද?

- විෂයට ඇති කැමැත්ත.
- නිවැරදි බව
- දුෂ්කර කොටස්

05. පන්තියේ අනිත් මිතුරන්/මිතුරියන් සමඟ දක්වන සම්බන්ධතාව කෙරෙහි ඔවුන්ගේ අදහස කුමක්ද?

06. ඉගෙනීමට ඇති කැමැත්ත/අනාගත බලාපොරොත්තු ගැන ඔවුන් දක්වන අදහස කුමක්ද?

Annex VIIB

Key informant interviews with supportive service providers in the phase I of development of LDSQ (English)

Interviewer guide for supportive service providers – English

7. How long have you been working in this field

8. Can you give me a brief description about you

9. Are you aware about learning difficulty?/ Do you have any experience in diagnosing or managing children with learning difficulty

10. Explain his/her behaviour in the class room
    - Attentiveness/ Ability to concentrate on a task
    - Follow instructions
    - Ability to organize work

11. What sort of behaviour do they exhibit towards reading?
    - Speed/fluency of reading
    - Accuracy of reading
    - Willingness to read

12. What sort of behaviour do they exhibit towards writing?
    - Willingness, positioning of pencil while writing
    - Neatness/ letter size/ incomplete writing/ frequent erasing
    - Ability of copying correctly

13. What is their behaviour towards mathematical calculation
    - Willingness towards the subject
    - Accuracy
    - Difficult areas

Key informant interviews with supportive service providers in the phase I of development of LDSQ (English)

Interviewer guide – Sinhala

01. මෙම ක්ෂේත්‍රයේ ඔබ කොපමණ කාලයක් සේවය කරනවාද?

02. ඔබ ගැන කෙටි විස්තරයක් මට ලබාදිය හැකිද?

02. ඉගෙනීමේ දුර්වලතාවය ගැන ඔබ දැනසිටියාද?/ ඉගෙනීමේ දුර්වලතාවයන් පෙළෙන දරුවන් හඳුනාගැනීමට හා කලමණාකරණය කිරීමට ඔබට අත්දැකීම් තිබෙනවාද?

04. පන්ති කාමරය තුළ ඔවුන්ගේ හැසිරීම විස්තර කරන්න.

- අවධානයෙන් සිටීම/එක එල්ලේ කාර්යයක නිරතවීමට ඇති හැකියාව.
- උපදෙස් පිළිපැදීම.
- වැඩ සංවිධානය කිරීමට ඇති හැකියාව

05. කියවීම සම්බන්ධයෙන් ඔවුන් දක්වන හැසිරීම කෙසේ වේද?

කියවීමේ වේගය/චතුර බව (ව්‍යක්ත බව)

කියවීමේ නිවැරදිතාව

කියවීමට ඇති කැමැත්ත

06. ලිවීම සම්බන්ධයෙන් ඔවුන් දක්වන හැසිරීම කෙසේ වේද?

- කැමැත්ත / ලියන විට පැන්සල අල්ලන ආකාරය
- පිළිවෙල බව/ අසම්පූර්ණ ලිවීම්/අකරු ප්‍රමාණය/ නිතර මැකීමට පුරුදුව සිටීම.
- නිවැරදිව බලා ලිවීමට ඇති හැකියාව

07. ගණිතය සම්බන්ධයෙන් ඔවුන් දක්වන හැසිරීම කෙසේ වේද?

- විෂය කෙරෙහි දක්වන කැමති.
- නිවැරදිතාවය
- දුෂ්කර කොටස්

Annex VIIIA

Item list 2 - Items derived from key informant interviews (Sinhala).

1. කියවීමට අකැමැත්ත පෙන්වයි/ කියවීම මගහරියි
2. ඉතා අඩු වේගයකින් කියවයි
3. වචන හා වරාම ලකුණු ගැන නොසලකා ඉතා වේගයෙන් කියවයි
4. තැනින් තැන නවතමින් තැවත පටන් ගනිමින් දෙගිඩියාවෙන් කියවයි
5. කියවනවිට වට පිට බලයි
6. ඇඟිල්ල තබමින් කියවීමට උත්සාහ කරයි
7. අකුරින් අකුර ගැටගසමින් කියවයි
8. කියවීමේදී නුපුරුදු වචන අනුමාන කරයි
9. පිල්ලම් සහිත වචන අපහසුවෙන් කියවයි
10. අකුරු වැඩි ප්‍රමාණයක් ඇති වචන හා මහප්‍රාණ අකුරු සහිත වචන අපහසුවෙන් කියවයි
11. අළුත් වචන මතක තබාගැනීමට අපහසු බවක් පෙන්වයි
12. ලිවීමට අකැමැත්ත පෙන්වයි/ ලිවීම මගහරියි
13. ලියන විට අපහසු ආකාරයෙන්/ වැරැදි ආකාරයෙන් පැන්සල අල්ලයි
14. ඉතා සෙමින් ලියයි
15. එකම පේළියේ විවිධ ප්‍රමාණයේ අකුරු ලියයි
16. කියවය නොහැකි කැත අකුරු ලියයි
17. ලියන විට නිතර මකයි (සෑම වචනයක් හෝ දෙකක් පාසා)
18. ලියන විට නිතර නිතර පැන්සල උල් කරයි
19. පිල්ලම් සහිත අකුරු නිවැරැදිව නොලියයි
20. පද නොබෙදා ලියයි/ වැරැදි ලෙස පද බෙදා ලියයි
21. වැරැදි උච්චාරණ සහිත අකුරු යොදා ලියයි (ං වෙනුවට ම්/ ඊ වෙනුවට යී)
22. අපිළිවෙල හා අසම්පූර්ණ ආකාරයෙන් ලියයි
23. ගණිතයට අකැමැත්ත දක්වයි/ ගණන් සෑදීම මග හරියි
24. දෙන ලද කාලය තුළ ගණිත වැඩ සම්පූර්ණ නොකරයි
25. ගණිත ගෙදර වැඩ නොකරයි
26. ගණිත ගැටළු විසඳීමට උත්සාහ දැරීමට පෙරම උදව් ඉල්ලයි
27. සංඛ්‍යා නම් කිරීමට අපහසුබවක් දක්වයි/ පවසන සංඛ්‍යාවක් ලිවීමට අපහසුබවක් දක්වයි
28. අසාර්ථක ලෙස සංඛ්‍යා පෙළ ගැස්වීම නිසා වැරැදි ලෙස ගණනය කරයි
29. ගුණන වගු හැදෑරීමේදී අපහසුතාවක් දක්වයි

30. ඔරලෝසු මුහුණතක් බලා වේලාව පැවසීමේදී අපහසුතාවක් දක්වයි

31. ආරෝහණ හා අවරෝහණ පිළිවෙලට සංඛ්‍යා පෙළ ගැස්වීමට අපහසුතාවක් දක්වයි

32. වම හා දකුණු දිශා හඳුනා නොගනී

33. ලොකු/ කුඩා උස/මට අඩු/ වැඩි යන ප්‍රමාණාත්මක සංකල්ප වෙන්කර හඳුනාගැනීමේදී ගැටළු මතුවේ

Annex VIII B

Item list 2 -Items derived from key informant interviews (English).

1. Dislike reading/Avoid reading
2. Reads very slowly
3. Reads very quickly ignoring phrasing and punctuations
4. Read with many starts, stops and hesitation
5. Looks around while reading
6. Tries to keep the finger while reading
7. Read by joining letters one by one
8. Guesses unfamiliar words while reading
9. Difficulty in pronouncing complex words
10. Difficulty in reading words with many letters and complex letters
11. Has poor retention in new vocabulary
12. Dislikes writing/ and avoid writing
13. Holds the pencil in an awkward / wrong position when writing
14. Writes very slowly
15. Writes letters with different sizes on the same line
16. Illegible and shaggy hand writing
17. Erases frequently while writing (erase every word or two)
18. Sharpens the pencil frequently while writing
19. Writes complex letters incorrectly
20. Doesn't divide the words/ incorrectly divide the words when writing
21. Writes letters with wrong pronunciation
22. Write in a messy and incomplete way
23. Dislike/avoid doing math
24. Doesn't complete math work in a given time
25. Doesn't do math home work
26. Asks for help before trying math problems
27. Difficulty in naming numerals / Difficulty in writing numerals when it is said
28. Poorly align numbers resulting in computational errors.
29. Has difficulty in learning multiplication tables
30. Has difficulty in telling time from a clock

31. Has difficulty in arranging numbers in ascending or/ and descending order
32. Poor left right orientation
33. Has difficulty in differentiating concepts such as big/small, tall/short, few/many

Preliminary draft of LDSQ (PSC)

Annex IX

Item (අංශය)	Never	Rarely	Sometimes	Often	Always
Reading					
1. කියවීමට අකැමැත්ත පෙන්වයි/ කියවීම මගහරියි Dislike reading/Avoid reading					
2. ඉතා අඩු වේගයකින් කියවයි Reads very slowly					
3. වචන හා විරාම ලකුණු ගැන නොසලකා ඉතා වේගයෙන් කියවයි Reads very quickly ignoring phrasing and punctuations					
4. තැනින් තැන නවතමින් තැවත පටන් ගනිමින් දෙගිඩියාවෙන් කියවයි Read with many starts, stops and hesitation					
5. කියවන විට වට පිට බලයි Looks around while reading					
6. කියවීමේදී බොහෝවිට තමා කියවන ස්ථානය මගහැරේ Losses place while reading					
7. කියවීමේදී වචන අඩුකර කියවීම/ අළුතෙන් වචන එකතු කිරීම/ අන්තරගතය වෙනස් කිරීම සිදුකරයි Omit, add or distort the reading matter while reading					
8. ඇඟිල්ල තබමින් කියවීමට උත්සාහ කරයි Tries to keep the finger while reading					
9. අකුරින් අකුර ගැටගසමින් කියවයි Read by joining letters one by one					
10. එක හා සමාන අකුරු හා වචන හඳුනා නොගනී (ට-ම/ ත-ක-න) Doesn't differentiate between similar looking letters and words					
11. වචන අනෙක් පැත්ත හරවා කියවයි Reverses words while reading					
12. කියවීමේදී නුපුරුදු වචන අනුමාන කරයි Guesses unfamiliar words while reading					
13. පිල්ලම් සහිත වචන අපහසුවෙන් කියවයි Difficulty in pronouncing complex words					
14. අකුරු වැඩි ප්‍රමාණයක් ඇති වචන හා මහප්‍රාණ අකුරු සහිත වචන අපහසුවෙන් කියවයි Difficulty in reading words with many letters and complex letters					
15. කියවීමේ අපහසුතාවය නිසා නියමිත කාලය තුළ වැඩ නිම නොකරයි Fails to finish work on time due to reading difficulty					
16. අළුත් වචන මතක තබාගැනීමට අපහසු බවක් පෙන්වයි Has poor retention in new vocabulary					
17. ඡේද ඇසුරින් අසන ලද ප්‍රශ්න වලට නිවැරදිව පිළිතුරු නොදෙයි Fails to correctly answer the comprehension questions from reading activities					
Writing					

18.ලිවීමට අකැමැත්ත පෙන්වයි/ ලිවීම මගහරියි Dislikes writing/ and avoid writing					
19.ලියන විට අපහසු ආකාරයෙන්/ වැරැදි ආකාරයෙන් පැන්සල අල්ලයි Holds the pencil in an awkward / wrong position when writing					
20.ඉතා සෙමින් ලියයි Writes very slowly					
21.එකම පේළියේ විවිධ ප්‍රමාණයේ අකුරු ලියයි Writes letters with different sizes on the same line					
22.ලිවීමේදී නුසුදුසු අකුරු ප්‍රමාණ භාවිතා කරයි (ඉතා විශාල හෝ ඉතා කුඩා අකුරු ලියයි Uses inappropriate letter size when writing (i.e., too large or too small)					
23.රූල මත අකුරු ලිවීමට අපහසු බවක් පෙන්වයි Has trouble in staying "on the line" while writing					
24. කියවිය නොහැකි කැත අකුරු ලියයි Illegible and shaggy hand writing					
25.ලිවීමේදී අකුරු අතර හා වචන අතර අසමාන පරතර තබයි Uses uneven spacing between letters and words while writing					
26.ලියන විට නිතර මකයි (සෑම වචනයක් හෝ දෙකක් පාසා) Erases frequently while writing (erase every word or two					
27.ලියන විට නිතර නිතර පැන්සල උල් කරයි Sharpens the pencil frequently while writing					
28.ලිවීමේදී අකුරු අඩු කරයි/ අළුතින් අකුරු එකතු කරයි Miss out / substitute letters while writing					
29.ලියන විට අකුරු/ ඉලක්කම්/ සංකේත අයෙක් පැත්ත හරවා ලියයි Reverses letters/ numbers and symbols while writing					
30.පිල්ලම් සහිත අකුරු නිවැරැදිව නොලියයි Writes complex letters incorrectly					
31.එක හා සමාන සේ පෙනෙන වචන පටලවා ලියයි Confuses similar looking words while writing					
32. කළුලෑල්ලේ හෝ පාඩම් පොතෙහි ඇති දෑ පිටපත් කිරීමේදී අපහසුතාවයක්/ ප්‍රමාදයක් පෙන්වයි Finds difficulty/ delay in copying work from a blackboard or from a text book					
33. පද නොබෙදා ලියයි/ වැරැදි ලෙස පද බෙදා ලියයි Doesn't divide the words/ incorrectly divide the words when writing					
34.වැරැදි උච්චාරණ සහිත අකුරු යොදා ලියයි (ං වෙනුවට ම්/ ර් වෙනුවට යි) Writes letters with wrong pronounciation					
35.අපිළිවෙල හා අසම්පූර්ණ ආකාරයෙන් ලියයි Write in a messy and incomplete way					

Mathematics					
36.ගණිතයට අකැමැත්ත දක්වයි/ ගණන් සෑදීම මග හරියි Dislike/avoid doing math					
37.දෙන ලද කාලය තුළ ගණිත වැඩ සම්පූර්ණ නොකරයි Doesn't complete math work in a given time					
38.ගණිත ගෙදර වැඩ නොකරයි Doesn't do math home work					
39.ගණිත ගැටළු විසඳීමට උත්සාහ දැරීමට පෙරම උදව් ඉල්ලයි Asks for help before trying math problems					
40.සංඛ්‍යා නම් කිරීමට අපහසුබවක් දක්වයි / පවසන සංඛ්‍යාවක් ලිවීමට අපහසුබවක් දක්වයි Difficulty in naming numerals/ Difficulty in writing numerals when it is said					
41.සංඛ්‍යා අනෙක් පැත්ත හරවා ලියයි Reverses numbers when writing					
42.සමාන පෙනුමක් ඇති සංඛ්‍යා පටලවා ගනියි (0 සහ 9, 3 සහ 5) Confuses similar looking numbers (0 and 9, 3 and 5)					
43.ගණිත ගැටළු විසඳීමේදී සංකේත (+/-/x/÷) පටලවා ගනී Confuses operational signs when working with math problems (+/-/x/÷)					
44.ගණිත ගැටළු විසඳීමේදී දකුණේ සිට වමට විසඳීම වෙනුවට වමේ සිට දකුණට විසඳයි works math problems from left to right instead of right to left					
45.එකතු කිරීම් අවශ්‍ය ගණිත ගැටළු විසඳීමට අසමත් බවක් පෙන්වයි Fails to correctly solve math problems requiring addition					
46.අඩු කිරීම් අවශ්‍ය ගණිත ගැටළු විසඳීමට අසමත් බවක් පෙන්වයි Fails to correctly solve math problems requiring subtraction					
47.අසාර්ථක ලෙස සංඛ්‍යා පෙළ ගැස්වීම නිසා වැරැදි ලෙස ගණනය කරයි Poorly align numbers resulting in computational errors.					
48.ගෙනඒම් සහිත ගැටළු විසඳීමට අපහසුතාවක් දක්වයි Has difficulty in solving math problems requiring borrowing					
49.ගෙනයාම් සහිත ගැටළු විසඳීමට අපහසුතාවක් දක්වයි Has difficulty in solving math problems requiring carrying over					
50.ගුණන වගු හැදෑරීමේදී අපහසුතාවක් දක්වයි Has difficulty in learning multiplication tables					
51.ඔරලෝසු මුහුණතක් බලා වේලාව පැවසීමේදී අපහසුතාවක් දක්වයි Has difficulty in telling time from a clock					
52.වගන්ති සහිත ගණිත ගැටළු විසඳීමට අපහසුතාවක් දක්වයි Has difficulty in solving math word problems					
53. ආරෝහණ හා අවරෝහණ පිළිවෙලට සංඛ්‍යා පෙළ ගැස්වීමට අපහසුතාවක් දක්වයි Has difficulty in arranging numbers in ascending or/ and descending order					

54. වම හා දකුණු දිශා හඳුනා නොගනී Poor left right orientation					
55. ලොකු/ කුඩා උස/මට අඩු/ වැඩි යන ප්‍රමාණාත්මක සංකල්ප වෙන්කර හඳුනාගැනීමේදී ගැටළු මතුවේ Has difficulty in differentiating concepts such as big/small, tall/short, few/many					
General					
56. වැඩ කරන කාලය තුළ අඩුවෙන් අවධානය යොමුකරයි Pay poor attention during lessons					
57. පන්ති කාලය තුළ අන් ළමුන්ට බාධා කරයි Disturbs others during class time					
58. නිතර පාසැලට නොපැමිණේ Often absent to school					
59. අන් ළමයින්ගෙන් පාඩම් වැඩ පිටපත් කරයි Copy work from other children					

Annex X

Assessment of Content Validity Index (CVI) Section C

Dear Sir,Madam

This is the preliminary item list of LDSQ (PSC). The items in the preliminary list were gathered from item selected by the experts using existing instrument and interviews with Key informants (service providers). Please review the items for duplication.

Specific learning behaviors that each child would exhibit in reading, writing and math and general derived from key informant's interview were also included in the preliminary list. Please mark as X indicating how relevant each items in measuring learning difficulty.

Please rate these items as

1- Totally irrelevant content
2- Irrelevant content
3- Relevant content
4- Extremely relevant content

Please make your comments on duplication of items and suggestions to rephrase any statement in order to improve comprehensibility of the questionnaire.

Comments:

Item (අංශය)	1	2	3	4
Reading				
1. කියවීමට අකැමැත්ත පෙන්වයි/ කියවීම මගහරියි Dislike reading/Avoid reading				
2. ඉතා අඩු වේගයකින් කියවයි Reads very slowly				
3. වචන හා විරාම ලකුණු ගැන නොසලකා ඉතා වේගයෙන් කියවයි Reads very quickly ignoring phrasing and punctuations				
4. තැනින් තැන නවතමින් තැවත පටන් ගනිමින් දෙගිඩියාවෙන් කියවයි Read with many starts, stops and hesitation				
5. කියවන විට වට පිට බලයි Looks around while reading				
6. කියවීමේදී බොහෝවට තමා කියවන ස්ථානය මගහැරේ Losses place while reading				
7. කියවීමේදී වචන අඩුකර කියවීම/ අළුතෙන් වචන එකතු කිරීම/ අන්තරගතය වෙනස් කිරීම සිදුකරයි Omit, add or distort the reading matter while reading				
8. ඇඟිල්ල තබමින් කියවීමට උත්සාහ කරයි Tries to keep the finger while reading				
9. අකුරින් අකුර ගැටගසමින් කියවයි Read by joining letters one by one				
10. එක හා සමාන අකුරු හා වචන හඳුනා නොගනී (ට-ම/ ත-ක-න) Doesn't differentiate between similar looking letters and words				
11. වචන අනෙක් පැත්ත හරවා කියවයි Reverses words while reading				
12. කියවීමේදී නුපුරුදු වචන අනුමාන කරයි Guesses unfamiliar words while reading				
13. පිල්ලම් සහිත වචන අපහසුවෙන් කියවයි Difficulty in pronouncing complex words				
14. අකුරු වැඩි ප්‍රමාණයක් ඇති වචන හා මහප්‍රාණ අකුරු සහිත වචන අපහසුවෙන් කියවයි Difficulty in reading words with many letters and complex letters				
15. කියවීමෙ අපහසුතාවය නිසා නියමිත කාලය තුළ වැඩ නිම නොකරයි Fails to finish work on time due to reading difficulty				
16. අළුත් වචන මතක තබාගැනීමට අපහසු බවක් පෙන්වයි Has poor retention in new vocabulary				
17. ඡේද ඇසුරින් අසන ලද ප්‍රශ්න වලට නිවැරැදිව පිළිතුරු නොදෙයි Fails to correctly answer the comprehension questions from reading activities				
Writing				
18. ලිවීමට අකැමැත්ත පෙන්වයි/ ලිවීම මගහරියි Dislikes writing/ and avoid writing				
19. ලියන විට අපහසු ආකාරයෙන්/ වැරැදි ආකාරයෙන් පැන්සල අල්ලයි Holds the pencil in an awkward / wrong position when writing				

20.ඉතා සෙමන් ලියයි Writes very slowly				
21.එකම පේළියේ විවිධ ප්‍රමාණයේ අකුරු ලියයි Writes letters with different sizes on the same line				
22.ලිවීමේදී නුසුදුසු අකුරු ප්‍රමාණ භාවිතා කරයි (ඉතා විශාල හෝ ඉතා කුඩා අකුරු ලියයි Uses inappropriate letter size when writing (i.e., too large or too small)				
23.රූල මත අකුරු ලිවීමට අපහසු බවක් පෙන්වයි Has trouble in staying "on the line" while writing				
24. කියවිය නොහැකි කැත අකුරු ලියයි Illegible and shaggy hand writing				
25.ලිවීමේදී අකුරු අතර හා වචන අතර අසමාන පරතර තබයි Uses uneven spacing between letters and words while writing				
26.ලියන විට නිතර මකයි (සෑම වචනයක් හෝ දෙකක් පාසා) Erases frequently while writing (erase every word or two				
27.ලියන විට නිතර නිතර පැන්සල උල් කරයි Sharpens the pencil frequently while writing				
28.ලිවීමේදී අකුරු අඩු කරයි/ අළුතින් අකුරු එකතු කරයි Miss out / substitute letters while writing				
29.ලියන විට අකුරු/ ඉලක්කම්/ සංකේත අනෙක් පැත්ත හරවා ලියයි Reverses letters/ numbers and symbols while writing				
30.පිල්ලම් සහිත අකුරු නිවැරදිව නොලියයි Writes complex letters incorrectly				
31.එක හා සමාන සේ පෙනෙන වචන පටලවා ලියයි Confuses similar looking words while writing				
32. කළුලැල්ලේ හෝ පාඩම් පොතෙහි ඇති දෑ පිටපත් කිරීමේදී අපහසුතාවයක්/ ප්‍රමාදයක් පෙන්වයි Finds difficulty/ delay in copying work from a blackboard or from a text book				
33. පද නොබෙදා ලියයි/ වැරදි ලෙස පද බෙදා ලියයි Doesn't divide the words/ incorrectly divide the words when writing				
34.වැරදි උච්චාරණ සහිත අකුරු යොදා ලියයි (ං වෙනුවට ම්/ ඊ වෙනුවට යි) Writes letters with wrong pronounciation				
35.අපිළිවෙල හා අසම්පූර්ණ ආකාරයෙන් ලියයි Write in a messy and incomplete way				
Mathematics				
36.ගණිතයට අකැමැත්ත දක්වයි/ ගණන් සෑදීම මග හරියි Dislike/avoid doing math				

37.දෙන ලද කාලය තුළ ගණිත වැඩ සම්පූර්ණ නොකරයි Doesn't complete math work in a given time				
38.ගණිත ගෙදර වැඩ නොකරයි Doesn't do math home work				
39.ගණිත ගැටළු විසඳීමට උත්සාහ දැරීමට පෙරම උදව් ඉල්ලයි Asks for help before trying math problems				
40.සංඛ්‍යා නම් කිරීමට අපහසුවක් දක්වයි / පවසන සංඛ්‍යාවක් ලිවීමට අපහසුවක් දක්වයි Difficulty in naming numerals/ Difficulty in writing numerals when it is said				
41.සංඛ්‍යා අනෙක් පැත්ත හරවා ලියයි Reverses numbers when writing				
42.සමාන පෙනුමක් ඇති සංඛ්‍යා පටලවා ගනියි (0 සහ 9, 3 සහ 5) Confuses similar looking numbers (0 and 9, 3 and 5)				
43.ගණිත ගැටළු විසඳීමේදී සංකේත (+/-/x/÷) පටලවා ගනී Confuses operational signs when working with math problems (+/-/x/÷)				
44.ගණිත ගැටළු විසඳීමේදී දකුණේ සිට වමට විසඳීම වෙනුවට වමේ සිට දකුණට විසඳයි works math problems from left to right instead of right to left				
45.එකතු කිරීම් අවශ්‍ය ගණිත ගැටළු විසඳීමට අසමත් වීමක් පෙන්වයි Fails to correctly solve math problems requiring addition				
46.අඩු කිරීම් අවශ්‍ය ගණිත ගැටළු විසඳීමට අසමත් වීමක් පෙන්වයි Fails to correctly solve math problems requiring subtraction				
47.අසාර්ථක ලෙස සංඛ්‍යා පෙළ ගැස්වීම නිසා වැරැදි ලෙස ගණනය කරයි Poorly align numbers resulting in computational errors.				
48.ගෙනඒම් සහිත ගැටළු විසඳීමට අපහසුතාවක් දක්වයි Has difficulty in solving math problems requiring borrowing				
49.ගෙනයාම් සහිත ගැටළු විසඳීමට අපහසුතාවක් දක්වයි Has difficulty in solving math problems requiring carrying over				
50.ගුණන වගු හැදෑරීමේදී අපහසුතාවක් දක්වයි Has difficulty in learning multiplication tables				
51.ඔරලෝසු මුහුණතක් බලා වේලාව පැවසීමේදී අපහසුතාවක් දක්වයි Has difficulty in telling time from a clock				
52.වගන්ති සහිත ගණිත ගැටළු විසඳීමට අපහසුතාවක් දක්වයි Has difficulty in solving math word problems				
53. ආරෝහණ හා අවරෝහණ පිළිවෙලට සංඛ්‍යා පෙළ ගැස්වීමට අපහසුතාවක් දක්වයි Has difficulty in arranging numbers in ascending or/ and descending order				
54. වම හා දකුණු දිශා හඳුනා නොගනී Poor left right orientation				

55.ලොකු/ කුඩා උස/මට අඩු/ වැඩි යන ප්‍රමාණාත්මක සංකල්ප වෙන්කර හඳුනාගැනීමේදී ගැටළු මතුවේ Has difficulty in differentiating concepts such as big/small, tall/short, few/many				
General				
56.වැඩ කරන කාලය තුළ අඩුවෙන් අවධානය යොමුකරයි Pay poor attention during lessons				
57.පන්ති කාලය තුළ අන් ළමුන්ට බාධා කරයි Disturbs others during class time				
58.නිතර පාසැලට නොපැමිණේ Often absent to school				
59.අන් ළමයින්ගෙන් පාඩම් වැඩ පිටපත් කරයි Copy work from other children				

I shall be thankful for all the experts for your valuable comments and kind cooperation that extend to make this a success.

Thank you,

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Annex XI

Content Validity Index - Learning Difficulty Screening Questionnaire for Primary School Children (LDSQ (PSC))

Item (අංශය)	1	2	3	4	CVI
Reading					
1. කියවීමට අකැමැත්ත පෙන්වයි/ කියවීම මගහරියි Dislike reading/Avoid reading					1
2. ඉතා අඩු වේගයකින් කියවයි Reads very slowly					1
3. වචන හා විරාම ලකුණු ගැන නොසලකා ඉතා වේගයෙන් කියවයි Reads very quickly ignoring phrasing and punctuations					0
4. තැනින් තැන නවතමින් තැවත පටන් ගනිමින් දෙගිඩියාවෙන් කියවයි Read with many starts, stops and hesitation					1
5. කියවන විට වට පිට බලයි Looks around while reading					0.5
6. කියවීමේදී බොහෝවට තමා කියවන ස්ථානය මගහැරේ Losses place while reading					1
7. කියවීමේදී වචන අඩුකර කියවීම/ අළුතෙන් වචන එකතු කිරීම/ අන්තරගතය වෙනස් කිරීම සිදුකරයි Omit, add or distort the reading matter while reading					1
8. ඇඟිල්ල තබමින් කියවීමට උත්සාහ කරයි Tries to keep the finger while reading					1
9. අකුරින් අකුර ගැටගසමින් කියවයි Read by joining letters one by one					1
10. එක හා සමාන අකුරු හා වචන හඳුනා නොගනී (ට-ම/ ත-ක-න) Doesn't differentiate between similar looking letters and words					1

11. වචන අනෙක් පැත්ත හරවා කියවයි (ගස – සග) Reverses words while reading					1
12. කියවමේදී නුපුරුදු වචන අනුමාන කරයි Guesses unfamiliar words while reading					1
13. පිල්ලම් සහිත වචන අපහසුවෙන් කියවයි Difficulty in pronouncing complex words					1
14. අකුරු වැඩි ප්‍රමාණයක් ඇති වචන හා මහප්‍රාණ අකුරු සහිත වචන අපහසුවෙන් කියවයි Difficulty in reading words with many letters and complex letters					1
15. කියවීමේ අපහසුතාවය නිසා නියමිත කාලය තුළ වැඩ නිම නොකරයි Fails to finish work on time due to reading difficulty					1
16. අළුත් වචන මතක තබාගැනීමට අපහසු බවක් පෙන්වයි Has poor retention in new vocabulary					1
17. පේද ඇසුරින් අසන ලද ප්‍රශ්න වලට නිවැරැදිව පිළිතුරු නොදෙයි Fails to correctly answer the comprehension questions from reading activities					1
Writing					
18. ලිවීමට අකැමැත්ත පෙන්වයි/ ලිවීම මගහරියි Dislikes writing/ and avoid writing					1
19. ලියන විට අපහසු ආකාරයෙන්/ වැරැදි ආකාරයෙන් පැන්සල අල්ලයි Holds the pencil in an awkward / wrong position when writing					1
20. ඉතා සෙමින් ලියයි Writes very slowly					1

21.එකම පේළියේ විවිධ ප්‍රමාණයේ අකුරු ලියයි/ ඉතා විශාල හෝ ඉතා කුඩා අකුරු ලියයි Writes letters with different sizes on the same line/writes very big or very small letters					1
22.රැල මත අකුරු ලිවීමට අපහසු බවක් පෙන්වයි Has trouble in staying "on the line" while writing					1
23. කියවිය නොහැකි කැත අකුරු ලියයි Illegible and shaggy hand writing					0.2
24.ලිවීමේදී අකුරු අතර හා වචන අතර අසමාන පරතර තබයි Uses uneven spacing between letters and words while writing					1
25.ලියන විට නිතර මකයි (සෑම වචනයක් හෝ දෙකක් පාසා) Erases frequently while writing (erase every word or two)					0.4
26.ලියන විට නිතර නිතර පැන්සල උල් කරයි Sharpens the pencil frequently while writing					0.2
27.ලිවීමේදී අකුරු අඩු කරයි/ අළුතින් අකුරු එකතු කරයි Miss out / substitute letters while writing					1
28.ලියන විට අකුරු/ ඉලක්කම්/ සංකේත අයෙක් පැත්ත හරවා ලියයි Reverses letters/ numbers and symbols while writing					1
29.පිල්ලම් සහිත අකුරු නිවැරදිව නොලියයි Writes complex letters incorrectly					1
30.එක හා සමාන සේ පෙනෙන වචන පටලවා ලියයි Confuses similar looking words while writing					1
31. කළුලැල්ලේ හෝ පාඩම් පොතෙහි ඇති දෑ පිටපත් කිරීමේදී අපහසුතාවයක්/ ප්‍රමාදයක් පෙන්වයි Finds difficulty/ delay in copying work from a blackboard or from a text book					1

32. පද නොබෙදා ලියයි/ වැරැදි ලෙස පද බෙදා ලියයි Doesn't divide the words/ incorrectly divide the words when writing					1
33.වැරැදි උච්චාරණ සහිත අකුරු යොදා ලියයි (ං වෙනුවට ම්/ ර් වෙනුවට යි) Writes letters with wrong pronounciation					1
34.අපිළිවෙල හා අසම්පූර්ණ ආකාරයෙන් ලියයි Write in a messy and incomplete way					1
Mathematics					
35.ගණිතයට අකැමැත්ත දක්වයි/ ගණන් සෑදීම මග හරියි Dislike/avoid doing math					1
36.දෙන ලද කාලය තුළ ගණිත වැඩ සම්පූර්ණ නොකරයි Doesn't complete math work in a given time					1
37.ගණිත ගෙදර වැඩ නොකරයි Doesn't do math home work					1
38.ගණිත ගැටළු විසඳීමට උත්සාහ දැරීමට පෙරම උදව් ඉල්ලයි Asks for help before trying math problems					1
39.සංඛ්‍යා නම් කිරීමට අපහසුවක් දක්වයි / පවසන සංඛ්‍යාවක් ලිවීමට අපහසුවක් දක්වයි Difficulty in naming numerals/ Difficulty in writing numerals when it is said					1
40.සංඛ්‍යා අනෙක් පැත්ත හරවා ලියයි Reverses numbers when writing					1
41.සමාන පෙනුමක් ඇති සංඛ්‍යා පටලවා ගනියි (0 සහ 9, 3 සහ 5) Confuses similar looking numbers (0 and 9, 3 and 5)					1
42.ගණිත ගැටළු විසඳීමේදී සංකේත (+/-/x/÷) පටලවා ගනී					

Confuses operational signs when working with math problems (+/-/x/÷)					1
43.ගණිත ගැටළු විසඳීමේදී දකුණේ සිට වමට විසඳීම වෙනුවට වමේ සිට දකුණට විසඳයි works math problems from left to right instead of right to left					1
44.අනාර්ථක ලෙස සංඛ්‍යා පෙළ ගැස්වීම නිසා වැරැදි ලෙස ගණනය කරයි Poorly align numbers resulting in computational errors.					1
45.ගෙනඒම් සහිත ගැටළු/ සරල අඩු කිරීම් අවශ්‍ය ගණිත ගැටළු විසඳීමට අපහසුතාවක් දක්වයි Has difficulty in solving math problems requiring borrowing/simple substraction					1
46.ගෙනයාම් සහිත ගැටළු/ සරල එකතු කිරීම් අවශ්‍ය ගණිත ගැටළු විසඳීමට අපහසුතාවක් දක්වයි Has difficulty in solving math problems requiring carrying over/simple addition					1
47.ගුණන වගු හැදෑරීමේදී අපහසුතාවක් දක්වයි Has difficulty in learning multiplication tables					1
48.ඔරලෝසු මුහුණතක් බලා වේලාව පැවසීමේදී අපහසුතාවක් දක්වයි Has difficulty in telling time from a clock					1
49.වගන්ති සහිත ගණිත ගැටළු විසඳීමට අපහසුතාවක් දක්වයි Has difficulty in solving math word problems					1
50. ආරෝහණ හා අවරෝහණ පිළිවෙලට සංඛ්‍යා පෙළ ගැස්වීමට අපහසුතාවක් දක්වයි Has difficulty in arranging numbers in ascending or/ and descending order					1
51. වම හා දකුණු දිශා හඳුනා නොගනී Poor left right orientation					1
52.ලොකු/ කුඩා උස/මට අඩු/ වැඩි යන					

ප්‍රමාණාත්මක සංකල්ප වෙන්කර හඳුනාගැනීමේදී ගැටළු මතුවේ Has difficulty in differentiating concepts such as big/small, tall/short, few/many					1

During assessment of content relevance items which had similar meaning were combined together and one item was formulated.

- Items 21and 22 were combined together and item 21 was formed
- Item 45 and 49 were combined together and item 46 was formed
- Items 46 and 48 were combined together and item 45 was formed.

Total number of items was reduced from 59 to 56

Annex XII

ප්‍රාථමික අංශයේ පාසැල් දරුවන්ගේ ඉගෙනීමේ දුර්වලතා හඳුනාගැනීමේ ප්‍රශ්ණාවලිය

ගුරු අත්පොත

ප්‍රශ්ණාවලිය පිරවීමේදී තෝරාගත් ශිෂ්‍යයා හෝ ශිෂ්‍යාව පන්ති කාමරය තුළ ඉගෙන ගැනීමේදී එහි සඳහන් හැසිරීම් විලාශ කොතරම් දුරට පෙන්නුම් කරන්නේද යන්න සඳහන් කරන්න.

මෙය පෙන්නුම් කරන ප්‍රමාණය අනුව අදාල කොටුව තුළ - X ලකුණ යොදන්න. මෙය පෙන්නුම් කරන ප්‍රමාණය ඔබ ලබා ගත් අත්දැකීම් අනුව තීරණය කරන්න.

සඳහන් කර ඇති හැසිරීම් විලාශ තෝරාගත් ශිෂ්‍යයා හෝ ශිෂ්‍යාව පෙන්නුම් කරන පන්තියේ අනිකුත් ළමයින්ට සාපේක්ෂවද නිර්ණය කළ හැකියි.

1. පන්තියේ අන් ළමයින්ට සාපේක්ෂව නියමිත පන්තියට අදාල කියවීමේ වේගයක් පෙන්නුම් නොකරයි. ඉතා සෙමින් කියවන අතර එය නිතරම සිදුකරයි. සාමාන්‍යයෙන් 3/4 ශ්‍රේණිය වන විට අතුරින් අතුර ගැට ගසමින් කියවීම සිදු නොකරන අතර මෙම දුර්වලතා ඇති ළමයින් නිතරම කියවීමේදී අකුරු ගැටගසයි. මේ නිසා කියවීමේ වේගයද අඩාල වේ.
2. අවිශ්වාසයෙන් යුතුව කියවයි. නවතමින් නැවත පටන් ගනිමින් අස්ථිර ආකාරයේ දෙගිඩියාවෙන් කියවයි.
3. කියවාගෙන යන විට අතරමගදී කියවන ස්ථානය මගහැරේ. නැවත එම ස්ථානය සොයා කියවාගෙන යයි. මෙය විටින් විටම සිදුකරයි.
4. කියවාගෙන යනවිට සමහර වචන අඩුකර කියවයි. සමහර විට මේ වචනයට සමාන අළුත් වචන ඇතුල් කරමින් කියවාගෙන යයි. මෙසේ සිදුකිරීම නිසා අන්තර්ගතය වෙනස් කිරීමක් සිදු වේ.
5. නිතරම ඇඟිල්ල තබමින් වාක්‍ය සොයමින් කියවීම සිදුකරයි. ඇඟිල්ල තබා කියෙවිවද එය නිවැරදි ආකාරයට කියවීමට අසමත් වේ.
6. එක හා සමාන සේ පෙනෙන අකුරු පටලවා කියවයි. එක හා සමාන සේ පෙනෙන වචනද පටලවා කියවයි.

   උදා : ට හා ම

ත, ඛ, න, යන අකුරු ද පටලවා කියවයි.

7. පුරුදු නැති වචන අනුමාන කරමින් කියවයි. පාඩම් පොතෙහි එන අළුත් වචන සම්පූර්ණයෙන්ම නොකියවා එහි පළමු අකුරෙන් වචනය අනුමාන කරමින් වෙනත් වචනයක් යෙදීම සිදුකරයි.

උදා : පාඨශාලාව යන වචනය සම්පූර්ණයෙන්ම නොකියවා එය පාසැල ලෙස කියවීම.

ගුරුවරයා යන වචනය සම්පූර්ණයෙන්ම නොකියවා එහි පළමු අකුර දුටු විට ගුරුතුමිය ලෙස කියවයි

8. පිල්ලම් ඇති වචන පිල්ලම නොමැතිව කියවීම සිදු කරයි.

උදා : කෝටුව - කොටුව ලෙසද

කේතලය - කෙතලය ලෙසද කියවීම සිදුකරයි.

කුරුල්ලා වෙනුවට කුරුලා යන්න කියවයි

9. අකුරු වැඩි ප්‍රමාණයක් ඇති වචන මෙන්ම මහප්‍රාණ අකුරු අවබෝධ කරගැනීමට අපහසු බවත් දක්වයි. වචන අපහසුතාවකින් කියවයි. පන්තියේ අනිකුත් ළමයින්ට සාපේක්ෂව මෙම අකුරු මතක තබාගැනීමට හැකියාවක් පෙන්නුම් නොකරයි.

10. කියවා උත්තර ලිවීමට අවශ්‍ය අභ්‍යාස සඳහා වැඩි කාලයක් ගත කරයි. මේ නිසා නිතරම නියමත වේලාවට අභ්‍යාස නිම නොකරයි.

11. අළුතෙන් ඉගෙන ගන්නා වචන මතක තබා ගැනීමට අසීරු බවත් පෙන්වයි. පාඩමක් කියවා අවසානයේදී නැවත එම වචන ඇසූ විට අන් ළමයින්ට සාපේක්ෂව පහසුවෙන් අමතක වමක් සිදුවේ.

12. ඡේදයක් කියවා තේරුම් ගැනීමට ශක්තියක් නැත. සමහර විට අසීරුවෙන් ඡේදය කියවීවද එහි අන්තර්ගතය තේරුම් ගැනීමට / නැවත පැවසීමට / එයින් අසන ප්‍රශ්නවලට උත්තර සැපයීමට අපහසුතාවක් පෙන්නුම් කරයි.

13. අන් ළමයින්ට සාපේක්ෂව ලිවීමේ අභ්‍යාස වලට අකැමැත්ත පෙන්වයි. හැකි සෑම වටම ලිවීම මගහැරීමට බලයි. ලියන කාලය අතර තුර කිසිසේත් අදාල නොවන වැඩ වල නිරත වේ.

14. ලියන වේගය සාපේක්ෂව ඉතා අඩුය. ඉතා සෙමින් අකුරු ලියයි. එක එල්ලේ අවධානයෙන් ලිවීම සිදු නොකරන අතර නිතර ප්‍රමාදයක් සිදුවේ

15. ඉතා කුඩා හෝ ඉතා විශාල (අදාල පන්තියට සුදුසු නැති) අකුරු යොදමින් ලියයි. නැතහොත් එකම පේළියේ විවිධ ප්‍රමාණයේ අකුරු ලියයි. සාමාන්‍යයෙන් පන්ති ඉහළට යෑමේදී අකුරු වල විශාලත්වය අඩු වීමක් සිදුවන නමුත් මෙම දරුවන් එවැනි සංවර්ධනයක් පෙන්නුම් කරන්නේ නැත. තබාහෝ වට ඔවුන් ලියන අකුරු ප්‍රමාණයෙන් ඉති විශාල වන අතර සමහර වට කියවිය නොහැකි ඉතා කුඩා අකුරු ලියයි.

16. යාබද අකුරු අතර හා වචන අතර අසමාන පරතර තබයි.

උදා : නගරය ; නගර ය ලෙස ලියයි

මගේගම හරි ලස්සනයි

සුරතල්බලුපැටියා

17. ලිවීමේදී අකුරු අඩුකරයි / අළුතින් අකුරු එකතු කරයි.

අස හරිම ලසනය (අහස හරිම ලස්සනයි)

18. පිල්ලම් යෙදීමේදී දුර්වලතාවන් පෙන්වයි. බොහෝවිට පිල්ලම් නොයොදා ලියයි / නැතහොත් වැරදි පිල්ලම් යොදයි.

අවුරුදු සිරිත් විරිත් යන්න

අවිරදු සරත වරත ලෙස ලිවිය හැක.

කෝටුව කෙටුව ලෙස ලියයි

19. එක හා සමානව ස් පෙනෙන වචන පටලවා ගනියි.

උදා : මගෙ ගම

සල්මල්

20. කළුලැල්ලේ ඇති අභ්‍යාස පිටපත් කිරීමේදී පොතක ඇති අභ්‍යාස පිටපත් කිරීමේදී ප්‍රමාදයක් පෙන්නුම් කරයි. වැරැදි ලෙස පිවපත් කරයි

21. පද බෙදීම නිවැරදිව නොකරයි.. වාක්‍ය ලිවීමේදී වචන අතර ඉඩ නොතබා ලිවීම සිදුකරයි.

උදා : කොටයානපුරුසතෙකි

22. කියවන විට ලිවීමේදී වැරදි උච්චාරණ සහිත අකුරු යොදා ලියයි.

උදා : රිතලය - සීතලය

එහේ මෙහේ ලෙසද

එමෙ මෙමේ

23. ඉතා අපිළිවෙල ආකාරයට ලියන අතර නිතර මකමින් කටු ගසමින් ලිවීමේ කටයුතු ඉතා අපිළිවෙල ආකාරයෙන් සිදු කරයි.

24. අන් ළමයින්ට සාපේක්ෂව ගණිතයට අකැමැත්ත පෙන්වයි. ගණන් සෑදීමට ඉදිරිපත් නොවේ. එය මගහරියි

25. ප්‍රමාදය නිසා / හේරුම් නොගැනීම නිසා දෙන ලද කාලය තුළ ගණිත අභ්‍යාස සම්පූර්ණ නොකරයි.

26. ගණිත අභ්‍යාස ගෙදර වැඩ සම්පූර්ණ නොකරයි.

27. ගණිත අභ්‍යාස කිරීමට උත්සහ නොදරන අතර ගුරුවරයාගෙන් / අන් ළමයින්ගෙන් නිතර උදව් ඉල්ලයි.

28. සංඛ්‍යාවක් පෙන්වූ විට එය නම්කිරීමට අපොහොසත් වේ.

උදා : 354 පෙන්වූ විට - තුන්සිය පනස් හතර ලෙස නොකියයි.

එසේම මෙම සංඛ්‍යාව පැවසූ විට එස ලිවීම නොකරයි.

29. + / - / X වැනි සංකේත නිවැරදිව හේරුම් නොගනී.

+ අභ්‍යාසයකට පසුව - අභ්‍යාස ඇති විට එවාද එකතු කරයි.

සංකේතය ගැන අවබෝධයක් නැත

අභ්‍යාස මිශ්‍ර වූවට එකතු හා අඩුකිරීම වශයෙන් වෙන් කර ගැනීමට හැකියාවක් නැත

30. සංඛ්‍යා ස්ථාන අනුව සාර්ථක ලෙස පෙළ නොගස්වයි. දහයස්ථානය පහළින් එකස්ථානය ලියයි.

උදා : 321 එකතු කිරීම 17 ලිවීමේදී

321

\+

17 ලෙසද ලියයි.

491

31. සරල අඩු කිරීම් මෙන්ම ගෙන එමි සහිත ගැටළු විසඳීමට අපහසු බවක් පෙන්නුම් කරයි.

උදා : 35

16 -

21 ලෙස ලියයි.

32. සරල එකතු කිරීම් හා ගෙනයාම් සහිත සහිත ගැටළු විසඳීමට අපහසු බවක් පෙන්වයි.

113

108

2111 ලෙස ලියයි.

33. ගුණන වගු මතක තබා ගැනීමට අපහසු බවක් පෙන්වයි.

34. වගන්ති සහිත ගැටළු ඇතිවිට එවා තේරුම් නොගනී. සරල එකතු කිරීමක් / අඩු කිරීමක් තුළද වගන්ති ඇතිවිට එය තේරුම් ගෙන නොකරයි.

35. ගණන් එකතු කිරීම මෙන්ම අඩු කිරීමද දකුනේ සිට වමට නොකර වමෙන් පටන් ගෙන දකුණු දෙසට කරයි.

35

16

411

36. ක්‍රමානුකූලව කුඩා සංඛ්‍යාවේ සිට විශාල සංඛ්‍යාව දක්වාද විශාල සංඛ්‍යවේ සිට කුඩා සංඛ්‍යාව දක්වාද ශ්‍රේණිගත කිරීමට අපහසු බවක් පෙන්වයි

ලොකු කුඩා සංකල්පය අවබෝධ කර ගැනීමට අපහසු බවක් දක්වන අතර සංඛ්‍යා දෙකකින් වඩා විශාල කුමක්ද? වඩා කුඩා කුමක්ද? තෝරා ගැනීමට අපොහොසත් වේ

124, 242,321 ආරෝහණ පටපාටයට පෙළගැස්වීම

124 321 241

Annex XIII A

INFORMATION SHEET- TEACHERS – Development of LDSQ (PSC)

Learning difficulty among primary school children in the district of Kalutara: Prevalence, behavioural comorbidities, risk factors and parental psychological distress.

Dear Parents,

1. **Purpose of the study**

Learning difficulty among primary school children has become a devastating problem for teachers, parents as well as to the state in developed parts of the world. The prevalence of learning difficulty in this part of the world is around 10%. It has been proven that majority of these children are having behavioral problems which inflate the burden of learning difficulty. This not only affects the individual with the disability, but can also have a substantial impact on other members of the family, especially the psychological status of parents. Primary school age is the age at which learning problem become more evident and easily detectable. Therefore this is the best age to detect this problem in order to prevent further consequences.

This part of the study aims to develop a teacher administered questionnaire to screen Learning Difficulty among primary school children.

1. **Voluntary participation**

Your role in this study is to administer Learning Difficulty Screening Questionnaire (LDSQ) to identify Learning Difficulty among children in your class. Your participation in this study is voluntary. You are free to not participate at all or to withdraw from the study at any time despite consenting to take part initially. You are hereby assured that your non participation or withdrawal at any time will not affect the education of your class children or benefit enjoying in the school..

2. **Duration, procedures of the study and participant's responsibilities**

You, as the class teacher need to administer LDSQ questionnaire for your class children. This can be done from the observation you have already made. An Adequate time period will be given to observe these children's learning. It is your responsibility to provide valid information on these behaviors after a through observation of your class children.

3. **Potential benefits**

Although the participation in this study will not have a direct benefit to you it will certainly have an indirect benefit. It will help to prepare a screening tool which can be used in future to detect Learning Difficulty among primary school children.

4. Risks, hazards and discomforts

Participation in this study will not cause any risk, hazard or discomfort to you. The only difficulty is to spend your time to fill the questionnaire. Your class room activities will not be disturbed at any cost.

5. Reimbursements

You will not be paid any money for participating in this study

6. Confidentiality

Confidentiality of all collected information is guaranteed and no information by which you can be identified will be released or published. Any information given by you will not be shared at an individual basis with a second party. Any resulting communication (reports, presentations, theses, research publications, etc.) from this study will not expose your identity in any way.

7. Termination of study participation

You may withdraw your consent to participate in this study at any time without any reason given on your part. . In such instances you will not be subjected to any penalty or loss of any benefits you were enjoying previously. Please notify the investigator as soon as you decide to withdraw your consent.

8. Clarification

If you have questions about any procedure or if you need any further information please feel free to ask from the principal investigator mentioned below.

Annex XIII B

INFORMATION SHEET FOR PARENTS- development of LDSQ (PSC)

Learning difficulty among primary school children in the district of Kalutara: Prevalence, behavioural comorbidities, risk factors and parental psychological distress

Dear parents,

2. Purpose of the study

Learning difficulty among primary school children has become a devastating problem for teachers, parents as well as to the state in developed parts of the world. The prevalence of learning difficulty in this part of the world is around 10%. It has been proven that majority of these children are having behavioral problems which inflate the burden of learning difficulty. This not only affects the individual with the disability, but can also have a substantial impact on other members of the family, especially the psychological status of parents. Primary school age is the age at which learning problem become more evident and easily detectable. Therefore this is the best age to detect this problem in order to prevent further consequences.

This part of the study aims to develop a teacher administered questionnaire to screen Learning Difficulty among primary school children.

9. Voluntary participation

Your participation in this study is voluntary. You are free to not participate at all or to withdraw from the study at any time despite consenting to take part initially. You are hereby assured that your non participation or withdrawal at any time will not in any way affect your child's education or benefit he/she enjoying in the school.

10. Duration, procedures of the study and participant's responsibilities

The class teacher will assess the learning problems in the class room setting by using a questionnaire. This will include your child as well. Your consent to include your child for that part of the study will also be needed as that would be the initial part of the study.

11. Potential benefits

Although your child's participation in this study will not have a direct benefit to you it will certainly have an indirect benefit. It will help to prepare a screening tool which can be used in future to detect Learning Difficulty among primary school children. If your child has any learning problems they will be detected and taken care of.

12. Risks, hazards and discomforts

Participation in this study will not cause any risk, hazard or discomfort to your child. Referral of children detected as having learning difficulty to specialist care will be done with your consent.

13. Reimbursements

You will not be paid any money for participating in this study

14. Confidentiality

Confidentiality of all collected information is guaranteed and no information about your child by which he or she can be identified will be released or published.

15. Termination of study participation

You may withdraw your consent to participate in this study at any time without any reason given on your part. . In such instances you will not be subjected to any penalty or loss of any benefits you were enjoying previously. Please notify the investigator as soon as you decide to withdraw your consent.

16. Clarification

If you have questions about any procedure or if you need any further information please feel free to ask from the principal investigator mentioned below. :

Annex XIV

Final draft of LDSQ (PSC) after application of item analysis

Extent of problem behaviour	Never	rarely	Sometime	Often	Always
Item					
Reading					
1. Reads very slowly					
2. Read with many starts, stops and hesitation					
3. Losses place while reading					
4. Omit, add or distort the reading matter while reading					
5. Tries to keep the finger while reading					
6. Doesn't differentiate between similar looking letters and words					
7. Guesses unfamiliar words while reading					
8. Difficulty in pronouncing complex words					
9. Difficulty in reading words with many letters and complex letters					
10. Fails to finish work on time due to reading difficulty					
11. Has poor retention in new vocabulary					
12. Fails to correctly answer the comprehension questions from reading activities					
Writing					
13. Dislikes writing/ and avoid writing					
14. Writes very slowly					
15. Writes letters with different sizes on the same line/writes very big or very small letters					
16. Uses uneven spacing between letters and words while writing					
17. Miss out / substitute letters while writing					
18. Reverses letters/ numbers and symbols while writing					
19. Writes complex letters incorrectly					
20. Confuses similar looking words while writing					
21. Finds difficulty/ delay in copying work from a blackboard or from a text book					
22. Doesn't divide the words/					

incorrectly divide the words when writing					
23. Writes letters with wrong pronunciation					
24. Write in a messy and incomplete way					
Math					
25. Dislike/avoid doing math					
26. Doesn't complete math work in a given time					
27. Doesn't do math home work					
28. Asks for help before trying math problems					
29. Difficulty in naming numerals/ Difficulty in writing numerals when it is named					
30. Confuses operational signs when working with math problems (+/-/x/÷)					
31. Poorly align numbers resulting in computational errors.					
32. Has difficulty in solving math problems requiring borrowing/ simple subtraction					
33. Has difficulty in solving math problems requiring carrying over/ simple addition					
34. Has difficulty in learning multiplication tables					
35. Has difficulty in solving math word problems					
36. Works math problems from left to right instead of right to left					
37. Has difficulty in arranging numbers in ascending or/ and descending order					

Annex XV

Schools selected for factor analysis

Name of the school	Type	Number taken for factor analysis
Dodangoda Miriswatta M.V	1AB	120
Bombuwala Sri Dharmaloka M.V	1C	120
Bolossagama M.V	1C	80
Gamagoda K.V	Type 2	40
Kajuduwa P.V	Type3	40
Total		400

Annex XVI A

ඉගෙනීමේ දුර්වලතා හඳුනාගැනීමේ ප්‍රශ්නාවලිය

1.1 අංකය				
1.2 අධ්‍යාපන කොට්ඨාශය				
1.3 අධ්‍යාපන කලාපය				
1.4 පාසැල				
1.5 පාසැල් වර්ගය	1AB	1C	Type 2	Type3
1.6 ශිෂ්‍යයාගේ නම				
1.7 ස්ත්‍රී පුරුෂ භාවය				
1.8 පන්තිය	3		4	

තෝරාගත් ශිෂ්‍ය ශිෂ්‍යාවන් කියවීම, ලිවීම හා ගණිතය සම්බන්ධයෙන් අසාඇති ගැටළු කෙතරම් දුරට පෙන්නුම් කරන්නේදැයි සඳහන් කරන්න. මෙය පසුගිය මාස තුන තුළ ඔවුන් නිරීක්ෂණය කිරීමේදී ඔබ ලද අත්දැකීම් වලින් තීරණය කරන්න. වැඩි පැහැදිලි කිරීම් සඳහා ගුරු අත් පොත බලන්න. අදාල කොටුව තුළ X යොදන්න

ගැටළුව පෙන්නුම් කරන ප්‍රමාණය	කිසිසේත් නැත	කලාතුරකින්	සමහරවිට	බොහෝවිට	සැමවිටම
අංගය					
කියවීම					
1. ඉතා අඩු වේගයකින් කියවයි					
2. තැනින් තැන නවතමින් තැවත පටන් ගනිමින් දෙගිඩියාවෙන් කියවයි					
3. කියවීමේදී බොහෝවිට තමා කියවන ස්ථානය මගහැරේ					
4. කියවීමේදී වචන අඩුකර කියවීම/ අළුතෙන් වචන එකතු කිරීම/ අන්තරගතය වෙනස් කිරීම සිදුකරයි					
5. ඇඟිල්ල තබමින් කියවීමට උත්සාහ කරයි					
6. අකුරින් අකුර ඇසීමෙන් කියවයි					
7. කියවීමේදී නුපුරුදු වචන අනුමාන කරයි					
8. පිල්ලම් සහිත වචන අපහසුවෙන් කියවයි					
9. අකුරු වැඩි ප්‍රමාණයක් ඇති වචන හා මහප්‍රාණ අකුරු සහිත වචන අපහසුවෙන් කියවයි					
10. කියවීමෙ අපහසුතාවය නිසා නියමිත කාලය තුළ වැඩ නිම නොකරයි					

ගැටළුව පෙන්නුම් කරන ප්‍රමාණය	කිසිසේ ත් නැත	කලාතුරකින්	සමහරවිට	බොහෝවිට	සැමවිටම
11. අළුත් වචන මතක තබාගැනීමට අපහසු බවක් පෙන්වයි					
12. ජේද ඇසුරින් අසන ලද ප්‍රශ්න වලට නිවැරැදිව පිළිතුරු නොදෙයි					
ලිවීම					
13. ලිවීමට අකැමැත්ත පෙන්වයි/ ලිවීම මගහරියි					
14. ඉතා සෙමින් ලියයි					
15. එකම පේළියේ වචන ප්‍රමාණයේ අකුරු ලියය/ ඉතා විශාල හෝ ඉතා කුඩා අකුරු ලියයි					
16. ලිවීමේදී අකුරු අතර හා වචන අතර අසමාන පරතර තබයි					
17. ලිවීමේදී අකුරු අඩු කරයි/ අළුතින් එකතු කරයි					
18. පිල්ලම් සහිත අකුරු නිවැරැදිව නොලියයි					
19. එක හා සමාන සේ පෙනෙන වචන පටලවා ලියයි					
20. කළුලැල්ලේ හෝ පාඩම් පොතෙහි ඇති දෑ පිටපත් කිරීමේදී අපහසුතාවයක්/ ප්‍රමාදයක් පෙන්වයි					
21. පද නොබෙදා ලියයි/ වැරැදි ලෙස පද බෙදා ලියයි					
22. වැරැදි උච්චාරණ සහිත අකුරු යොදා ලියයි (ං වෙනුවට ම්/ ර් වෙනුවට යි)					
23. අපිළිවෙල හා අසම්පූර්ණ ආකාරයෙන් ලියයි					
ගණිතය					
24. ගණිතයට අකැමැත්ත දක්වයි/ ගණන් සෑදීම මග හරියි					
25. දෙන ලද කාලය තුළ ගණිත වැඩ සම්පූර්ණ නොකරයි					
26. ගණිත ගෙදර වැඩ නොකරයි					
27. ගණිත ගැටළු විසඳීමට උත්සාහ දැරීමට පෙරම උදව් ඉල්ලයි					
28. සංඛ්‍යා නම් කිරීමට අපහසුබවක් දක්වයි/ පවසන සංඛ්‍යාවක් ලිවීමට අපහසුබවක් දක්වයි					

ගැටළුව පෙන්නුම් කරන ප්‍රමාණය	කිසිසේත් නැත	කලාතුරකින්	සමහරවට	බොහෝවට	සැමවටම
29. ගණිත ගැටළු විසඳීමේදී සංකේත (+/-/x/÷) පටලවා ගනී					
30. අසාර්ථක ලෙස සංඛ්‍යා පෙළ ගැස්වීම නිසා වැරැදි ලෙස ගණනය කරයි (ඒකස්ථානය/දහයස්ථානය/ සියස්ථානය ආදී වශයෙන්)					
31. ගෙනඒම් සහිත ගැටළු / සරල අඩු කිරීම් අවශ්‍ය ගණිත ගැටළු විසඳීමට අපහසුතාවක් දක්වයි					
32. ගෙනයාම් සහිත ගැටළු / සරල එකතු කිරීම් අවශ්‍ය ගණිත ගැටළු විසඳීමට අපහසුතාවක් දක්වයි					
33. ගුණන වගු හැදෑරීමේ හා ගුණ කිරීමේ අපහසුතාවයක් දක්වයි					
34. වගන්ති සහිත ගණිත ගැටළු විසඳීමට අපහසුතාවක් දක්වයි					
35. ගණිත ගැටළු විසඳීමේදී දකුණේ සිට වමට විසඳීම වෙනුවට වමේ සිට දකුණට විසඳයි					
36. ආරෝහණ හා අවරෝහණ පිළිවෙලට සංඛ්‍යා පෙළ ගැස්වීමට අපහසුතාවක් දක්වයි					

Annex XVI B

Learning Difficulty Screening Questionnaire for Primary School Children (LDSQ (PSC))

1. **Identification and contact information**

1.1 Serial Number				
1.2 Educational Zone				
1.3 Educational Division				
1.4 Name of school				
1.5 Type of school	1AB	1C	Type 2	Type3
1.6 Name of child				
1.7 Sex				
1.8 Grade of child	Grade 3		Grade 4	

Please mention to what extent the selected student exhibit the problem behavior towards reading, writing and mathematics. This can be decided from the observation you made about the learning behaviour of each child during last three months. Please refer teachers' manual for clarifications. Please put a X mark in the relevant box

Extent of problem behaviour	**Never**	**rarely**	**Sometime**	**Often**	**Always**
Item					
Reading					
1. Reads very slowly					
2. Read with many starts, stops and hesitation					
3. Losses place while reading					
4. Omit, add or distort the reading matter while reading					
5. Tries to keep the finger while reading					
6. Doesn't differentiate between similar looking letters and words					
7. Guesses unfamiliar words while reading					
8. Difficulty in pronouncing complex words					
9. Difficulty in reading words with many letters and complex letters					
10. Fails to finish work on time due to reading difficulty					

11. Has poor retention in new vocabulary					
12. Fails to correctly answer the comprehension questions from reading activities					
Writing					
13. Dislikes writing/ and avoid writing					
14. Writes very slowly					
15. Writes letters with different sizes on the same line/writes very big or very small letters					
16. Uses uneven spacing between letters and words while writing					
17. Miss out / substitute letters while writing					
18. Writes complex letters incorrectly					
19. Confuses similar looking words while writing					
20. Finds difficulty/ delay in copying work from a blackboard or from a text book					
21. Doesn't divide the words/ incorrectly divide the words when writing					
22. Writes letters with wrong pronunciation					
23. Write in a messy and incomplete way					
Maths					
24. Dislike/avoid doing math					
25. Doesn't complete math work in a given time					
26. Doesn't do math home work					
27. Asks for help before trying math problems					
28. Difficulty in naming numerals/ Difficulty in writing numerals when it is named					
29. Confuses operational signs when working with math problems (+/-/x/÷)					

30. Poorly align numbers resulting in computational errors.					
31. Has difficulty in solving math problems requiring borrowing/ simple subtraction					
32. Has difficulty in solving math problems requiring carrying over/ simple addition					
33. Has difficulty in learning multiplication tables					
34. Has difficulty in solving math word problems					
35. Works math problems from left to right instead of right to left					
36. Has difficulty in arranging numbers in ascending or/ and descending order					

Annex XVI IA

INFORMATION SHEET- TEACHERS – Validation of LDSQ (PSC)

Learning difficulty among primary school children in the district of Kalutara: Prevalence, behavioural comorbidities, risk factors and parental psychological distress.

Dear Parents,

3. Purpose of the study

Learning difficulty among primary school children has become a devastating problem for teachers, parents as well as to the state in developed parts of the world. The prevalence of learning difficulty in this part of the world is around 10%. It has been proven that majority of these children are having behavioral problems which inflate the burden of learning difficulty. This not only affects the individual with the disability, but can also have a substantial impact on other members of the family, especially the psychological status of parents. Primary school age is the age at which learning problem become more evident and easily detectable. Therefore this is the best age to detect this problem in order to prevent further consequences.

This part of the study aims to set cut off levels for already developed teacher administered questionnaire to screen Learning Difficulty among primary school children.

17. Voluntary participation

Your role in this study is to administer Learning Difficulty Screening Questionnaire (LDSQ) to identify Learning Difficulty among children in your class. Your participation in this study is voluntary. You are free to not participate at all or to withdraw from the study at any time despite consenting to take part initially. You are hereby assured that your non participation or withdrawal at any time will not affect the education of your class children or benefit enjoying in the school..

18. Duration, procedures of the study and participant's responsibilities

You, as the class teacher need to administer LDSQ questionnaire for your class children. This can be done from the observation you have already made. An Adequate time period will be given to observe these children's learning. It is your responsibility to provide valid information on these behaviors after a through observation of your class children.

Apart from this vision and hearing of the class children will be checked by a health personnel without disturbing the routine work of the class.

19. Potential benefits

Although the participation in this study will not have a direct benefit to you it will certainly have an indirect benefit. It will help to prepare a screening tool which can be used in future to detect Learning Difficulty among primary school children.

20. Risks, hazards and discomforts

Participation in this study will not cause any risk, hazard or discomfort to you. The only difficulty is to spend your time to fill the questionnaire. Your class room activities will not be disturbed at any cost.

21. Reimbursements

You will not be paid any money for participating in this study

22. Confidentiality

Confidentiality of all collected information is guaranteed and no information by which you can be identified will be released or published. Any information given by you will not be shared at an individual basis with a second party. Any resulting communication (reports, presentations, theses, research publications, etc.) from this study will not expose your identity in any way.

23. Termination of study participation

You may withdraw your consent to participate in this study at any time without any reason given on your part. . In such instances you will not be subjected to any penalty or loss of any benefits you were enjoying previously. Please notify the investigator as soon as you decide to withdraw your consent.

24. Clarification

If you have questions about any procedure or if you need any further information please feel free to ask from the principal investigator mentioned below. :

Annex XVII B

INFORMATION SHEET FOR PARENTS – validation of LDSQ (PSC)

Learning difficulty among primary school children in the district of Kalutara: Prevalence, behavioural comorbidities, risk factors and parental psychological distress

Dear Parents,

1. **Purpose of the study**

Learning difficulty among primary school children has become a devastating problem for teachers, parents as well as to the state in developed parts of the world. The prevalence of learning difficulty in this part of the world is around 10%. It has been proven that majority of these children are having behavioral problems which inflate the burden of learning difficulty. This not only affects the individual with the disability, but can also have a substantial impact on other members of the family, especially the psychological status of parents. Primary school age is the age at which learning problem become more evident and easily detectable. Therefore this is the best age to detect this problem in order to prevent further consequences.

This part of the study aims to get cutoff level for the teacher administered questionnaire to screen Learning Difficulty among primary school children.

2. **Voluntary participation**

Your participation in this study is voluntary. You are free to not participate at all or to withdraw from the study at any time despite consenting to take part initially. You are hereby assured that your non participation or withdrawal at any time will not in any way affect your child's education or benefit he/she enjoying in the school..

3. **Duration, procedures of the study and participant's responsibilities**

The class teacher will assess the learning problems in the class room setting by using a questionnaire. Hearing and vision will also be examined. This will include your child as well. Your consent to include your child for that part of the study will also be needed as that would be the initial part of the study.

If your child will be selected as a participant in the final group of this study, she/he will be examined for learning difficulty by a Clinical Psychologist. An interviewer will collect basic information from you using an Interviewer Administered Questionnaire (IAQ) which would take about 5 minutes.

4. **Potential benefits**

Your and your child's participation in this study will have direct benefit to both of you. Firstly if your child has any learning problems they will be detected and taken care of. Indirectly it will have a greater benefit for all the future children as this will produce a questionnsire to assess learning difficulty.

Risks, hazards and discomforts

Participation in this study will not cause any risk, hazard or discomfort to you. Referral of children detected as having learning difficulty to specialist care at General Hospital Kalutara or Child Guidance Clinics at Lady Ridgeway Hospital will be done in a way convenient to both yourself and the Consultant Psychiatrist.

5. Reimbursements

You will not be paid any money for participating in this study

6. Confidentiality

Confidentiality of all collected information is guaranteed and no information by which you can be identified will be released or published. Any information given by you will not be shared at an individual basis with a second party. Any resulting communication (reports, presentations, theses, research publications, etc.) from this study will not expose your identity in any way.

7. Termination of study participation

You may withdraw your consent to participate in this study at any time without any reason given on your part. . In such instances you will not be subjected to any penalty or loss of any benefits you were enjoying previously. Please notify the investigator as soon as you decide to withdraw your consent.

8. Clarification

If you have questions about any procedure or if you need any further information please feel free to ask from the principal investigator mentioned below. :

Annex XVII IA

GUIDELINE FOR USING "SNELLENS 'E' "VISION SCREENING CHART

This is a version of Snellens eye chart which is specially used for school children and children who cannot read English alphabet. Please follow following steps when performing this test.

- Place chart on wall or door, free from other visual distractions, at eye level for the student(s) being screened
- Measure a distance of 6 Meters (20 feet) from the chart to the place on the floor the student being screened should stand. Mark this spot with a strip of colored masking tape.
- Give the students following instructions necessary to complete the screening. If a group is to be screened, instruct the entire group at once, prior to starting the screening for that group.
    - Stand with toes directly behind the colored piece of tape
    - Look directly at the chart
    - Cover left eye first, without pressing against his/her eye. Read from right eye.
    - Use the index finger of one hand to indicate which way the "E" is pointing .
    - Repeat this process for the right eve while covering the left eye
    - Ask the students to wear spectacles if they are using spectacles.
    - Start from the first line and come down. The last raw is 6/6. If the student is unable to give a correct response at the 6/6 line, move
      up the chart, one line at a time until the student is able to provide a correct response.
    - Record the acuity for this eye. Then instruct the student to cover his/her other eye and repeat the screening and recording process.
    - If the student successfully responded with both eyes at the 6/6 acuity line, the student has passed his/her vision screening. If not refer to the eye clinic after filling the referral form.

Annex XVIII B

Guideline for using whispering hearing test

This is a simple and accurate screening test to assess hearing impairment. Please follow following instructions when performing this test.

- Select a quiet place like an empty class room or the library to perform this test
- Take the children one by one to the testing area
- Explain what they have to do
- Keep particular student in the seated position
- Stand behind the child at a distance of arm length. (This is done to avoid lip reading)
- Whisper a word which consists combination of three number and letter (eg: 4K2)
- Quietly exhale before whispering to ensure as quiet a voice as possible.
- Ask the child to repeat the word. If it is wrong tell another combination
- Do this separately for both ears
- If the child repeat three combinations correctly out of six combinations, consider that the child has no problem
- Refer those who failed to do so to the ENT clinic after filling the referral forms

Annex XIX

Learning difficulty among primary school children in grade three and grade four in the district of Kalutara – Validation study

Demographic and Socioeconomic Interviewer Administered Questionnaire for parents/ caregivers

Serial Number:

D		M		Y			

1.1 What is the date of birth of the child?	D	M	Y	
1.2 What is the sex of the child?	1. Male		2. Female	
1.3 What is the ethnicity of the child?	1. Sinhala		4. Burger	
	2. Tamil		5. Other (specify)	
	3. Muslim			
1.4 What is the religion of this child?	1. Buddhist		4. Roman catholic	
	2. Hindu		5. Christian	
	3. Islam		6. Other (specify)	
1.5 Please mention the grade of the child				
1.6 What is your family income?				
	Mother	Rs.	Father	Rs.
1.7 Please provide following information about you and your spouse				
Information	Mother		Father	
3.3.5 Highest educational qualification	1. Never gone to school		1. Never gone to school	
	2. Up to grade 5		2. Up to grade 5	
	3. Grade 6 to 10		3. Grade 6 to 10	
	4. Passed G.C.E O/L		4. Passed G.C.E O/L	
	5. Grade 11-13		5. Grade 11-13	
	6. Passed GCE A/L		6. Passed GCE A/L	
	7. University education		7. University education	
	8. Higher education other than university education		8. Higher education other than university education	

Number of clusters allocated to grade 3 and 4 classes in Kalutara Educational Division

Name of schools	Grade 3			Grade 4		
	Population	Cumulative/P	No: clusters	Population	Cumulative/P	No: clusters
Deldoowa K.V,	37	37		25	25	
Deshasthra V.	29	66	(1)	20	45	(1)
Diyagama M.V.	78	144		67	112	
Gnanodaya M.V.	142	286	(2)	143	255	(2)
Kalapugama V.	29	315		0	255	
Kalutara Balika V.	226	541	(3)	230	485	(3)
Kalutara M.V.	182	723	(2)	188	673	(2)
Buddhist K.V.	32	755	(1)	41	714	(1)
Dharmapala M.V.	82	837	(1)	86	800	(1)
Roman Catholic V.	53	890		55	855	
Sri Seevali V.	42	932	(1)	38	893	(1)
Mavala K.V.	25	957		37	930	
Moronthuduwa Dhammananda V.	137	1094	(2)	106	1036	(2)
Meuseus K.V	90	1184	(1)	92	1129	(1)
Nagoda M.V.	85	1269	(1)	86	1215	(1)
Pothupitiya M.V.	126	1395	(1)	121	1336	(1)
Shri Suboda V.	40	1435	(1)	55	1391	(1)
St.Johns College	125	1560	(1)	105	1496	(1)
Thissa M.M.V.	233	1793	(3)	240	1736	(3)
Uggalboda V.	118	1911	(1)	115	1851	(1)
Velapura V.	135	2046	(2)	135	1986	(2)

Number of clusters allocated to grade 3 and 4 classes in Bandaragama Educational Division

Name of schools	Grade 3			Grade 4		
	Population	Cumulative/P	No: clusters	Population	Cumulative/P	No: clusters
Aruggoda Sri Parakrama V.	108	108	(2)	85	85	(1)
Bandaragama Central College	199	307	(2)	245	330	(3)
Halthota K.V.	27	334		38	368	
Gangamuwa K.V.	30	364				
Galpatha Junior School	22	386	(1)	32	400	(1)
Mahabellana Primary School	193	579	(2)	137	537	(1)
Mahavila Kanishta Vidyalaya	56	635		47	584	(1)
Paragasthota Vidyaloka M.V.	59	694	(2)	48	632	
Ramukkana M.V.	94	788	(1)	94	726	(2)
Sri Swarnajothi V.	26	814		26	752	
Seelarathana M.V.	83	897	(1)	59	811	(1)
Sri Devarakshitha M.V.	121	1018	(2)	109	920	(1)
Sri Sraralankara M.V.	125	1143	(1)	92	1012	(1)
Uduwara Junior School	25	1168		37	1049	
Sri Saddhathissa M.V.	124	1292	(2)	128	1177	(1)
Weniwelpitiya K.V	23	1315		25	1202	(1)
Wewita Galthude Dammakiththi V.	42	1357	(1)	28	1230	(1)
Wewita Maithree V.	143	1500	(1)	124	1354	(1)

Name of schools	Grade 3			Grade 4		
	Population	Cumulative/P	No: clusters	Population	Cumulative/P	No: clusters
Bellana M.V.	70	77	(1)	68	68	(1)
Dapiligoda P.V	177	247	(2)	75	143	(1)
Kewitiyagala V.	39	286	(1)	35	178	(1)
Molkava M.V	39	325		49	227	
Pelanda M.V	36	361	(1)	34	261	(1)
Rathmale K.V	23	384		20	281	
Sri Piyarathana	63	447	(1)	40	321	
Yatiyana K.V	35	482		27	348	(1)
Baduraliya K.V	116	598	(1)	120	468	(1)
Dikhena K.V.	20	618		26	494	
Magura P.V	34	652	(1)	34	528	(1)
Hadigalla K.V	39	691		21	549	
Ingurudaluwa K.V	20	711	(1)	22	571	(1)
Hadigalla Janapada V.	36	747		22	594	
Sri Siddartha K.V	20	767		24	618	
Veediyabandara M.V	104	871	(1)	105	723	(1)

Annex XXI A

කළුතර දිස්ත්‍රික්කයේ ප්‍රාථමික අංශයේ පාසැල් දරුවන්ගේ ඉගෙනීමේ දුර්වලතා පිළිබඳ සමීක්ෂණය

දෙමව්පියන්/ රැකබලාගන්නන් සඳහා වූ ආර්ථික හා සමාජීය තොරතුරු ලබාගැනීමේ ප්‍රශ්නාවලිය

අනු අංකය | | | | |

සම්මුඛ පරීක්ෂණය කළ දිනය

දි		මා		අවු			

සම්මුඛ පරීක්ෂණය කරන්නාගේ නම .....

1. හඳුනාගැනීමේ හා සම්බන්ධ කරගැනීමේ තොරතුරු

1.1 අධ්‍යාපන කොට්ඨාශය	1. කළුතර			2. බණ්ඩාරගම			3. අගලවත්ත	
1.2 පාසැල් වර්ගය	1. 1AB		2.1C		3. Type 2		4. Type 3	
1.3 පාසැලේ නම								
1.4 දරුවාගේ නම								
1.5 දරුවාගෙ පන්තිය	1. 3 ශ්‍රේණිය				2. 4 ශ්‍රේණිය			
1.6 නිවසේ ලිපිනය								
1.7 ඔබ පදිංචි ප්‍රදේශය අයත් වන්නේ පහත කුමන බල ප්‍රදේශයකවද	1. නගර සභා				2. ප්‍රාදේශීය සභා			
1.8 කරුණාකර මවගේ / පියාගේ/ රැකබලාගන්නාගේ දුරකථන අංකය ඇතොත් සඳහන් කරන්න								

2. දරුවාගේ මූලික සමාජීය තොරතුරු

2.1 මෙම දරුවාගේ උපන් දිනය කවදාද?	දි		මා				වි	
2.2 දරුවාගේ ස්ත්‍රී පුරුෂ භාවය කුමක්ද?	1. පුරුෂ					2. ස්ත්‍රී		
2.3 දරුවාගේ ජාතිය කුමක්ද?	1. සිංහල					4.බර්ගර්		
	2. දෙමළ					5.වෙනත් (සඳහන් කරන්න)		
	3. මුස්ලිම්							
2.4 දරුවාගේ ආගම කුමක්ද?	1. බෞද්ධ					4.රෝමානු කතෝලික		
	2.හින්දු					5.ක්‍රිස්තියානි		
	3.ඉස්ලාම්					6.වෙනත්(සඳහන් කරන්න)		

3. දෙමව්පියන්ගේ සමාජයීය හා ආර්ථික තොරතුරු

3.1 මෙම දරුවාට ප්‍රධාන වශයෙන් රැක බලාගන්නේ කවුරුන්ද?				
	1. මව පමණක්		4. දෙමව්පියන් නොවන රැකබලාගනනෙක්	
	2. පියා පමණක්			
	3. දෙමව්පියන්			
ඔබ දෙමව්පියන් නම් ප්‍ර: අංක 3.2ට යන්න. ඔබ දෙමව්පියන් නොවන රැකබලාගනරනෙක් නම් ප්‍ර: අංක 3.4ට යන්න.				

3.2 ඔබේ පවුලේ මාසික ආදායම කොපමණද?				
	මව		පියා	

3.3 කරුණාකර ඔබ හා ඔබේ ස්වාමිපුරුෂයා සම්බන්ධ පහත තොරතුරු ලබාදෙන්න												
තොරතුර	මව						පියා					
3.3.1 උපන් දිනය	දි	මා	වර්ෂය				දි	මා	වර්ෂය			

3.3.2 ජාතිය	1. සිංහල		1. සිංහල	
	2. දෙමළ		2. දෙමළ	
	3. මුස්ලිම		3. මුස්ලිම	
	4. බර්ගර්		4. බර්ගර්	
	5. වෙනත්(සඳහන් කරන්න)		5. වෙනත් (සඳහන් කරන්න)	
3.3.3 ආගම	1. බෞද්ධ		1. බෞද්ධ	
	2. හින්දු		2. හින්දු	
	3. ඉස්ලාම්		3. ඉස්ලාම්	
	4. රෝමානු කතෝලික		4. රෝමානු කතෝලික	
	5. කතෝලික		5. කතෝලික	
	6. වෙනත් (සඳහන් කරන්න)		6. වෙනත් (සඳහන් කරන්න)	
3.3.4 විවාහක/ අවිවාහක තත්වය	1.විවාහක		1. විවාහක	
	2.අවිවාහක		2. අවිවාහක	
	3. දික්කසාද		3. දික්කසාද	
	4. වෙන්ව සිටින		4. වෙන්ව සිටින	
	5. වැන්දඹු		5. වැන්දඹු	
	6.වෙනත්(සඳහන් කරන්න)		6. වෙනත්(සඳහන් කරන්න)	

	මව		පියා	
3.3.5 ඔබ හා ඔබගේ ස්වාමිපුරුෂයා ලබා ඇති ඉහලම අධ්‍යාපන සදුසුකම කුමක්ද	1. කිසිදා පාසැල් ගොස් නැත		1. කිසිදා පාසැල් ගොස් නැත	
	2. 5 ශ්‍රේණිය දක්වා		2. 5 ශ්‍රේණිය දක්වා	
	3. 6-10 ශ්‍රේණිය දක්වා		3. 6-10 ශ්‍රේණිය දක්වා	
	4. සා/පෙළ සමත්		4. සා/පෙළ සමත්	
	5. 11-13 පන්තිය දක්වා		5.11-13 පන්තිය දක්වා	
	6. උ/පෙළ සමත්		6.උ/පෙළ සමත්	
	7. විශ්ව විද්‍යාල අධ්‍යාපනය		7.විශ්ව විද්‍යාල අධ්‍යාපනය	
	8. විශ්ව විද්‍යාල නොවන උසස් අධ්‍යාපනය		8.විශ්ව විද්‍යාල නොවන උසස් අධ්‍යාපනය	
3.3.6 රැකියා තත්වය	1. රැකියාවක් කරයි		1. රැකියාවක් කරයි	
	2. රැකියාවක් නොකරයි		2. රැකියාවක් නොකරයි	
3.3.7 රැකියාවක් කරන්නේ නම් එය සඳහන් කරන්න				
3.3.8 ඔබගේ රැකියාවෙ ස්වභාවය කුමක්ද?	1. පූර්ණකාලීනව නිවසින් පිටත රැකියාවක් රාත්‍රිය නිවසින් පිටත ගත කරයි		1. පූර්ණකාලීනව නිවසින් පිටත රැකියාවක් රාත්‍රිය නිවසින් පිටත ගත කරයි	
	2. පූර්ණකාලීනව නිවසින් පිටත රැකියාවක් රාත්‍රිය නිවසේ ගත කරයි		2. පූර්ණකාලීනව නිවසින් පිටත රැකියාවක් රාත්‍රිය නිවසේ ගත කරයි	
	2. අර්ධ කාලීනව නිවසින් පිටත රැකියාවක්		2. අර්ධ කාලීනව නිවසින් පිටත රැකියාවක්	
	3. නිවස ආශ්‍රිත රැකියාවක්		3. නිවස ආශ්‍රිත රැකියාවක්	
3.3.9 දරුවාගේ පියා දැනට විදේශගතව රැකියාවක් කරන්නේද?				
	1. ඔව්		2. නැත	
3.3.10 දරුවාගේ මව දැනට විදේශගතව රැකියාවක් කරන්නේද?				
	1. ඔව්		2. නැත	
3.4 ඔබ දෙමව්පියන් නොවන රැකබලාගන්නෙක් නම් මෙම දරුවාට ඔබ ඥාති සම්බන්ධකමක් දක්වන්නේද?				
	3. ඔව්		4. නැත	
3.5 පිළිතුර ඔව් නම් එම ඥාති සම්බන්ධය කුමක්ද				
3.5 කරුණාකර ඔබගේ ජීවන තත්වය සම්බන්ධයෙන් අසන පහත ප්‍රශ්න වලට පිළිතුරු සපයන්න				
3.5.1 නිවසේ සාමාජිකයන් පානීය ජලය ලබාගන්නා ප්‍රධාන ක්‍රමය කුමක්ද?				
I. පයිප්ප නළ	නිවස තුළට ලබාගත් නළ ජලය			
	ගෙවත්තේ පිහිට නළ ජලය			
	පොදු ජල කරාමය/ විදි ජල කරාමය			
II. ළිඳ	නළ ළිඳ			
	ගෙවත්තේ පිහිට ආරක්ෂිත ළිඳ			
	ගෙවත්තෙන් පිටත පිහිට ආරක්ෂිත ළිඳ			

	අනාරක්ෂිත ළිඳ	
III. දිය උල්පත්	ආරක්ෂිත දිය උල්පත්	
	අනාරක්ෂිත දිය උල්පත්	
IV. පෘෂ්ඨීය ජලය	ගඟෙන්/ වැවෙන්/ දිය පාරකින්	
V. වෙනත්	ජල බවුසරය	
	වැසි ජලය	
	බෝතල් කරන ලද ජලය	
	වෙනත් (සඳහන් කරන්න)	

3.5.2 ඔබ පාවච්ච කරන වැසිකිළියේ ස්වභාවය කුමක්ද?

I. ජලය දමන	මලපහ නල පද්ධතියකට ගලා යයි	
	මලපහ අසුව් ටැංකියකට ගලා යයි	
	මලපහ වලකට ගලා යයි	
	මලපහ වෙනත් තැනකට ගලා යයි	
	මලපහ ගලා යන තැන නොදනී	
II. වල	වාතාශ්‍රය දියුණු කළ කොන්ක්‍රීට් ලැල්ලක් සහිත	
	වල විවෘත	
III. වැසිකිලි පහසුකම් නැත		
IV. වෙනත් (සඳහන් කරන්න)		

3.5.3 ඔබගේ නිවසේ පහත සඳහන් පහසුකම් තිබේද? (එක පිළිතුරකට වඩා වැඩි විය හැක)

	ඔව්	නැත
I. විදුලිය		
II. රේඩියෝව		
III. රූපවාහිනිය		
IV. ශීතකරණය		
V. ස්ථාවර දුරකථනය		
VI. ජංගම දුරකථනය		
VII. ඔරලෝසුව		
VIII. සූර්ය ශක්තිය		
IX. වායුසමීකරණ		

3.5.4 ඔබගේ නිවසේ කවර හෝ සාමාජිකයකු සතුව පහත සඳහන් වාහන තිබේද? (එක පිළිතුරකට වඩා වැඩි විය හැක)

	ඔව්	නැත
I. බයිසිකලය		
II. මෝටර බයිසිකලය හෝ ස්කූටරය		
III. ට්‍රැක්ටරය හෝ අත් ට්‍රැක්ටරය		
IV. කාරය		
V. වෑන් රථය		
VI. ජීප් රථය		

3.5.5 ඔබගේ නිවසේ බිම නිමවා ඇති ප්‍රධාන ද්‍රව්‍ය කුමක්ද?

I. ස්වභාවික	වැලි	
	ගොම/ මඩ	
II. නිම නොකළ	ලෑලි (ඔප නොදැමූ)	
	උණ බම්බු	
III. නිම කළ	ඔප දැමූ ලෑලි හෝ බිම මැට	
	වයිනයිල්	
	ටෙරාසෝ/ ග්‍රැනයිට්/ ටයිල්	
	සීමෙන්ති/කොන්ක්‍රිට්	
IV. වෙනත් (සඳහන් කරන්න)		

3.5.6 ඔබගේ නිවසේ වහල නිමවා ඇති ප්‍රධාන ද්‍රව්‍ය කුමක්ද?

I. ස්වභාවික	පිදුරු / තල් අතු/ පොල් අතු/ ඉලුක්	
II. නිම නොකළ	කාඩ්බෝඩු/ රෙදි	
III. නිම කළ	තහඩු/ තාර රෙදි	
	උළු	
	කොන්ක්‍රිට්/ සීමෙන්ති	
	ඇස්බැස්ටෝස්	
IV. වෙනත් (සඳහන් කරන්න)		

3.5.7 ඔබගේ නිවසේ පිටත බිත්ති නිමවා ඇති ප්‍රධාන ද්‍රව්‍ය කුමක්ද?

I. ස්වභාවික	තල් අතු/ පොල් අතු/ ලී කොටන්	
II. නිම නොකළ	උණ බම්බු හා මැට	
	ප්ලයිවුඩ්	
	කාඩ්බෝඩ්	
III. කපරාරු නොකළ	කපරාරු නොකළ ගඩොල්	
	කපරාරු නොකළ සීමෙන්ති ගල්	
	කපරාරු නොකළ කබොක් ගල්	
IV. නිම කළ	හුණු කපරාරු කළ ගඩොල්	
	කපරාරු කළ සීමෙන්ති ගල්	
	කපරාරු කළ කබොක් ගල්	
V. වෙනත් (සඳහන් කරන්න)		

3.5.8 ඔබගේ නිවසේ ආහාර පිසීම සඳහා ප්‍රධාන වශයෙන් යොදා ගන්නා ඉන්ධන වර්ගය කුමක්ද?

I. විදුලිය	
II. ගෑස්	
III. භූමිතෙල්	
IV. දර	
V. නිවසේ කෑම උයන්නේ නැත	
VI. වෙනත් (සඳහන් කරන්න)	
3.5.9 ඔබගේ නිවසේ නිදා ගැනීම සඳහා භාවිතා කරන නිදන කාමර ගණන කීයද?	

Annex XXI B

Learning difficulty among primary school children in grade three and grade four in the district of Kalutara

Demographic and Socioeconomic Interviewer Administered Questionnaire for parents/ caregivers

Serial Number:

Date of interview

D		M		Y			

Name of the interviewer.....

1. Identification and contact information

1.1 Educational Division	1. Kalutara			2. Bandaragama			3. Agalawatta	
1.2 Type of School	1. 1AB		2.1C		3. Type 2		4. Type 3	
1.3 Name of school								
1.4 Name of child								
1.5 Grade of child	1. Grade 3				2. Grade 4			
1.6 Address of residence								
1.7 Sector to which the	1. Urban Council				2. Local Government			
1.8 Please mention contact number of mother/ father/ caretaker if any								

2. Demographic information of the child

2.1 What is the date of birth of the child?	D	M	Y					
2.2 What is the sex of the child?	1. Male						2. Female	
2.3 What is the ethnicity of the child?	1. Sinhala						4. Burger	
	2. Tamil						5. Other (specify)	
	3. Muslim							
2.4 What is the religion of this child?	1. Buddhist						4. Roman catholic	
	2. Hindu						5. Christian	
	3. Islam						6. Other (specify)	

1. Socio economic information of parents/ Caregiver

3.1 Please mention who is the primary caregiver of this child?				
	1. Only mother		3. Both parents	
	2. Only father		4.Non parental caregiver	
If you are the parent please go to Q.3.2 and if you are a non-parental caregiver please go to Q. 3.4				
3.2 What is your family income?				

	Mother	Rs.	Father	Rs.

3.3 Please provide following information about you and your spouse

Information	Mother						Father					
3.3.1 Date of birth	D	M	Year				D	M	Yeer			

3.3.2 Ethnicity	1. Sinhala		1. Sinhala	
	2. Tamil		2. Tamil	
	3. Muslim		3. Muslim	
	4. Burger		4. Burger	
	5. Other		5. Other	
3.3.3 Religion	1. Buddhist		1. Buddhist	
	2. Hindu		2. Hindu	
	3. Islam		3. Islam	
	4. Roman catholic		4. Roman catholic	
	5. Christian		5. Christian	
	6. Other		6. Other	
3.3.4 Marital status	1. Un Married		1. Un Married	
	2. Currently married		2. Currently married	
	3. Divorced		3. Divorced	
	4. Separated		4. Separated	
	5. Widowed		5. Widowed	
	6. Other		6. Other	
3.3.5 Highest educational qualification	1. Never gone to school		1. Never gone to school	
	2. Up to grade 5		2. Up to grade 5	
	3. Grade 6 to 10		3. Grade 6 to 10	
	4. Passed G.C.E O/L		4. Passed G.C.E O/L	
	5. Grade 11-13		5. Grade 11-13	
	6. Passed GCE A/L		6. Passed GCE A/L	
	7. University education		7. University education	
	8. Higher education other than university education		8. Higher education other than university education	
3.3.6 Employment status	1. Employed		1. Employed	
	2. Not employed		2. Not employed	

Information	Mother	Father
3.3.7 Occupation		

3.3.8 Type of	1. Full time and spend		1. Full time and spend	

occupation	nights outside home		nights outside home	
	2. Full time but spend the nights at home		2. Full time but spend the nights at home	
	3. Part time outside the house		3. Part time outside the house	
	4. Employed within the house		4. Employed within the house	

3.3.9 Is the father of the child is currently employed abroad?

	1. Yes		2. No	

3.3.10 Is the mother of the child is currently employed abroad?

	1. Yes		2. No	

3.4 If you are a non-parental care giver, are you related to this child?

	1. Yes		2. No	

3.5 Please answer following questions regarding your status of living

3.5.1 What is the major source of drinking water for members of your household?

I.	Piped	Piped in to dwelling	
		Piped in to yard/ plot	
		Public tap	
II.	Well	Tube well	
		Protected well within the premises	
		Protected well outside the premises	
		Unprotected well	
III.	Spring	Protected spring	
		Unprotected spring	
IV.	Surface water	River/ dam/stream/ ponds/lake/canal	
V.	Other	Rain water	
		Bowser	
		Bottle water	
		Other (specify)……..	

3.5.2 What kind of toilet facility is available for the use by the members of your family?

I.	Pour flush/Flush	Flush/ pour flush to piped sewer system	
		Flush/ pour flush to septic tank	
		Flush/ pour flush to pit latrine	
		Flush/ pour flush to elsewhere	
		Flush/ pour flush don't know where	
I.	Pit latrine	Ventilated improved pit latrine	
		Pit latrine with a slab	
		Pit latrine without slab/open pit	
II.	No facility		
III.	Other (specify)		

3.5.3 Does you house have following facilities? **(multiple responses possible)**			
		Yes	No
I.	Electricity		
II.	A Radio		
III.	A television		
IV.	A refrigerator		
V.	Land telephone		
VI.	Mobile phone		
VII.	Clock		
VIII.	Solar power		
IX.	Air condition		

3.5.4 Does any member of your household own any of the following vehicles?			
		Yes	No
I.	A bicycle		
II.	A motor cycle/scooter		
III.	A tractor/ land master		
IV.	A car		
V.	A van		
VI.	A jeep		

3.5.5 What is the main material used for the floor of the house?		
I. Natural floor	Sand	
	Dung/earth	
II. Rudimentary floor	Wood planks	
	Bamboo	
III. Finished floor	Polished wood/ Parquet or Terra cotta	
	Vinyl or asphalt strips	
	Terrazzo/ Granite/ Floor tile	
	Cement/ Concrete	
Other (specify)		

3.5.6 What is the main material used for the roof of the house?			
		Yes	No
I. Natural roofing	Straw/palm leaf/ cadjan/iluk		
II. Rudimentary roofing	Cardboard/ Carton		
III. Finished roofing	Metal/tin sheet/ tar sheet		
	Tile		
	Cement/ concrete		
	Asbestos		
IV. Other (specify)			

3.5.7 What is the main material used for the exterior walls of the house?	

I.	Natural walls	Cadjan/ palm/trunks	
II.	Rudimentary walls	Bamboo with mud	
		Ply wood	
		cardboard	
III.	Unfinished walls	Unfinished Bricks	
		Unfinished cement blocks	
		Unfinished kabok stone	
IV.	Finished walls	Finished bricks (covered)	
		Finished cement blocks	
		Finished Kabok stone	
V.	Other (specify)		

3.5.8 What type of fuel does your house hold mainly used for cooking?

		Yes	No
I.			
II.	Electricity		
III.	LPG		
IV.	Kerosene		
V.	Wood		
VI.	No cooking done in the house hold		
VII.	Other (specify)		

3.5.9 How many rooms in this household are used for sleeping?

Annex XXII

Calculation of Asset Index, list of asset items the statistics used for the development of the asset index

Asset Index was calculated for each house hold of the participant using the method described by Thalagala (2004). Asset variable in the demographic and socioeconomic IAQ, section 3.5 were included during the calculation of Asset Index. Variables were coded in a binary way. Number of rooms were categorized as <2 rooms and ≥2rooms.

Raw factor score coefficient corresponding to different asset items was calculated using PCA. The first factor score corresponding to a particular variable was considered as the relative weight corresponding to that variable. Each asset item was assigned a standardized asset item weights depending on the presence or absence of the asset item. The standardized asset item weights were calculated by multiplying the factor score coefficient of the variable by the standardized values of the variable measured in the binary scale formula is given below.

$$\frac{\text{Value of asset variable- un-weighted mean of asset variable}}{\text{Un-weighted standard deviation of asset variable}} \times \text{raw asset factor coefficient}$$

Table 1 presents the mean, standard deviation, factor score coefficient related to particular asset variable, and the two standardized asset item eights corresponding to the variable depending on its presence and absence. Using the standardized values an asset index will be formulated for each household. This will be divided in to four quintiles.

Item	Mean	SD	Factor score coefficient	Score if the item is present	Score if the item is absent
Source of water supply					
Tap within the house	0.29	0.453	0.082	0.1285	-0.0525
Tap within the premises	0.1	0.301	-0.006	-0.0179	0.0020
Tap common	0.08	0.268	-0.032	-0.1099	0.0096
Tube well	0.02	0.124	-0.008	-0.0632	0.0013
Protected well within the premises	0.42	0.493	-0.029	-0.0341	0.0247
Protected well outside the premises	0.06	0.243	-0.029	-0.1122	0.0072
Unprotected well	0.01	0.115	-0.015	-0.1291	0.0013
River	0.01	0.11	-0.017	-0.1530	0.0015
Spring	0.02	0.124	-0.005	-0.0395	0.0008
Type of latrine					
Flush/pour flush in to piped sewer	0.15	0.359	0.127	0.3007	-0.0531
Flush/ pour flush to pit latrine	0.85	0.36	-0.126	-0.0525	0.2975

Household assets					
Availability of electricity	0.89	0.317	0.058	0.0201	-0.1628
Radio	0.72	0.451	0.054	0.0335	-0.0862
Television	0.9	0.299	0.049	0.0164	-0.1475
Refrigerator	0.5	0.5	0.103	0.1030	-0.103
Land phone	0.36	0.479	0.091	0.1216	-0.0684
Mobile phone	0.86	0.343	0.048	0.0196	-0.1203
Clock	0.9	0.304	0.029	0.0095	-0.0859
Owns a bicycle	0.41	0.491	0.033	0.0397	-0.0276
Owns a bicycle	0.36	0.481	0.08	0.1064	-0.0599
Owns a car	0.04	0.191	0.065	0.3267	-0.0136
Owns a van	0.02	0.154	0.042	0.2673	-0.0055
Owns a tractor	0.01	0.102	0.007	0.0679	-0.0007
Type of floor					
Mud	0.04	0.205	-0.043	-0.2014	0.0084
Terrazo, tile	0.18	0.381	0.117	0.2518	-0.0553
Cement/concrete	0.78	0.416	-0.085	-0.0450	0.1594
Type of roof					
Cadjan	0.01	0.091	-0.023	-0.2502	0.0025
Sheet	0.06	0.237	-0.054	-0.2142	0.0137
Tile	0.39	0.487	0.02	0.0251	-0.0160
Concrete	0.03	0.159	0.047	0.2867	-0.0089
Asbastos	0.52	0.5	-0.004	-0.0038	0.0042
Type of wall					
Cadjan	0.01	0.091	-0.023	-0.2502	0.0025
Mud and bamboo	0.02	0.156	-0.035	-0.2199	0.00449
unfinished cobok	0.14	0.345	-0.058	-0.1446	0.02354
finished brick	0.1	0.305	0.091	0.2685	-0.02984
finished cement stone	0.57	0.495	0.013	0.0113	-0.01497
finished cabock	0.16	0.362	-0.018	-0.0418	0.00796
Type of fuel used for cooking					
ECK1 electricity	0.01	0.074	0.031	0.4147	-0.00419
ECK2 gas	0.26	0.437	0.126	0.2134	-0.07497
ECK3 kerosine	0.01	0.102	0.007	0.0679	-0.00069
ECK4 wood	0.76	0.427	-0.12	-0.0674	0.21358
Number of rooms for sleeping					
ER number of rooms	0.79	0.405	0.072	0.0373	-0.14044

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பணிப்பாளர் கல்வி அலுவலகம்
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Provincial Department of Education
Western Province

ලියන අංකය
எமது இல
Our No.

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உமது இல
Your Number

76, ආනන්ද කුමාරස්වාමි මාවත,
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කළාප අධ්‍යාපන අධ්‍යක්ෂ,
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පිටපත : කළාප අධ්‍යාපන අධ්‍යක්ෂ - පිළියන්දල.
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කළාප අධ්‍යාපන අධ්‍යක්ෂ - මතුගම.

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Administration 2682262 General
Administration 2682263

Accountants
Chief Accountant 2691574
Accountant Audit 2678397
Accountant Finance 2678394

Officers
DDE (Planning) 2678398
DDE (Administration) 2678396
Administrative Officer 2678390

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Provincial Department of Education
Western Province

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My Number

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உமது இல
Your Number

76, ආනන්ද කුමාරස්වාමි මාවත,
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<u>ප්‍රාථමික අංශයේ දරුවන්ගේ අධ්‍යාපනය සම්බන්ධව</u>
<u>සමීක්ෂණයක් පැවැත්වීම සඳහා අවසර ලබා දීම.</u>

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Your Number

76, ආනන්ද කුමාරස්වාමි මාවත,
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කළාප අධ්‍යාපන අධ්‍යක්ෂ,
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පිටපත : කළාප අධ්‍යාපන අධ්‍යක්ෂ - පිළියන්දල.
කළාප අධ්‍යාපන අධ්‍යක්ෂ - හොරණ.
කළාප අධ්‍යාපන අධ්‍යක්ෂ - මතුගම.

Annex XXIV A

INFORMATION SHEET- TEACHERS – Prevalence study

Learning difficulty among primary school children in the district of Kalutara: Prevalence, behavioural comorbidities, risk factors and parental psychological distress.

Dear Parents,

1. **Purpose of the study**

Learning difficulty among primary school children has become a devastating problem for teachers, parents as well as to the state in developed parts of the world. The prevalence of learning difficulty in this part of the world is around 10%. It has been proven that majority of these children are having behavioral problems which inflate the burden of learning difficulty. This not only affects the individual with the disability, but can also have a substantial impact on other members of the family, especially the psychological status of parents. Primary school age is the age at which learning problem become more evident and easily detectable. Therefore this is the best age to detect this problem in order to prevent further consequences.

This part of the study aims to assess the magnitude of Learning Difficulty using the developed screening instrument. Behavioural problems among children will also be assessed.

2. **Voluntary participation**

Your role in this study is to administer Learning Difficulty Screening Questionnaire (LDSQ) to identify Learning Difficulty among children in your class. Your participation in this study is voluntary. You are free to not participate at all or to withdraw from the study at any time despite consenting to take part initially. You are hereby assured that your non participation or withdrawal at any time will not affect the education of your class children or benefit enjoying in the school..

3. **Duration, procedures of the study and participant's responsibilities**

You, as the class teacher need to administer LDSQ questionnaire for your class children to assess the learning problems. At the same time you need to complete the Strength and Difficulties Questionnaire to assess the behavavioural problems. This can be done from the observation you have already made. An Adequate time period will be given to observe these children's learning. It is your responsibility to provide valid information on these behaviors after a through observation of your class children.

Hearing, vision and IQ of class children will also be examined during the school hours.

4. **Potential benefits**

Although the participation in this study will not have a direct benefit to you it will certainly have an indirect benefit. It will help to prepare a screening tool which can be used in future to detect Learning Difficulty among primary school children.

5. **Risks, hazards and discomforts**

Participation in this study will not cause any risk, hazard or discomfort to you. The only difficulty is to spend your time to fill the questionnaire. Your class room activities will not be disturbed at any cost.

6. **Reimbursements**

You will not be paid any money for participating in this study

7. **Confidentiality**

Confidentiality of all collected information is guaranteed and no information by which you can be identified will be released or published. Any information given by you will not be shared at an individual basis with a second party. Any resulting communication (reports, presentations, theses, research publications, etc.) from this study will not expose your identity in any way.

8. **Termination of study participation**

You may withdraw your consent to participate in this study at any time without any reason given on your part. . In such instances you will not be subjected to any penalty or loss of any benefits you were enjoying previously. Please notify the investigator as soon as you decide to withdraw your consent.

9. **Clarification**

If you have questions about any procedure or if you need any further information please feel free to ask from the principal investigator mentioned below. :

VOLUNTEER CONSENT FORM

Learning difficulty among primary school children in the district of Kalutara: Prevalence, behavioural comorbidities, risk factors and parental psychological distress.

To be completed by the participant

The participant should complete the entire sheet by him self

1. Have you read the information sheet? YES/NO
2. Have you had an opportunity to discuss this study and ask any questions? YES/NO
3. Have you had satisfactory answers to all your questions? YES/NO
4. Have you received enough information about the study? YES/NO
5. Who explained the study to you? .....
6. Do you understand that you are free for non-participation for the study without giving a reason for not to participate and without affecting children's education? YES/NO
7. Have you had sufficient time to come to your decision? YES/NO
8. Do you agree to take part in this study? YES/NO
9. Do you suspect any of your children to have visual problems YES/NO
10. Do you suspect any of your children to have hearing problems YES/NO

    Name those children.....

Teacher's signature..... Date.....

Name (BLOCK CAPITALS).....

To be completed by the investigator

I have explained the study to the above participant and he/she has indicated his/her willingness to participate.

Investigator's signature..... Date.....

Name (BLOCK CAPITALS).....

Annex XXIV B

INFORMATION SHEET- Parents –prevalence/ case control study

Learning difficulty among primary school children in the district of Kalutara: Prevalence, behavioural comorbidities, risk factors and parental psychological distress

Dear Parents,

1. **Purpose of the study**

Learning difficulty among primary school children has become a devastating problem for teachers, parents as well as to the state in developed parts of the world. The prevalence of learning difficulty in this part of the world is around 10%. It has been proven that majority of these children are having behavioral problems which inflate the burden of learning difficulty. This not only affects the individual with the disability, but can also have a substantial impact on other members of the family, especially the psychological status of parents. Primary school age is the age at which learning problem become more evident and easily detectable. Therefore this is the best age to detect this problem in order to prevent further consequences.

This part of the study aims to assess the magnitude of learning difficulty and associated behavioral problems among primary school children.

1. **Voluntary participation**

Your participation in this study is voluntary. You are free to not participate at all or to withdraw from the study at any time despite consenting to take part initially. You are hereby assured that your non participation or withdrawal at any time will not in any way affect your child's education or benefit he/she enjoying in the school..

2. **Duration, procedures of the study and participant's responsibilities**

An interviewer (either the principal investigator or a research assistant) will collect information from you using an Interviewer Administered Questionnaire (IAQ) which would take about 10 minutes and included basic demographic and socioeconomic information.

You will receive a second questionnaire, which will be read to you to assess the behavioral problems of the child. It will also take a few minutes to complete the entire questionnaire.

Hearing vision and IQ of your child will be assessed by a medical personnel. The class teacher will assess the learning problems in the class room setting by using a questionnaire. This will include your child as well. Your consent to include your child for that part of the study will also be needed as that would be the initial part of the study.

It also contains contact details and family income level. Contact information is taken to refer the child to the relevant authorities if any problems are detected and to invite you for the second part of the study if necessary.

If your child will get selected for the second part of the study you will have to face a detailed interview to find the factors leading to learning difficulty. This questionnaire contains information on birth, developmental, childhood period, family, home and neighborhood. Maternal and birth information of the child will be verified by reports and records available with you. Therefore available antenatal records, birth records and Child Health Developmental Records are needed to get more accurate information and you are requested to provide the available reports. At the same time your valid information on all related factors during the interview is needed to make this a success.

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3. Potential benefits

Your and your child's participation in this study will have direct benefit to both of you. Firstly if your child has any learning problems they will be detected and taken care of. At the same time if the child has any behavioral problems they will be referred to nearest health institutions for further care. Indirectly it will have a greater benefit for all the future children as information you are provided as the risk factors of learning difficulty would enable to screen such children at an early stage thus preventing enormous amount of future consequences.

4. Risks, hazards and discomforts

Participation in this study will not cause any risk, hazard or discomfort to you. Referral of children detected as having learning difficulty to specialist care at General Hospital Kalutara or Child Guidance Clinics at Lady Ridgeway Hospital will be done in a way convenient to both yourself and the Consultant Psychiatrist.

5. Reimbursements

You will not be paid any money for participating in this study

6. Confidentiality

Confidentiality of all collected information is guaranteed and no information by which you can be identified will be released or published. Any information given by you will not be shared at an individual basis with a second party. Any resulting communication (reports, presentations, theses, research publications, etc.) from this study will not expose your identity in any way.

7. Termination of study participation

You may withdraw your consent to participate in this study at any time without any reason given on your part. . In such instances you will not be subjected to any penalty or loss of any benefits you were enjoying previously. Please notify the investigator as soon as you decide to withdraw your consent.

8. Clarification

If you have questions about any procedure or if you need any further information please feel free to ask from the principal investigator mentioned below. :

VOLUNTEER CONSENT FORM

Learning difficulty among primary school children in the district of Kalutara: Prevalence, behavioural comorbidities, risk factors and parental psychological distress.

To be completed by the participant

The participant should complete the entire sheet by him self

9. Have you read the information sheet? YES/NO
10. Have you had an opportunity to discuss this study and ask any questions? YES/NO
11. Have you had satisfactory answers to all your questions? YES/NO
12. Have you received enough information about the study? YES/NO
13. Who explained the study to you? .....
14. Do you understand that you are free for non-participation for the study without giving a reason for non- participation and without affecting child's education? YES/NO
15. Have you had sufficient time to come to your decision? YES/NO
16. Do you agree to take part in this study? YES/NO
17. Do you agree to participate your child in the class room assessments YES/NO

Participant's signature.....

Date.....

Name (BLOCK CAPITALS).....

Please fill following if you are willing to participate in the study

Address-

Telephone number if any.....

Do you suspect any hearing problem in your child **Yes/No**

Do you suspect any vision problem in your child **Yes/No**

Is your child suffering from any major illnesses? **Yes/No**

If yes mention.....

Is your child taking treatment for any psychiatric problems **Yes/No**

To be completed by the investigator

I have explained the study to the above participant and he/she has indicated his/her willingness to participate.

Investigator's signature.....

Date.....

Name (BLOCK CAPITALS).....

Annex XXV

Interviewer guide – Demographic and Socio economic Questionnaire

General instructions for administering the questionnaire

- Make a convenient place where privacy can be maintained after discussing with the school authorities.
- Building a **good rapport** is very important to obtain reliable information. Greet the parents who were presented and introduce you. Explain the objective of the data collection and reconfirm that they have given the consent. Explain further that this study won't pose any harm to their children and it will be a benefit for lot of children.
- Some individuals might pose more questions than others. Patiently give them all the information necessary and proceed calmly.
- Doubts can be clarified with PI, as PI is available in the field and will pay on off supervision visit while the data collection is going on.
- When repeating a question, do not change the wording and content of the question.
- When a question is to be skipped, follow the instructions given in the questionnaire very carefully. eg: if yes, go to Q : 3.2. This means that if the answer is yes the next question to be asked is 3.2.
- Nature of the questionnaire: This is an interviewer administered questionnaire. Therefore questions should be asked without an influence to get an answer. First read the question without the responses and try to get an answer. Then read it again with the responses and identify the relevant response category.
- For open ended questions like income and occupation write the answer clearly in the space provided.
- For close ended questions, the possible responses are given in the boxes provided and mark (X) for the response given.
- When the respondent's answer is not fall in to any category, mark the "other" box and write the answer clearly and briefly in the space provided.
- It is your responsibility to check all the answers have been answered correctly and check for completeness of the questionnaire at the end of the interview.
- Ending the interview is as important as the initiation. Some of these mothers may need to be contacted again for the second part of the study. It is your responsibility

to thank all the respondents during the session of winding up. Thank all the class teachers at the end of interviewing the whole class.

Specific instructions for administering the questionnaire

1. **Demographic and Socio economic questionnaire**
   Start the questionnaire from contact information of the child and proceed in order according to the questionnaire.

1. Identification and contact detail
   1.1 Name of the child- please mention name of the child as mentioned in the class register
   1.2 Present grade of the child – eg: grade 3 A
   1.3 Complete address of the residence
   1.4 Ask whether the residence of the child is under urban council or local government
   1.5 Telephone number (if available) of parent /care giver
2. Basic information of the child
   2.1 Date of birth of the child- mention completely as date, month and year
   2.2 Sex of the child, mention whether the child is male or female
   2.3 Ethnicity of the child- mark in the relevant space
   2.4 Religion of the child- mark in the relevant space
3. Parent or care giver information- demographic and socioeconomic
   3.1 Who is the principal caregiver of the child – The person who has greatest responsibility for the daily care and rearing of the child?
   If fathers are working full time outside the house, mother is the primary caregiver
   3.2 If principal care giver is a parent, the regular monthly income of the family, from all sources of income. Please mention income of mother and father separately
   3.3 Parent information
      3.3.1 What is date of birth of mother and father- mention date, month and year?
      3.3.2 What is the ethnicity of mother and father- mark in the relevant space? If "other" mention that.

3.3.3 What is the religion of mother and father- mark in the relevant space? If other mention that.

3.3.4 What is the marital status of mother and father?- mark in the relevant space If other mention that.

3.3.5 What is the highest education qualification obtained by mother and father? Please mention higher studies other than university education under 8th category.

3.3.6 Mention whether the mother and father are employed presently.

3.3.7 Mention the present occupation of mother and father. What they have been doing during last three months to generate income for the family.

3.3.8 Mention whether they are occupied full time or part time, within the house or outside the house.

1. Full time and spends the night outside- if they work 40 or more hours per week and spend 2-4 or more nights outside the house, this will belong to full time category.(eg. armed force officers, foreign employees)
2. Full time and spends the night at home- if they work 40 or more hours per week and but spend the nights at home or spend one night/week outside the house, this will belong to full time category.
3. Part time outside the house – Work <40 hour per week and spend all the nights at home
4. Employed within the house- Does a home based occupation

3.4. Whether you are a non-parental caregiver. This questioned should be asked if the response for question 3.1 is a non-parental caregiver.

3.4.1 Whether the child has any relationship to the caregiver.

3.5 Questions related to house hold assets and facilities. Mark according to availability of the asset

3.5.1 What is the main source of water?

i. If tap water, mention whether it is piped in to house/ garden, common tap

ii. If well water, mention whether it is a tube well, protected or unprotected well

iii. Whether water from a spring, protected /unprotected

iv. If surface water like river/ lake

v. Other sources like bottled water, rain water etc.

3.5.2 Type of toilet using - whether water sealed, pour flush, pit, bucket etc.mention each asset under "yes" or "No" category.

3.5.3 Assets at home – mention whether they have each asset separately. If they don't have it mention as "No".

3.5.4 Whether any member of the house owns listed vehicles.

3.5.5 Main material that was used for the floor of the house. First select the category of natural, unfinished or finished. Then mark the correct material. If other materials are not used mark "No" for each.

3.5.6 Main material that was used for the roof of the house. First select the category of natural, unfinished or finished. Then mark the correct material. If other materials are not used mark "No" for each. If both tile and asbestos had been used mentioned both.

3.5.7 Main material that was used for the wall of the house. First select the category of natural, unfinished or finished. Then mark the correct material. If other materials are not used mark "No" for each.

3.5.7 What is the type of fuel using for cooking.

3.5.8 Mention total number of bed rooms in the house.

Strengths and Difficulties Questionnaire

T 4-10

For each item, please mark the box for Not True, Somewhat True or Certainly True. It would help us if you answered all items as best you can even if you are not absolutely certain. Please give your answers on the basis of the child's behavior over the last six months or this school year.

Child's name ..... Male/Female

Date of birth.....

	Not True	Somewhat True	Certainly True
Considerate of other people's feelings	☐	☐	☐
Restless, overactive, cannot stay still for long	☐	☐	☐
Often complains of headaches, stomach-aches or sickness	☐	☐	☐
Shares readily with other children, for example toys, treats, pencils	☐	☐	☐
Often loses temper	☐	☐	☐
Rather solitary, prefers to play alone	☐	☐	☐
Generally well behaved, usually does what adults request	☐	☐	☐
Many worries or often seems worried	☐	☐	☐
Helpful if someone is hurt, upset or feeling ill	☐	☐	☐
Constantly fidgeting or squirming	☐	☐	☐
Has at least one good friend	☐	☐	☐
Often fights with other children or bullies them	☐	☐	☐
Often unhappy, depressed or tearful	☐	☐	☐
Generally liked by other children	☐	☐	☐
Easily distracted, concentration wanders	☐	☐	☐
Nervous or clingy in new situations, easily loses confidence	☐	☐	☐
Kind to younger children	☐	☐	☐
Often lies or cheats	☐	☐	☐
Picked on or bullied by other children	☐	☐	☐
Often offers to help others (parents, teachers, other children)	☐	☐	☐
Thinks things out before acting	☐	☐	☐
Steals from home, school or elsewhere	☐	☐	☐
Gets along better with adults than with other children	☐	☐	☐
Many fears, easily scared	☐	☐	☐
Good attention span, sees work through to the end	☐	☐	☐

Do you have any other comments or concerns?

Please turn over - there are a few more questions on the other side

Strengths and Difficulties Questionnaire

හත දැක්වෙන එක් එක් අංගයට ඔබට ගැලපෙන උත්තරය සපයන්න.

සුගිය මාස 6 පමණ ඇතුලතදී දරුවා පිළිබඳව ඔබ දන්නා තරුණු අනුව උත්තර දෙන්න. අදාල නැති අංග තිබිය හැක. එහෙත් සෑම අංගයකටම උත්තර සපයන්න.

දරුවාගේ නම :

ගැහැණු / පිරිමි

උපන් දිනය :

	වැරදිය	තරමක් හරි	හරියටම හරි
අන් අයගේ හැඟීම් සැලකිල්ලට ගනියි. ඔවුන්ගේ හැඟීම් ගැන සංවේදීය.	☐	☐	☐
නොසන්සුන්ය. පමණට වඩා ක්‍රියාකාරීය. එක ඉරියව්වකින් වැඩිවේලා සිටිය නොහැක.	☐	☐	☐
නිතර බඩේ අමාරු, වෙනත් අසනීප සෑදේ	☐	☐	☐
අනිකුත් ළමුන් සමග කැමැත්තෙන් (කෑම, සෙල්ලම් බඩු, පැන්සල් ආදිය) බෙදාගනියි.	☐	☐	☐
නිතර තදින් තේන්තියයි. කෝපවෙයි.	☐	☐	☐
අන්අය සමග ආශ්‍රය අඩුය. තනිව සෙල්ලම් කරන ගතියක් ඇත.	☐	☐	☐
සාමාන්‍යයෙන් කීකරුය. වැඩිහිටියන් කියන දේ පිළිපදියි.	☐	☐	☐
සිතේ බොහෝ කරදර ඇත. නිතර සිතේ කරදර ඇතිබව පෙනේ.	☐	☐	☐
කෙනෙකු වේදනාවට අසහනයට හෝ අසනීපයට පත්වූ විට උදව් උපකාර කරයි.	☐	☐	☐
නිතර දගලන නොසන්සුන් ගතියක් දක්වයි.	☐	☐	☐
අඩුගනමන් එක හොඳ මිතුරෙක් / මිතුරියක්වත් සිටියි.	☐	☐	☐
නිතර අන් ළමුන් හා රණ්ඩු කරයි. නැතිනම් අන් අයට හිරිහැර කරයි.	☐	☐	☐
නිතර දුකෙන්, කණගාටුවෙන් හෝ කඳුලු පිරී ඇසින් සිටී.	☐	☐	☐
අනිත් ළමුන් සාමාන්‍යයෙන් ඔහුට / ඇයට කැමතිය.	☐	☐	☐
පහසුවෙන් අවධානය කැඩෙන සුලුය. සිත ඒ මේ අත දුවන සුලුය.	☐	☐	☐
අලුත් අවස්ථාවන්ට මුහුණ දෙනවිට බය ගතියක් දක්වයි. ආත්ම විශ්වාසය ඉක්මණින් හීන වෙයි.	☐	☐	☐
තමන්ට වඩා බාල ළමුන්ට කරුණාව දක්වයි.	☐	☐	☐
නිතර බොරු කියන ගතියක් නැත්නම් වංචා කරන ගතියක් ඇත.	☐	☐	☐
අනිත් ළමුන්ගේ හා යෞවන වයසේ අයගේ වීහිලු හිරිහැරවලට ලක්වේ.	☐	☐	☐
නිතර අන් අයට (මවුපියන්, ගුරුවරුන්, අනිත් ළමුන්ට) උදව් කිරීමට ඉදිරිපත් වෙයි.	☐	☐	☐
යමක් කිරීමට පෙර සිතා බලයි.	☐	☐	☐
ගෙදරින් පාසැලින් හෝ වෙන තැන්වලින් සොරකම් කරයි.	☐	☐	☐
අන් ළමුන් ඇසුරු කරනවාට වඩා පහසුවෙන් වැඩිහිටියන් ඇසුරු කරයි.	☐	☐	☐
නොයෙකුත් බයවල් ඇත. පහසුවෙන් බියට පත්වන සුලුය.	☐	☐	☐
පටන්ගත් වැඩක් අවසානය දක්වා කරයි. හොඳ අවධානයක් ඇත.	☐	☐	☐

කිව යුතු වෙනත් කරුණු ඇත්නම් මෙහි සඳහන් කරන්න.

අනිත් පිටේ තව ප්‍රශ්ණ කීපයක් ඇත.

Scoring the Informant-Rated Strengths and Difficulties Questionnaire

The 25 items in the SDQ comprise 5 scales of 5 items each. It is usually easiest to score all 5 scales first before working out the total difficulties score. Somewhat True is always scored as 1, but the scoring of Not True and Certainly True varies with the item, as shown below scale by scale. For each of the 5 scales the score can range from 0 to 10 if all 5 items were completed. Scale score can be prorated if at least 3 items were completed.

Emotional Symptoms Scale	Not True	Somewhat True	Certainly True
Often complains of headaches, stomach-aches ...	0	1	2
Many worries, often seems worried	0	1	2
Often unhappy, downhearted or tearful	0	1	2
Nervous or clingy in new situations ...	0	1	2
Many fears, easily scared	0	1	2

Conduct Problems Scale	Not True	Somewhat True	Certainly True
Often has temper tantrums or hot tempers	0	1	2
Generally obedient, usually does what ...	2	1	0
Often fights with other children or bullies them	0	1	2
Often lies or cheats	0	1	2
Steals from home, school or elsewhere	0	1	2

Hyperactivity Scale	Not True	Somewhat True	Certainly True
Restless, overactive, cannot stay still for long	0	1	2
Constantly fidgeting or squirming	0	1	2
Easily distracted, concentration wanders	0	1	2
Thinks things out before acting	2	1	0
Sees tasks through to the end, good attention span	2	1	0

Peer Problems Scale	Not True	Somewhat True	Certainly True
Rather solitary, tends to play alone	0	1	2
Has at least one good friend	2	1	0
Generally liked by other children	2	1	0
Picked on or bullied by other children	0	1	2
Gets on better with adults than with other children	0	1	2

Prosocial Scale	Not True	Somewhat True	Certainly True
Considerate of other people's feelings	0	1	2
Shares readily with other children	0	1	2
Helpful if someone is hurt, upset of feeling ill	0	1	2
Kind to younger children	0	1	2
Often volunteers to help others	0	1	2

The Total Difficulties Score:

is generated by summing the scores from all the scales except the prosocial scale. The resultant score can range from 0 to 40 (and is counted as missing if one of the component scores is missing).

Interpreting Symptom Scores and Defining "Caseness" from Symptom Scores

Although SDQ scores can often be used as continuous variables, it is sometimes convenient to classify scores as normal, borderline and abnormal. Using the bandings shown below, an abnormal score on one or both of the total difficulties scores can be used to identify likely "cases" with mental health disorders. This is clearly only a rough-and ready method for detecting disorders – combining information from SDQ symptom and impact scores from multiple informants is better, but still far from perfect. Approximately 10% of a community sample scores in the abnormal band on any given score, with a further 10% scoring in the borderline band. The exact proportions vary according to country, age and gender – normative SDQ data are available from the web site. You may want to adjust banding and caseness criteria for these characteristics, setting the threshold higher when avoiding false positives is of paramount importance, and setting the threshold lower when avoiding false negatives is more important.

	Normal	Borderline	Abnormal
Parent Completed			
Total Difficulties Score	0 - 13	14 - 16	17 - 40
Emotional Symptoms Score	0 - 3	4	5 - 10
Conduct Problems Score	0 - 2	3	4 - 10
Hyperactivity Score	0 - 5	6	7 - 10
Peer Problems Score	0 - 2	3	4 - 10
Prosocial Behaviour Score	6 - 10	5	0 - 4
Teacher Completed			
Total Difficulties Score	0 - 11	12 - 15	16 - 40
Emotional Symptoms Score	0 - 4	5	6 - 10
Conduct Problems Score	0 - 2	3	4 - 10
Hyperactivity Score	0 - 5	6	7 - 10
Peer Problems Score	0 - 3	4	5 - 10
Prosocial Behaviour Score	6 - 10	5	0 - 4

Generating and Interpreting Impact Scores

When using a version of the SDQ that includes an "Impact Supplement", the items on overall distress and social impairment can be summed to generate an impact score that ranges from 0 to 10 for the parent-completed version and from 0-6 for the teacher-completed version.

	Not at all	Only a little	Quite a lot	A great deal
Parent report				
Difficulties upset or distress child	0	0	1	2
Interfere with HOME LIFE	0	0	1	2
Interfere with FRIENDSHIPS	0	0	1	2
Interfere with CLASSROOM LEARNING	0	0	1	2
Interfere with LEISURE ACTIVITIES	0	0	1	2
Teacher report				
Difficulties upset or distress child	0	0	1	2
Interfere with PEER RELATIONSHIPS	0	0	1	2
Interfere with CLASSROOM LEARNING	0	0	1	2

Responses to the questions on chronicity and burden to others are not included in the impact score. When respondents have answered "no" to the first question on the impact supplement (i.e. when they do not perceive the child as having any emotional or behavioural difficulties), they are not asked to complete the questions on resultant distress or impairment; the impact score is automatically scored zero in these circumstances.

Although the impact scores can be used as continuous variables, it is sometimes convenient to classify them as normal, borderline or abnormal: a total impact score of 2 or more is abnormal; a score of 1 is borderline; and a score of 0 is normal.

Annex XXVIII A

Learning difficulty among primary school children in grade 3 and grade 4 in the district of Kalutara – Risk Factor Questionnaire for mothers

Serial Number: | | | | |

Date of interview

D		M		Y			

Name of the interviewer.....

Identification and contact information

1.1 Name of the child				
1.2 Name of the school				
1.3 Grade of child	1. Grade 3		2. Grade 4	
1.4 Address of residence				
1.5 Please mention contact number of mother/ father/ caretaker if any				

1. Maternal and perinatal factors

1.1 Did you have a period of subfertility prior to the pregnancy of this child?	1. Yes		2. No	
If yes go to Q 1.4, if no Q 1.2				
1.2 How many times have you been pregnant prior to this pregnancy?				
1.3 What were the outcomes of those pregnancies?	1. Live birth		3. Intra uterine deaths	
	2. Abortions		4. Ectopic pregnancy	
1.4 Please mention whether you have planned this pregnancy or not				
1.5 What was your age at the time of delivery of this child?				
1.6 What was your marital status at the time of delivery?	1. Married		4. Separated	
	2. Unmarried		5. Widowed	
	3. Divorced		6. Other	
1.7 What type of pregnancy did you have with this child?	1. Single			
	2. Twin			
	3. Other			
1.8 Did you have any illness during the pregnancy period of this child?	1. Yes		2. No	
	If No go to Q1.11			

1.9 Name those illness/es (check with pregnancy records)	1. Increases blood pressure		5. Thyroid hormone disorder	
	2. Diabetes		6. Anaemia	
	3. Heart disease		7. Other	
	4. Low BMI			

1.10 Have you exposed to any substance like tobacco, alcohol or drugs during pregnancy?	1. Yes		2. No	
	If No go to Q 1.13			

1.11 what was/ were the substance/s and the frequency of exposure

Substance/es	**Frequency of exposure**			
	Daily	2-3 time/ week	Once a week	Less than once a week
Tobacco				
Alcohol				
Narcotic drugs (heroin)				
Other				

1.12 Did some one hit, slapped, kicked, or otherwise physically hurt you while you were pregnant?

	1.Yes		2.No	
1.13 If yes, by whom				

1.14 Are you in a state to remind your psychological status during pregnancy?

	1.Yes		2.No	

If Yes go to Q 1.15, If No go to Q 1.16

1.15 If yes, please answer for following statements

Statement related to pregnancy	Highly agree	Agree	Moderate	Disagree	Highly disgree
I spent the days very happily and peacefully					
I received love and care form my husband					
I received lot of support from the family					
I received adequate food and nutrition					
I did not experience any trauma that hurt me a lot					

1.16 Have you received any sort of mental health services during the pregnancy period of this child?

	1. Yes		2.No	

1.17 What was the mode of delivery of this child?	1. Normal vaginal delivery		3. Emergency caesarian section	
	2. Assisted vaginal delivery (forceps/		4. Elective caesarian section	

If only vaginal delivery go to Q 1.18				
1.18 What was the presenting part at the time of delivery of this child?	1. Head			
	2. Breech			
	3. Other			
1.19 What was the period of gestation at the time of delivery of this child? (check with records)				
1.20 What was the birth weight of this child? (check with records)				
1.21 Apgar score (if mentioned in the CHDR) at 5min				
1.22 Did this child have any of following complications during delivery? (check with records)				
	1. Birth trauma		3. Fetal distress	
	2. Meconium aspiration			
1.23 Did this child have any of following neonatal complications? (check with records)				
	1. Jaundice <24 hours		4. Hypoglycaemia	
	2. Jaundice> 24 hours		5. Neonatal	
	3. Feeding difficulty		6. Neonatal Sepsis	
1.24 Was the newborn admitted to the Premature Baby Unit (PBU)?				
	Yes		No	
	If No go to Q 2			
1.25 If yes, how many days				

2. Infancy related and developmental factors

2.1. Did the child experience any of the following conditions during infancy that needed special care? (CHDR/Diagnosis cards)				
Type of condition/s	**Presence of the condition**			
Congenital malformation	1. Yes		2. No	
Critical illness of mother after partum	1. Yes		2. No	
Formula feed during first four months	1. Yes		2. No	
Failure to thrive	1. Yes		2. No	
Meningitis	1. Yes		2. No	
Febrile/non-febrile fits	1. Yes		2. No	
Feeding problems	1. Yes		2. No	
Death of father	1. Yes		2. No	
Separation of mother /father	1. Yes		2. No	
Anaemia	1. Yes		2. No	
Thyroid hormone disease	1. Yes		2. No	
Exposure to general anesthesia	1. Yes		2. No	

2.2 Did the child has any of the following developmental delays or abnormalities? (check with records if available)				
Developmental milestone	**Presence of delay or abnormality**			
Delayed or abnormal crawling	1. Yes		2. No	
Delayed or abnormal walking	1. Yes		2. No	
Delayed or abnormal speech	1. Yes		2. No	

3. Early childhood and childhood related factors

3.1 Did the child suffer from following illnesses or experience following events during early childhood?				
Illness/ Event	**Presence of**			
Febrile fits	1. Yes		2. No	
Non febrile fits	1. Yes		2. No	
Recurrent otitis media (ear infections)with effusion	1. Yes		2. No	
Head injury which needed special care	1. Yes		2. No	
Exposure to anesthesia/ surgery	1. Yes		2. No	

3.2 Indicate whether the child has received any of following special health care during early child hood				
Type of special health care	**Received/not**			
Recurrent hospital admission (at least once a month)	1. Yes		2. No	
Regular clinic visits	1. Yes		2. No	
Long term medication use	1. Yes		2. No	
Use of mental health services at any time in life	1. Yes		2. No	

3.3 Who was the principal care giver during early childhood? (1-5years)	

3.4 Did the child experience any of following stressful life events during early childhood period?				
Type of stressful life event	**Experienced/not**			
Frequent change of care arrangement of the child	1. Yes		2. No	
Change of marital status of father/ mother	1. Yes		2. No	
Any one close to the child passed away	1. Yes		2. No	
Anyone close to child suffer accident- illness	1. Yes		2. No	
Imprisonment of mother/ father	1. Yes		2. No	
Unexpected loss of job by father or	1. Yes		2. No	
mother sudden household financial change	1. Yes		2. No	

3.5 Please state whether the child showed following symptoms related to allergic rhinitis during this period					
Symptom	**Never**	**Rarely**	**Sometimes**	**Often**	**Always**
Watery runny nose					
Itching of nose and ears					

Nasal obstruction					
Sneezing violent/ in bouts					
Red itchy eyes					
3.6 Please state whether the child showed following symptoms related to sleep disorder during this period					
Symptom	**Never**	**Rarely**	**Sometimes**	**Often**	**Always**
Mouth breathing					
Nose block					
Enuresis (Passing urine)					
Snoring					
3.7 At what age did the child first start preschool?					
3.8 What is the dominant hand of the child? The hand that the child is using for writing?					
	1. Left		2. Right		

4. Family related factors

4.1 Except you, your husband and your children are there any other members residing with you in the same household					
	1. Yes		2. No		
4.2 What is your family structure?	1. Two parent other than step family		Other (specify)		
	2. Two parent step father				
	3. Single mother, no father				
4.3 Please provide following information about siblings of this child					
Sibling	1st	2nd	3rd	4th	5th
Age					
4.4 Did any of your family members (father, mother or sibling) ever suffer from any type of learning difficulty ?(reading, writing, math)					
	Yes		No		

5. Home physical environment

5.1 Please mention the total number members living in your house				
5.2 Does the father of the child smoke?	1. Yes		2. No	
	Go to Q 5.3		Go to Q 5.5	
5.3 How long has he been smoking?				

5.4 Please mention the amount he smokes per day	1. Less than a packet		3. More than one packet	
	2. One packet		4. Other	
5.5 Does the father of the child consume alcohol?	1. Yes		2. No	
	Go to Q 5.6		Go to Q 5.8	
5.6 How long has he been taking alcohol?				
5.7 What is the frequency of consumption?	1. Daily		3. Once a week	
	2. Several times a week but not daily		4. monthly	
			5. Occasionally	
5.8 Does the father of the child use hard drugs like heroin?	1. Yes		2. No	
	Go to Q 5.9		Go to Q 5.11	
5.9 How long has he been taking drugs?				
5.10 what is the frequency of use?	1. Daily		3. Other	
	2. Several time a week			
5.11 Does any sibling living in the house holds having any of following disabilities that needs special care?				
	1. Mental retardation		3.Hyperaticity	
	2. Autism		4. Other	

5.12 When there is a disagreement among your family members how do you act/ behave?

	Never	Rarely	Sometime	Usually	Always
Discuss your disagreements calmly					
Argue heatedly or shout					
End up hitting or throwing things					

5.13 Are you handling pesticides or insecticides/ storing pesticides or insecticides inside the house?

	1. Yes		2. No	

Annex XXVIII B

පෞද්ගලිකයි රහසිගතයි

කළුතර දිස්ත්‍රික්කයේ ප්‍රාථමික අංශයේ පාසැල් දරුවන්ගේ ඉගෙනීමේ ගැටළු පිළිබඳ සමීක්ෂණය - අවදානම් සාධක පිළිබඳ මව්වරුන් ප්‍රශ්නාවලිය සඳහා වූ ප්‍රශ්නාවලිය

අනු අංකය

සම්මුඛ පරීක්ෂණය කළ දිනය

දි	මා	ව			

සම්මුඛ පරීක්ෂකගේ නම.....

හඳුනාගැනීමේ හා සම්බන්ධ කරගැනීමේ තොරතුරු

1.1දරුවාගේ නම		
1.2 දරුවාගේ පාසැල		
1.2දරුවාගෙ පන්තිය	1.3ශ්‍රේණිය	2. 4 ශ්‍රේණිය
1.3නිවසේ ලිපිනය		
1.4මවගේ / පියාගේ/රැකබලාගන්නාගේදුරකථන අංකය		

1. මාතෘ හා පෙරප්‍රසව ප්‍රසව හා පශ්චාත්ප්‍රසව තොරතුරු

1.1 මෙම දරුවාගේ ගැබ් ගැනීමට ප්‍රථම ඔබ මදසරු/ වඳ භාවයකින් පෙළුනේද?	1. ඔව්		2. නැත	
පිළිතුර ඔව් නම් ප්‍රශ්න අංක 1.4ට නැත නම් ප්‍රශ්න අංක 1.2 ට යන්න				
1.2 මෙයට පෙර ඔබ කී වාරයක් ගර්භනීව සිටියාද?				
1.3 එම ගර්භනීභාව වල ප්‍රතිඵලය කුමක් විද?	1. ජීව් දරු උපත්		3. මළදරු උපත්	
	2. ගබ්සාවීම්		4. ගර්භාශයෙන් පිටත පිළිසිඳ ගැනීමක්	
1.4 කරුණාකරමෙම ගර්භනී තත්වය ඔබ සැළකුම් කළ එකක්දැයි සඳහන් කරන්න				
1.5මෙම දරු ප්‍රසූතියද්දී ඔබගේ (මවගේ) වයස කොපමණද?				
1.6මෙම දරු ප්‍රසූතිය වනවිට ඔබගේ විවාහක/ අවිවාහක තත්වය කුමක්දැයි සඳහන් කරන්න	1. විවාහක		4. වෙන්ව සිටින	
	2. අවිවාහක		5. වැන්දඹු	
	3. දික්කසාද		6. වෙනත් (සඳහන් කරන්න)	

1.7මෙම දරුවාගේ ගර්භනීභාවයේ ස්වභාවයකුමක්ද?	2. නිවුන් දරු		
	3. වෙනත්		

1.8මෙම දරුවාගේගර්භනී කාලය තුළ ඔබ කිසියම් රෝගී තත්වයකින් පෙළුනේද?	1. ඔව්		2. නැත	
	පිළිතුර ඔව් නම් ප්‍ර: අංක 1.9 වෙත යන්න. නැත නම් ප්‍ර: අංක 1.11වෙත යන්න			
1.9එම රෝගී තත්වයන් මොනවාද (ගර්භනී සටහන්පත සමග සංසන්දනය කරන්න)	1. රුධිර පීඩනය ඉහළ යෑම		5.ගලගණ්ඩය	
	2. දියවැඩියාව		6. ලේ අඩුකම (රක්තහීනතාවය)	
	3. හෘද රෝග		7. වෙනත් (සඳහන් කරන්න)	
	4. ශරීර ස්කන්ධ දර්ශකය අඩුවීම			

1.10මෙම දරුවාගේ ගර්භනී කාලය තුළ ඔබ දුම්පානය, මත්පැන් හෝ මත්ද්‍රව්‍ය වැනි ද්‍රව්‍ය ගනු ලැබුවේද	1. ඔව්		2. නැත	
	පිළිතුර ඔව් නම් ප්‍ර: අංක 1.12 වෙත යන්න. නැත නම් ප්‍ර: අංක 1.13 වෙත යන්න			

1.11එම ද්‍රව්‍යය/ද්‍රව්‍යයන්මොනවාද? එය ලබා ගත්වාර ගණන කොපමණද

ද්‍රව්‍යය/ද්‍රව්‍යයන්	වාර ගණන			
	දිනපතා	සතියකට වාර 2-3 දක්වා	සතියකට වරක්	සතියකට වරකට වඩා අඩු වාර ගණනක්
දුම්පානය				
මත්පැන් පානය				
මත්ද්‍රව්‍ය/ මත්කුඩු භාවිතය				
වෙනත්				

1.12මෙම දරුවාගේ ගර්භනී කාලය තුළ කිසියම් කෙනෙක් ඔබට නිතර ගුට බැමක්/ කම්මුල් පහර දීමක් හෝ පයින් පහර දීමක් කර තිබේද?

	1. ඔව්		2. නැත	

1.13පිළිතුර ඔව් නම් එය කවුරුන් විසින් සිදුකරනු ලැබුවේද

1.14මෙම දරුවාගේ ගර්භනී කාලය තුළ ඔබගේ මානසික තත්වය ගැන සිහිපත් කළ හැකි තත්වයක ඔබ පසුවේද?

	1. ඔව්		2. නැත	

පිළිතුර ඔව් නම් ප්‍ර: අංක 1.15වෙත යන්න. නැත නම් ප්‍ර: අංක 1.16වෙත යන්න

1.15 මානසික තත්වය	තදින් එකඟ වෙමි	එකඟ වෙමි	මධ්‍යස්ථයි	එකඟ නොවෙමි	තදින් එකඟ වෙමි
1. මෙම දරුවාගේ ගර්භනී කාලය මම ඉතා සතුටින් හා සාමයෙන් ගත කළෙමි					

2. මෙම කාලය තුළ මට සැමියාගෙන් මහත් සහයෝගයක් හා ආදරය ලැබුණි					
3. මෙම කාලය තුළ මට පවුලේ සාමාජිකයන්ගෙන් මහත් සහයෝගයක් ලැබුණි					
4. මෙම කාලය තුළ මට ප්‍රමාණවත් ආහාර හා පෝෂණය ලැබුණි					
5. මෙම කාලය තුළ කිසිදු සිත් පීඩා ගෙන දෙන සිදුවීමක් සිදුනොවුණි					

1.16මෙම දරුවාගේ ගර්භනී කාලය තුළ ඔබ කිසියම් මානසික සෞඛ්‍ය සේවාවක් ලබා ගත්තෙද?

	1. ඔව්		3. නැත

1.17මෙම දරුවාගේ ප්‍රසූතියේ ස්වභාවය කුමක්ද?	1. සාමාන්‍ය දරු උපතක්		2. අඩු දැමීමක් හෝ vacuum කිරීමක්	
	3. හදිසි සිසේරියන් සැත්කම		4. සැලැසුම් කළ සිසේරියන් සැත්කමක්	

සාමාන්‍ය දරු උපතක් නම් පමණක් ප්‍රශ්න අංක 1.18වෙත යන්න

1.18මෙම දරුවාගේ ප්‍රසූතියේදී ප්‍රථමයෙන් පැමිණි කොටස (ප්‍රමුඛ කොටස)කුමක්ද? (වාර්තා සමග සංසන්දනය කරන්න)What was	1. හිස		
	2. තට්ටම		
	3. වෙනත් කොටසක්		

1.19මෙම දරුවා ප්‍රසූත කරන විට සම්පූර්ණ ගර්භනී කාලය කොපමණද?(වාර්තා සමග සංසන්දනය කරන්න)	
1.20මෙම දරුවාගේ උපත් බර කොපමණද? (වාර්තා සමග සංසන්දනය කරන්න)	
1.21මිනිත්තු 5දී ඇප්ගා සංඛ්‍යාව(දරුවාගේ සෞඛ්‍ය වර්ධක සටහනෙහි සඳහන් කර ඇත් නම් පමණක් සඳහන් කරන්න)	

1.22දරු ප්‍රසූතියේදීපහත සඳහන් ගැටළු කිසිවක් පෙන්නුම් කළේද? (වාර්තා සමග සංසන්දනය කරන්න)

	1. .උපත් අනතුරු ඇතිවීම		3. ශ්වසන අපහසුතා ඇතිවීම	
	2. අසූචි පෙවී තිබීම (meconium aspiration)			

1.23මෙම දරුවා ඉපදෙන විට හෝ ඉපදී මසක් ඇතුළත බළිඳා පහත ගැටළු කිසිවක් පෙන්නුම් කළේද(වාර්තා සමග සංසන්දනය කරන්න)

	1. ඉපදී පැය 24ක් ඇතුළත ශරීරය කහ වීම		4. රුධිර සීනි ප්‍රමාණය අඩු වීම	
	2. ඉපදී පැය 24කට පසුව ශරීරය කහ වීම		5. මොළේ උණ තත්වයක් ඇති වීම	
	3. මව්කිරි දීමේ අපහසුතා ඇතිවීම		6. විශබජ ශරීර ගත වීම	

1.24අළුත උපන් දරුවා නොමේරූ ළදරු ඒකකයට ඇතුලත් කරනු ලැබුවාද?				
	1. ඔව්		2. නැත	
	පිළිතුර ඔව් නම් ප්‍ර: අංක 1.26 වෙත යන්න. නැත නම් ප්‍ර: අංක 2වෙත යන්න			
1.25දින කීයක් එයේ නේවාසිකව සිටියාද?				

2. ළදරු කාලය හා සංවර්ධනය පිළිබඳ තොරතුරු

2.1ළදරු කාලය ඇතුළත දරුවා පහත සඳහන් විශේෂයෙන් රැකබලාගැනීමට හේතු වන තත්ව වලට මුහුණ දුන්නේද? (දරුවාගේ සෞඛ්‍ය වර්ධක සටහන හා රෝග විනිශ්චය පත් සමග සංසන්දනය කරන්න)			
තත්වය/තත්ව	ඇති/නැති බව		
සංජානනීය (උපතින්ම ඇතිවූ) ආබාධ	1. ඔව්	2. නැත	
ප්‍රසූතියෙන් පසු මවගේ තදබල රෝගී තත්වයක්	1. ඔව්	2. නැත	
පළමු මාස 4 තුළදී පිටකිරි දීම	1.ඔව්	2.නැත	
වර්ධනය ඉතා අඩාල වීම	1. ඔව්	2. නැත	
මොළේ උණ තත්වයක් ඇතිවීම	1. ඔව්	2. නැත	
උණ සහිත හෝ රහිත වලිප්පු තත්වයක් ඇති වීම	1 ඔව්	2 නැත	
මව්කිරි/ ආහාර දීමේ- අපහසුතා	1. ඔව්	2. නැත	
පියාගේ මරණය	1 ඔව්	2 නැත	
මවගේ/ පියාගේ වෙන්වීම/ විදේශගත වීම	1 ඔව්	2.නැත	
ලේ අඩුකම	1.ඔව්	2 නැත	
තයිරොයිඩ් ග්‍රන්ථියේ ක්‍රියාකාරිත්වයේ සම්බන්ධ රෝග තත්වයක් ඇතිවීම	1 ඔව්	2 නැත	
නිර්වින්දනය කර (සිහි නැති කොට) ශල්‍යකර්මවලට භාජනය කිරීම	1. ඔව්	2. නැත	

2.2 දරුවා හට පහත සඳහන් සංවර්ධනයේඅඩාලවීම් හෝ අසාමාන්‍යතාවයන් කිසිවක් තිබුණේද? වාර්තා ඇතිනම් පමණක් සංසන්දනය කරන්න				
සංවර්ධන අවස්ථාව	අඩාලවීම් හෝ අසාමාන්‍යතාවයන් තිබීම/ නොතිබීම			
දැණ ගැසීමේදී ප්‍රමාද/ අසාමාන්‍යතා	1. ඔව්		2. නැත	
ඇවිදීමේදී ප්‍රමාද/ අසාමාන්‍යතා	1. ඔව්		2. නැත	
කතාකිරීමේදී ප්‍රමාද/ අසාමාන්‍යතා	1. ඔව්		2. නැත	

3. පූර්ව ළමාවය / ළමාවය ආශ්‍රිත කරුණු

3.1 පූර්වළමාවයේදී (වයස අවුරුදු 1-5 දක්වා) මෙම දරුවා පහත රෝගී තත්වයකින් පෙළුනේද/ පහත තත්වයන්ට මුහුණ පෑවේද?				
රෝගී තත්වය/ තත්ව	තිබීම/නොතිබීම			
උණ වලිප්පුව	1. ඔව්		2. නැත	
උණ රහිත වලිප්පු තත්වයක්	1. ඔව්		2. නැත	
නිතර කන පැසවීම හා සැරව ගැලීම	1. ඔව්		2. නැත	
විශේෂ ප්‍රතිකාර අවශ්‍ය වන ආකාරයේ හිසට හදිසි අනතුරක්/ තුවාල වීමක් සිදුවීම	1. ඔව්		2. නැත	
නිර්වින්දනය කර (සිහි නැති කොට) ශල්‍යකර්මවලට භාජනය කිරීම	1. ඔව්		2. නැත	

3.2පූර්වළමාවය ඇතුළත (වයස අවුරුදු 1-5 දක්වා) දරුවා පහත සඳහන් විශේෂ සෞඛ්‍ය සේවාවන් කිසිවක් ලබා ගත්තේද?				
විශේෂ සෞඛ්‍ය සේවාව	ලබා ගත/ නොගත් බව			
1. නිතර රෝහල් ගතකිරීම් (මසකට වරක්වත්)	1. ඔව්		2. නැත	
2. නොකඩවා සායන සේවාවන් ලබාගැනීම	1. ඔව්		2. නැත	
3. දිගුකාලීනව ඖෂධ ලබාගැනීම	1. ඔව්		2. නැත	
4. මානසික සෞඛ්‍ය සේවාවන් ලබාගැනීම	1. ඔව්		2. නැත	

3.3පූර්වළමාවයේදී (වයස අවුරුදු 1-5 දක්වා) මෙම දරුවාගේ ප්‍රධාන රැකබලාගන්නා කවුරුන්ද?	

3.4පූර්වළමාවය ඇතුළත දරුවා පහත දැක්වෙන සිත් පීඩා ගෙනදෙන ජීවන සිදුවීම් වලට මුහුණ දුන්නේද?				
ජීවන සිදුවීම	මුහුණ දුන්/ නුදුන් බව			
දරුවාරැකබලා ගන්නා පිළිවෙල/ පුද්ගලයා නිතර වෙනස් වීම	ඔව්		නැත	
ඔවගේ හෝ පියාගේ විවාහක තත්ව වෙනස් වීම (වෙන්වීම/	ඔව්		නැත	
දරුවාට සමීප පවුලේ අයෙකුගේ මරණය	ඔව්		නැත	
දරුවාට සමීප පවුලේ අයෙකුට බරපතල රෝගයක් හෝ	ඔව්		නැත	
ඔව/ පියා සිරගත වීම	ඔව්		නැත	
බලාපොරොත්තු නොවූ අයුරින් මවගේ හෝ පියාගේ රැකියාව අහිමි වීම/ ආර්ථික දුෂ්කරතා ඇතිවීම	ඔව්		නැත	

3.5 මෙම කාලය තුළදරුවා පහත රෝග ලක්ෂණ කිසිවක් පෙන්නුම් කළේ දැයි සඳහන් කරන්න

රෝග ලක්ෂණය	කිසිසේත නැත	කලාතුරකින්	සමහරවිට	බොහෝවිට	සැමවිටම
නාසයෙන් සොටුදියර ගැලීම					
ඇස් හා කන් කැසීම					
නාසය හිරවීම					
තදින් කිවසුම් යෑම					
ඇස් කැසීම හා රතු වීම					

3.6 මෙම කාලය තුළදරුවා නින්ද හා සම්බන්ධ පහත රෝග ලක්ෂණ කිසිවක් පෙන්නුම් කළේ දැයි සඳහන් කරන්න

රෝග ලක්ෂණය	කිසිසේත නැත	කලාතුරකින්	සමහරවිට	බොහෝවිට	සැමවිටම
හුස්ම ගැනීමේ අපහසුතාවයන් නිසා කටින් හුස්ම ගැනීම					
නාසය හිරවීම					
නින්දෙන් මුත්‍රා පහවීම					
ගෙරවීම					

3.7දරුවා පෙර පාසැල් යෑම ආරම්භ කළේ කුමන වයසේද?
3.8 මෙමදරුවා ලිවීම ඇතුළු ප්‍රධාන වැඩ කටයුතු කිරීමට නිතර භාවිතා කරන්නේ කුමන අතද?

	1. වම		2. දකුණ	

4. පවුල සම්බන්ධ තොරතුරු

4.1 ඔබ, ඔබේ ස්වාමි පුරුෂයා හා දරුවන් හැර වෙන කිසිවෙක් ඔබේ නිවසේ සිටිද?				
	1. ඔව		2. නැත	
4.2 ඔබගේ පවුලේ (මෙම දරුවා අයත)ස්වභාවය කෙබඳුද?	1. පළමු විවාහයේ දෙමව්පියන් සිටින පවුලක්		අනික් (සඳහන් කරන්න)	
	2. මව හා සුළු පියා සිටින පවුලක් (දෙවන විවාහයකින් පසු)			
	3. මව පමණක් සිටින පවුලක්			

4.3මෙම දරුවාගේ සහෝදර සහෝදරියන් ගැන පහත තොරතුරු කරුණාකර ලබාදෙන්න					
සහෝදරයා/ සහෝදරිය්	1, 1වෙනි	2, 2 වෙනි	3. 3 වෙනි	4. 4 වෙනි	5. 5 වෙනි
වයස					

4.4ඔබේ පවුලේ කිසියම් කෙනෙකු (මව/පියා/සහෝදර සහෝදරියන්) කවදා හෝ කිසියම් (කියවීම/ලිවීම/ගණිතය)ඉගෙනීමේ දුර්වලතාවකින් පෙළුනේද?				
	1. ඔව		2. නැත	

5. නිවසේ පරිසරය සම්බන්ධ තොරතුරු

5.1කරුණාකරඔබේ නිවසේ සිටින මුළු සාමාජිකයින් ගණන කියදැයි සඳහන් කරන්න				
5.2 දරුවාගේ පියා දුම් පානය කරනවාද?	1.ඔව්		2.නැත	
	පිළිතුර ඔව් නම් ප්‍ර: අංක 5.3වෙත යන්න. නැත නම් ප්‍ර: අංක 5.5වෙත යන්න			
5.3කොපමන කාලයක් තිසයේ ඔහු දුම් පානය කරන්නේද?				
5.4එසේදුම පානය කරනවාර ගණන කොපමණද?	1.දිනකට පැකට්ටුවට වඩා අඩු ප්‍රමාණයක්		2.දිනකට පැකට්ටුවට වඩා වැඩි ප්‍රමාණයක්	
	3.දිනකට පැකට්ටුවක්		4.වෙනත් (සඳහන්	
5.5දරුවාගේ පියා මත්පැන් පානය කරනවාද?	1.ඔව්		2.නැත	
	පිළිතුර ඔව් නම් ප්‍ර: අංක 5.6 වෙත යන්න. නැත නම් ප්‍ර: අංක 5.8වෙත යන්න			
5.6 කොපමන කාලයක් තිසයේ ඔහු මත්පැන් පානය කරන්නේද?				
5.7එසේ මත්පැන් පානය කරන/ කළවාර ගණන කොපමණද?	1.දිනපතා		3. සතියකට වරක්	
	2.සතියකට කීප වතාවක් නමුත් දිනපතා නොවේ		4. මාසෙකට වරක්	
			5. කලාතුරකින්	

5.8දරුවාගේ පියා හෙරොයින් වැනි මත්කුඩු භාවිතා කරනවාද?	1.ඔව්		2.නැත	
	පිළිතුර ඔව් නම් ප්‍රශ්න අංක 5.9 වෙත යන්න. නැත නම් ප්‍රශ්න අංක 5.11වෙත යන්න			
5.9කොපමන කාලයක් තිසයේ ඔහු මත්කුඩු භාවිතා කරනවාද?				
5.10එසේමත්කුඩු භාවිතා කරන/ කළවාර ගණන කොපමණද?	1.දිනපතා		3.මාසෙකට වරක්	
	2.සතියකට කීප වතාවක් නමුත් දිනපතා නොවේ		4.වෙනත් (සඳහන් කරන්න)	
	1.ඔව්		2.නැත	
5.11දරුවාගේ සහෝදර සහෝදරියන් කිසිවෙක් විශේෂ අවධානයක් අවශ්‍ය වන පහත දුබලතාවකින් පෙළේද?				
	1.මන්ද මානසිකත්වය		2.අධික්‍රියාකාරීත්වය	
	3. ඔටිසම්		4.වෙනත් (සඳහන්	
5.12ඔබේ පවුලේ සාමාජිකයන් සමග තදබල එකඟ නොවීමක් පැමිණි විට ඔබ හැසිරෙන්නේ කෙසේදැයි සඳහන් කරන්න				

	1.කවදාවත් නැත	2.කලාතුර කින්	3.සමහර විට	4.බොහෝ විට	5.සැමවිටම
ඔබගේ එකඟ නොවීමක් නිශ්ශබ්දව සාකච්ඡා කිරීම					
උණුසුම්ව තර්ක කිරීම හෝ කෑගෝ ගැසීම					
පහර දීම් වලින් හෝ බඩු විසිකරීමෙන් කෙළවර වීම					

5.13ඔබ වල්නාශක හෝ කෘමිනාශක සමග වැඩ කිරීමක් හෝ වල්නාශක හෝ කෘමිනාශකඔබගේ නිවසේගබඩා කිරීමක් සිදුකරන්නේද				
	1.ඔව්		2.නැත	

Annex XXIX

Interviewer guide – Risk Factor Questionnaire

General instructions for administering the questionnaire

- Make a convenient place where privacy can be maintained after discussing with the school authorities.
- Building a **good rapport** is very important to obtain reliable information. Greet the parents who were presented and introduce you. Explain the objective of the data collection and reconfirm that they have given the consent. Explain further that this study won't pose any harm to their children and it will be a benefit for lot of children.
- Some individuals might pose more questions than others. Patiently give them all the information necessary and proceed calmly.
- Doubts can be clarified with PI, as PI is available in the field and will pay on off supervision visit while the data collection is going on.
- When repeating a question, do not change the wording and content of the question.
- When a question is to be skipped, follow the instructions given in the questionnaire very carefully. eg: if yes, go to Q : 3.2. This means that if the answer is yes the next question to be asked is 3.2.
- Nature of the questionnaire: This is an interviewer administered questionnaire. Therefore questions should be asked without an influence to get an answer. First read the question without the responses and try to get an answer. Then read it again with the responses and identify the relevant response category.
- For open ended questions like income and occupation write the answer clearly in the space provided.
- For close ended questions, the possible responses are given in the boxes provided and mark (X) for the response given.
- When the respondent's answer is not fall in to any category, mark the "other" box and write the answer clearly and briefly in the space provided.
- It is your responsibility to check all the answers have been answered correctly and check for completeness of the questionnaire at the end of the interview.

- Ending the interview is as important as the initiation. Some of these mothers may need to be contacted again for the second part of the study. It is your responsibility to thank all the respondents during the session of winding up. Thank all the class teachers at the end of interviewing the whole class.

Specific instructions for administering the questionnaire

2. **Risk Factor questionnaire**
   Compare with the demographic and socio economic IAQ. Re check the identification and contact information mentioned in the demographic and socio economic IAQ and verify the child. Always keep RFQ attached to demographic and socio economic IAQ. Proceed in order according to the questionnaire.

2. **Maternal and perinatal factors**

   3.4 Prior to this pregnancy was she unable to get conceived for a period though she wanted a child? If so, how long was that subfertility period?

   3.5 If there is no sub fertile period, how many time has she got pregnant?

   3.6 Explain different outcomes of pregnancy and inquire what happened to her previous pregnancies.

   3.7 Ask whether they have planned the pregnancy of this child or it was an unintended one.

   3.8 How old was the mother at the time of delivery of this child. If pregnancy record available check in that. If ID is available get the date of birth and recheck with the date of birth mentioned in the demographic and socioeconomic IAQ.

   3.9 As this is sensitive and a personal questions, inquire some details about the pregnancy of this child get friendly and inquire her marital status during the pregnancy of this child.

   3.10 Has she got this pregnancy as a single or twin pregnancy? Recheck with pregnancy records.

   3.11 Did have any illnesses during pregnancy that needed special care

   3.12 If yes, what are the illnesses? Check with available records.

3.13 Has she taken any type of medication throughout the pregnancy other than the vitamin pills.

3.14 During the pregnancy of this child did she take any substances (mentioned in the questionnaire) which can harm the pregnancy? (Ask this question with caution that it is rare in our culture)

3.15 Mentioned the substance that was used,

3.16 Did anybody physically abuse her (hit/slap/kick) her during the pregnancy of this child. This is a very sensitive question and asks after building a good rapport.

3.17 If yes, by whom?

3.18 Ask whether she can remember the pregnancy period of this child. If she says yes go to Q. 1.18.

3.19 Read each statement and get the answer accordingly. Give explanations where necessary. Check the agreement of the mother with each sentence given.

3.20 Did she go to a mental health clinic or to a doctor handling mental health problems or to a counselor with a psychological problem to get advice/opinion/service/ treatment?

3.21 What was the mode of delivery for this child? Check with records. Explain each type and get the answer.

3.22 If that is a normal vaginal delivery, what was the presenting part.

3.23 Whiter this child was a term baby. If not check the exact period of gestation.

3.24 Check the birth weight mentioned in the CHDR/ inquire from mother

3.25 If the Apgar score at 5min is mentioned, record this.

3.26 Ask the mother whether the child had any delivery complications. Explain the mother. It is more valid if you can obtain it from diagnosis cards. If a diagnosis card is not available, tick the space given for "no".

3.27 Explain each neonatal complication and inquire whether the child had this. Check with the records

3.28 Ask whether the child was admitted in a baby unit after birth.

3.29 If yes what was the period of stay?

4. **Infancy related and developmental factors.**

4.1 Explain each and every condition mentioned in the questionnaire related to infancy and ask whether the child had those problems. Mothers are aware about most of the conditions mentioned in the questionnaire. Always recheck with the available record. For the conditions anemia, thyroid hormone diseases, failure to thrive, meningitis, if it is not mentioned in a diagnosis card or CHDR mark the space "no".

4.2 Inquire about the motor development and speech development.

Whether the child had delay in crawling or abnormal crawling compared to similar age children or compared to the other children in the family.

Whether the child had delay in walking or abnormal walking compared to similar age children or compared to the other children in the family.

Whether the child had delay in speech development or abnormal speech compared to similar age children or compared to the other children in the family.

5. **Early childhood related factors (Age period 1-5 years)**

5.1 Ask whether the child suffered from any illnesses mentioned in the RFQ.

Febrile and non- febrile fits

Whether the child had episodes of fits when he or she gets fever

Did the child experience one or more episodes of fits without having fever? For both conditions check available records, clinic books and diagnosis cards.

Recurrent ear infections

Ask whether the child got recurrent ear discharge, ear ache, which needs treatment. Check with the diagnosis cards if available

Head injury

Inquire whether the child had a fall or head injury that needed hospitalization.

Exposure to anesthesia

Ask whether during the age of 1-5years the child underwent any type of major surgery.

5.2 Read the types of special health care one by one and ask the mother whether the child had received the type of services mentioned in the questionnaire. Explain where relevant.

5.3 During the period of 1-5years, who looked after the child? Who took the responsibility of daily caring and rearing of the child? Whether mother was in abroad. If mother was working was it full time outside the house?

5.4 Life events. – Ask from the mother whether the child has experienced any of life events mentioned during early childhood.

5.5 Read the symptoms of allergic rhinitis and ask the mother whether the child experienced any of those symptoms during early childhood. If yes, rate the frequency of symptoms accordingly.

5.6 Ask about the sleep pattern of the child during early childhood.

5.7 Inquire the mother at what age did the child start pre schooling.

5.8 What is the dominant hand of the child? Which hand does the child use for eating and writing and other main activities?

6. Family related factors

6.1 Are there any other members apart from the on family living in the same house? If the response is no it is a nuclear family. If there are other members it is an extended family.

6.2 Give an idea about the family structure. Whether the father is own/step farther. If step farther mark the space 2. Inquire whether it is a single mother family.

6.3 Ask the information about siblings. Age of the sibling.

6.4 Family history of LD. Ask whether any member ever suffered from reading, writing or math learning problems.

7. Home physical environment

7.1 How many members are there in your house?

7.2 Is the father of the child smoking

7.3 Average duration of smoking

7.4 The amount he smokes per day

7.5 Whether the child's father is taking alcohol?

7.6 Duration (average)

7.7 Frequency – if only taking during parties mention as occasional

7.8 Whether the child's father is taking hard drugs

7.9 Duration (average)

7.10 Frequency

7.11 Any person living with the child taking treatment for psychiatric illnesses.

7.12 Ask whether any sibling having any type of physical disabilities (congenital/acquired) that needs special care.

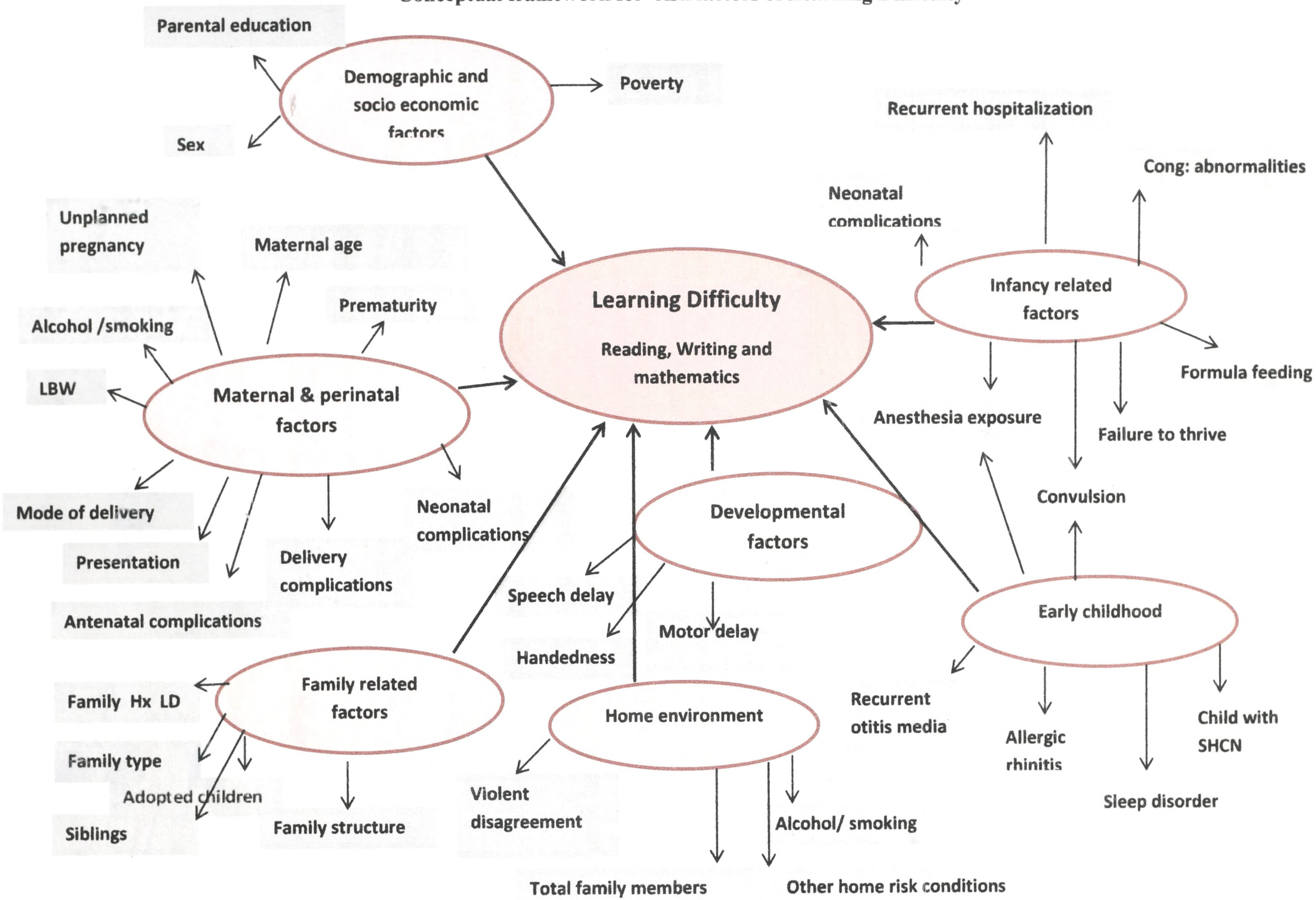
7.13 Ask whether any sibling is suffering from disabilities with cognitive impairment that needs special care.

7.14 During a disagreement situation what they do/ how they behave? Do they calmly discuss the problem? Do they argue heatedly and shout? Do they act in a violent manner which ends up in hitting and throwing things. Rate each behaviour according to given frequency. Ask these questions in relation to past six months.

7.15 Do they have any home based industries

7.16 Do they handle pesticides and insecticides/ store insecticides,pesticides.

Conceptual framework for risk factors of Learning Difficulty



Annex XXXI A

Focus group discussions with mothers of children with learning difficulty

Focus Group Discussion Guide – Mothers (English)

Date-

Place-

Time spend-

Particulars of the panel

Age	Highest educational qualification	Whether working or not

Moderators guide

Learning difficulty is one of the prevailing public health problems in our country. Learning behaviour of these children would create a stressful situation at home. Some will end up in behavioural problems. Mothers as primary care givers of these children would face challenges in daily life and while parenting these children which will ultimately end up in psychological distress. We are interested in finding out your views and experiences about your life as mothers who are having children with learning difficulty..

All opinions are welcome and valued. There is no right or wrong answers

1) How do you feel about your life?
   - Happy/ sad
   - Satisfied or not
   - Able to concentrate on day to day activities
   - Able to enjoy day to day activities

2) Do you think/ agree that your children are having a learning problem?

3) Have you noticed any other problems (eg. Behavioural problems) in your child apart from learning problems? If yes explain.

4) What is your experience about your involvement/ child's interest in academic activities?

5) Have you ever felt that this child is a difficult child? explain

- Child} does things that really bother you
- You find yourself giving up more of my life to meet Child's needs than expected
- Often feel angry with Child
- harder to care than expected

6) Have you ever punished the child for not taking interest in academic activities? Please explain

7) What is your view about the expenditure for this child compared to other children in the family. explain

8) Are you worrying about this child? If yes what are your worries?

- About the future
- About behavioural problems

9) What is your opinion about your role in caring other children in the family?
- Time to pay attention
- Time for school involvement

10) Have you ever come across family disharmony because of this child? explain

11) Have you ever embarrassed in the class meeting or in a gathering due to your child's learning problem?

12) Are you happy about the way the teachers and other children in the school treat your child?

Annex XXXI B

Focus group discussions with mothers of children with learning difficulty

Focus Group Discussion Guide – Mothers (Sinhala)

දිනය :-

ස්ථානය :-

වැය වූ කාලය :-

මඩුල්ල පිළිබඳ විස්තර :-

නම/වයස/තනතුර (තිබේ නම්)/ අධ්‍යාපනික මට්ටම :-

මෙහෙයවන්නාගේ මාර්ගෝපදේශය

ඉගෙනීමේ දුර්වලතාවය අපේ රටේ දැනට පවතින ප්‍රජා සෞඛ්‍ය ප්‍රශ්න වලින් එකකි. මේ දරුවන් ඉගෙනීම සම්බන්ධව දක්වන හැසිරීම් නිවස තුළ පීඩාකාරී තත්වයක් ඇති කරයි. සමහර දරුවන් වර්ජනාත්මක ගැටළු ද පෙන්නුම් කරනු ලැබේ. මෙම දරුවන්ගේ ප්‍රාථමික රැකබලා ගන්නා වශයෙන් මව්වරු එදිනෙදා ජීවිතයේ අභියෝග රැසකටම මුහුණ පාන අතර ඔවුන් හදාවඩා ගැනීමේ දී අවසානයේ දී දෙමව්පියන් බලවත් මානසික පීඩාවට ද ආතතියට ද ලක්වනු ඇත. ඉගෙනීමේ දුර්වලතා ඇති දරුවකුගේ මවක් වශයෙන් ඔබගේ ජීවිතය සම්බන්ධව ඔබගේ අදහස් හා අත්දැකීම් දැනගැනීමට අපි කැමැත්තෙන් සිටිමු.

සියළු අදහස් අපි අගය කොට සලකමු/නිවැරදි හෝ නිවැරදි උත්තර කිසිවක් නැත.

01. ඔබගේ ජීවිතය ගැන ඔබට හැඟෙන්නේ කුමක්ද?

- සතුට/දුක
- තෘප්තිමත්/නැත
- දවසේ වැඩ කටයුතු කෙරෙහි අවධානය යොමු කළ හැකිවීම.
- දවසේ වැඩ කටයුතු වලින් විනෝදයක් ලැබීම.

02. ඔබගේ දරුවන්ට ඉගෙනීමේ දුර්වලතාවක් ඇතිබව ඔබ සිතන්නේද?/ඇතිබවට එකඟ වන්නේද?

03. ඉගෙනීමේ දුර්වලතාවට අමතරව ඔබේ දරුවා තුළ වෙනයම් ගැටළුවක් (වර්ජනාත්මක ගැටළු) ඔබ දුටුවාද?

04. දරුවාගේ අධ්‍යාපන වැඩ කටයුතු සම්බන්ධයෙන් ඔබගේ දායකත්වය හා අධ්‍යාපන කටයුතු වලට දරුවාට ඇති උනන්දුව ගැන ඔබගේ අත්දැකීම කවරේද?

05. මෙම දරුවා දුෂ්කර දරුවෙක් යැයි ඔබට කවදා හෝ හැඟුණිද?

- දරුවා නිතර ඔබව අපහසුතාවට පත්කරන ආකාරයේ වැඩ කරනවාද?
- බලාපොරොත්තු නොවූ ආකාරයට මේ දරුවාගේ අවශ්‍යතාවන් සම්පූර්ණ කිරීමට ඔබේ ජීවිතයෙන් වැඩිකොටසක් කැපකිරීමට/අත්හැරීමට ඔබට සිදුවීම.
- නිතර දරුවා කෙරෙහි තරහක් ඇතිවීම.
- බලාපොරොත්තු වූවාට හදා වඩා ගැනීම/රැකබලා ගැනීම අපහසු වීම.

06. අධ්‍යාපන වැඩකටයුතු ගැන උනන්දුවක් නොදැක්වීම නිසා කවදා හෝ මෙම දරුවාට දඬුවම් දීමට ඔබට සිදුවුණාද? විස්තර කරන්න.

07. පවුලේ අනිකුත් දරුවන්ට සාපේක්ෂව මේ දරුවාට දරන වියදම් ගැන ඔබගේ අදහස කුමක්ද?

08. මෙම දරුවා ගැන ඔබ කනස්සල්ලට පත්වෙනවාද? ඔව් නම් එවා කුමක්ද?

- අනාගතය ගැන.
- වර්යාත්මක ගැටළු ගැන

09. පවුලේ අනිකුත් ළමයි රැක බලාගැනීමේ කාර්යය ගැන ඔබ දරන අදහස කුමක්ද?

- අවධානය යොමු කිරීමට ඇති කාලය
- පාසැල් වැඩ කටයුතු වලට සම්බන්ධ වීමට ඇති කාලය

10. මෙම දරුවා නිසා කිසිදිනක පවුලේ ආරාවුල් හා අසමගිතා ඇති වී තිබේද? විස්තර කරන්න

11. ඔබේ දරුවාගේ ඉගෙනීමේ දුර්වලතාවය නිසා කිසිදිනක රැස්වීමක් ඉදිරියේ හෝ හමුවක් ඉදිරියේ ඔබ ලැජ්ජාවට හෝ අවමානයට පත්වී තිබේද?

11. ගුරුවරුන් හා පාසැලේ අනිකුත් ළමයින් ඔබේ දරුවාට සලකන ආකාරය ගැන ඔබ සතුටු වනවාද?

Annex XXXII

Sensitivity specificity likelihood ratios and predictive values for different cut off points of reading subscale

Cutoff >	Sensitivity	95% CI	Specificity	95% CI	LR +	LR -	PPV	NPV
17	1	0.9000 to 1.000	0.0816	0.02269 to 0.1960	1.0889	0	0.5213	1
23	1	0.9000 to 1.000	0.102	0.03397 to 0.2223	1.1136	0	0.5269	1
25	1	0.9000 to 1.000	0.1429	0.05942 to 0.2724	1.1667	0	0.5385	1
27.5	1	0.9000 to 1.000	0.1837	0.08759 to 0.3202	1.225	0	0.5506	1
30	1	0.9000 to 1.000	0.2041	0.1024 to 0.3434	1.2564	0	0.5568	1
31.5	1	0.9000 to 1.000	0.2653	0.1495 to 0.4108	1.3611	0	0.5765	1
33	1	0.9000 to 1.000	0.3265	0.1995 to 0.4754	1.4848	0	0.5976	1
35	1	0.9000 to 1.000	0.5102	0.3634 to 0.6558	2.0416	0	0.6712	1
36.5	1	0.9000 to 1.000	0.5714	0.4221 to 0.7118	2.3332	0	0.7	1
38	1	0.9000 to 1.000	0.6327	0.4829 to 0.7658	2.7226	0	0.7314	1
39.5	1	0.9000 to 1.000	0.6939	0.5458 to 0.8175	3.2669	0	0.7656	1
40.5	1	0.9000 to 1.000	0.7347	0.5892 to 0.8505	3.7693	0	0.7903	1
42	1	0.9000 to 1.000	0.7755	0.6338 to 0.8823	4.4543	0	0.8167	1
43.5	1	0.9000 to 1.000	0.8571	0.7276 to 0.9406	6.9979	0	0.875	1
44.5	0.9143	0.7694 to 0.9820	0.8571	0.7276 to 0.9406	6.3982	0.1	0.8648	0.9091
45.5	0.9143	0.7694 to 0.9820	0.898	0.7777 to 0.9660	8.9637	0.0954	0.8996	0.9129
46.5	0.8857	0.7326 to 0.9680	0.898	0.7777 to 0.9660	8.6833	0.1273	0.8967	0.8871
47.5	0.8571	0.6974 to 0.9519	0.9388	0.8313 to 0.9872	14.0049	0.1522	0.9334	0.8679
48.5	0.8571	0.6974 to 0.9519	1	0.9275 to 1.000		0.1429	1	0.875
49.5	0.8	0.6306 to 0.9156	1	0.9275 to 1.000		0.2	1	0.8333
50.5	0.6571	0.4779 to 0.8087	1	0.9275 to 1.000		0.3429	1	0.7447
51.5	0.6286	0.4492 to 0.7853	1	0.9275 to 1.000		0.3714	1	0.7292
54	0.5143	0.3399 to 0.6862	1	0.9275 to 1.000		0.4857	1	0.6731
56.5	0.3714	0.2147 to 0.5508	1	0.9275 to 1.000		0.6286	1	0.614
57.5	0.3143	0.1685 to 0.4929	1	0.9275 to 1.000		0.6857	1	0.5932
59	0.2857	0.1464 to 0.4630	1	0.9275 to 1.000		0.7143	1	0.5833
60.5	0.0571	0.006997 to 0.1916	1	0.9275 to 1.000		0.9429	1	0.5147

PPV=Positive Predictive Value

NPV =Negative Predictive Value

LR+=Likelihood ratio positive

LR-=Likelihood ratio negative

Annex XXXIII

Sensitivity specificity likelihood ratios and predictive values for different cut off points of writing subscale

Cutoff >	Sensitivity	95% CI	Specificity	95% CI	LR +	LR -	PPV	NPV
15.5	1	0.9000 to 1.000	0.1429	0.05942 to 0.2724	1.1667	0	0.5385	1
20.5	1	0.9000 to 1.000	0.2449	0.1334 to 0.3887	1.3243	0	0.5698	1
21.5	1	0.9000 to 1.000	0.2653	0.1495 to 0.4108	1.3611	0	0.5765	1
23	1	0.9000 to 1.000	0.2857	0.1658 to 0.4326	1.4	0	0.5833	1
25	1	0.9000 to 1.000	0.3878	0.2520 to 0.5376	1.6335	0	0.6203	1
27.5	1	0.9000 to 1.000	0.4082	0.2700 to 0.5579	1.6898	0	0.6282	1
29.5	1	0.9000 to 1.000	0.449	0.3067 to 0.5977	1.8149	0	0.6447	1
31	1	0.9000 to 1.000	0.4694	0.3253 to 0.6173	1.8847	0	0.6533	1
32.5	1	0.9000 to 1.000	0.5306	0.3827 to 0.6747	2.1304	0	0.6805	1
33.5	1	0.9000 to 1.000	0.5918	0.4421 to 0.7300	2.4498	0	0.7101	1
35	1	0.9000 to 1.000	0.6122	0.4624 to 0.7480	2.5786	0	0.7206	1
36.5	1	0.9000 to 1.000	0.7347	0.5892 to 0.8505	3.7693	0	0.7903	1
37.5	1	0.9000 to 1.000	0.7551	0.6113 to 0.8666	4.0833	0	0.8033	1
38.5	1	0.9000 to 1.000	0.8163	0.6798 to 0.9124	5.4437	0	0.8448	1
40	1	0.9000 to 1.000	0.898	0.7777 to 0.9660	9.8039	0	0.9074	1
41.5	0.9429	0.808 to 0.9930	0.9184	0.8040 to 0.9773	11.5551	0.0622	0.9204	0.9415
42.5	0.8571	0.697 to 0.9519	0.9592	0.8602 to 0.9950	21.0074	0.149	0.9546	0.8703
43.5	0.8286	0.663 to 0.9344	1	0.9275 to 1.000		0.1714	1	0.8537
44.5	0.7429	0.567 to 0.8751	1	0.9275 to 1.000		0.2571	1	0.7955
46	0.6571	0.477 to 0.8087	1	0.9275 to 1.000		0.3429	1	0.7447
47.5	0.6286	0.449 to 0.7853	1	0.9275 to 1.000		0.3714	1	0.7292
48.5	0.6	0.421 to 0.7613	1	0.9275 to 1.000		0.4	1	0.7143
49.5	0.5714	0.393 to 0.7368	1	0.9275 to 1.000		0.4286	1	0.7
50.5	0.4286	0.263 to 0.6065	1	0.9275 to 1.000		0.5714	1	0.6364
52	0.2857	0.146 to 0.4630	1	0.9275 to 1.000		0.7143	1	0.5833
53.5	0.1714	0.0656 to 0.3365	1	0.9275 to 1.000		0.8286	1	0.5469
54.5	0.1143	0.0320 to 0.2674	1	0.9275 to 1.000		0.8857	1	0.5303

PPV=Positive Predictive Value

NPV =Negative Predictive Value

LR+=Likelihood ratio positive

LR-=Likelihood ratio negative

Annex XXXIV

Sensitivity specificity likelihood ratios and predictive values for different cut off points of math subscale

Cutoff >	Sensitivity	95% CI	Specificity	95% CI	LR +	LR -	PPV	NPV-
13.5	1	0.9000 to 1.000	0.1633	0.07322 to 0.2966	1.1952	0	0.5445	1
14.5	1	0.9000 to 1.000	0.1837	0.08759 to 0.3202	1.225	0	0.5506	1
15.5	1	0.9000 to 1.000	0.2245	0.1177 to 0.3662	1.2895	0	0.5632	1
17.5	1	0.9000 to 1.000	0.2449	0.1334 to 0.3887	1.3243	0	0.5698	1
20.5	1	0.9000 to 1.000	0.2857	0.1658 to 0.4326	1.4	0	0.5833	1
22.5	1	0.9000 to 1.000	0.3061	0.1825 to 0.4542	1.4411	0	0.5904	1
23.5	1	0.9000 to 1.000	0.4286	0.2882 to 0.5779	1.7501	0	0.6364	1
30	1	0.9000 to 1.000	0.5102	0.3634 to 0.6558	2.0416	0	0.6712	1
37.5	1	0.9000 to 1.000	0.551	0.4023 to 0.6933	2.2272	0	0.6901	1
39.5	1	0.9000 to 1.000	0.6939	0.5458 to 0.8175	3.2669	0	0.7656	1
43	1	0.9000 to 1.000	0.8163	0.6798 to 0.9124	5.4437	0	0.8448	1
47	0.9714	0.8508 to 0.9993	0.898	0.7777 to 0.9660	9.5235	0.0318	0.905	0.9691
48.5	0.9143	0.7694 to 0.9820	0.9796	0.8915 to 0.9995	44.8186	0.0875	0.9782	0.9196
50	0.9143	0.7694 to 0.9820	1	0.9275 to 1.000		0.0857	1	0.9211
51.5	0.8857	0.7326 to 0.9680	1	0.9275 to 1.000		0.1143	1	0.8974
52.5	0.8	0.6306 to 0.9156	1	0.9275 to 1.000		0.2	1	0.8333
54.5	0.7714	0.5986 to 0.8958	1	0.9275 to 1.000		0.2286	1	0.8139
56.5	0.7429	0.5674 to 0.8751	1	0.9275 to 1.000		0.2571	1	0.7955
57.5	0.7143	0.5370 to 0.8536	1	0.9275 to 1.000		0.2857	1	0.7778
58.5	0.6857	0.5071 to 0.8315	1	0.9275 to 1.000		0.3143	1	0.7609
59.5	0.5714	0.3935 to 0.7368	1	0.9275 to 1.000		0.4286	1	0.7
60.5	0.4571	0.2883 to 0.6335	1	0.9275 to 1.000		0.5429	1	0.6481
61.5	0.4	0.2387 to 0.5789	1	0.9275 to 1.000		0.6	1	0.625
62.5	0.2571	0.1249 to 0.4326	1	0.9275 to 1.000		0.7429	1	0.5738
63.5	0.1429	0.04806 to 0.3026	1	0.9275 to 1.000		0.8571	1	0.5385
64.5	0.1143	0.03203 to 0.2674	1	0.9275 to 1.000		0.8857	1	0.5303

PPV=Positive Predictive Value

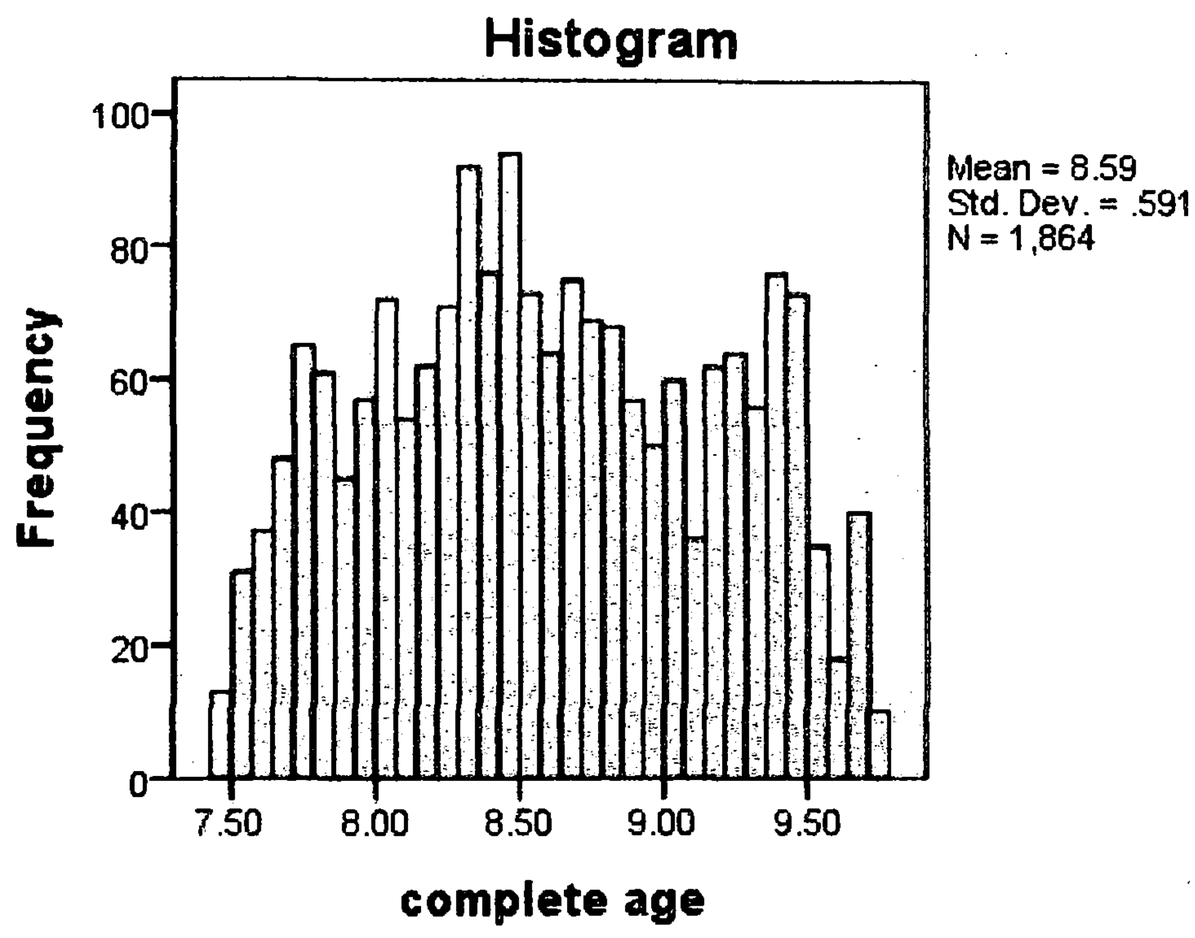
NPV =Negative Predictive Value

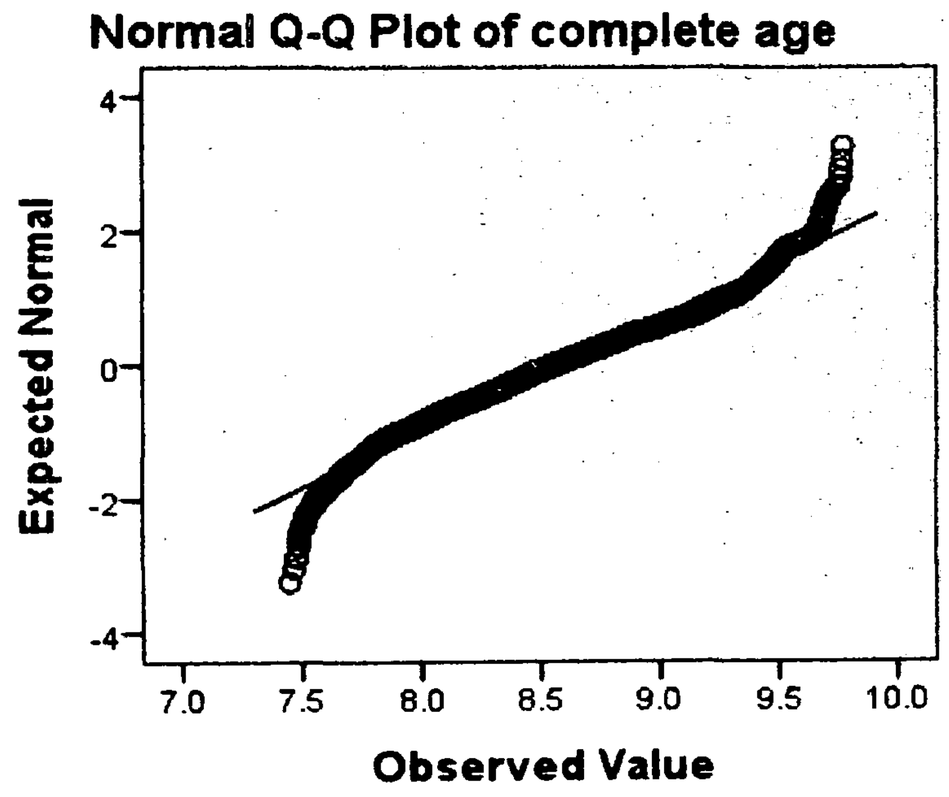
LR+=Likelihood ratio positive, LR-= Likelihood ratio positive

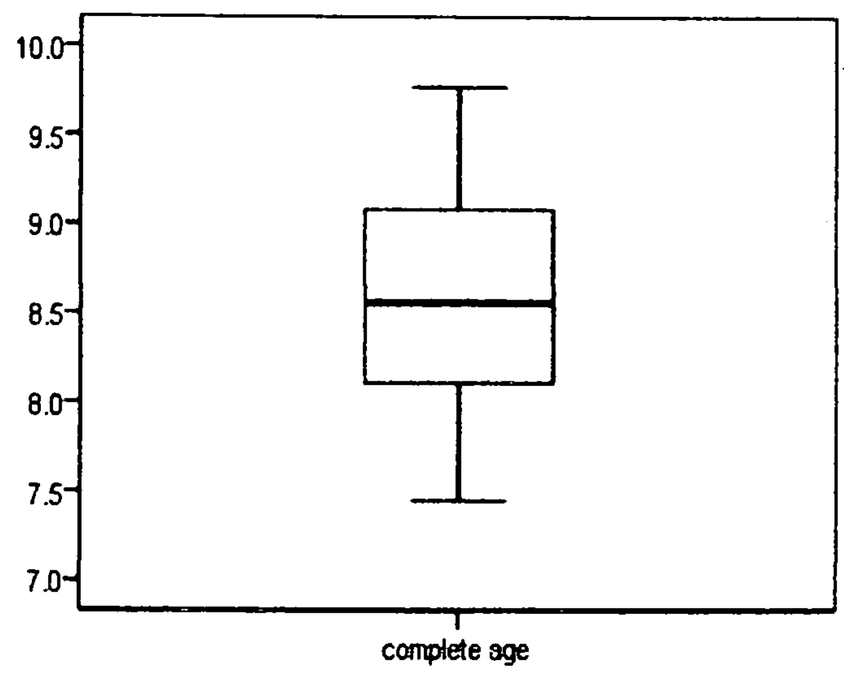
Annex XXXV

Histograms, Q-Q plots and P-P plots

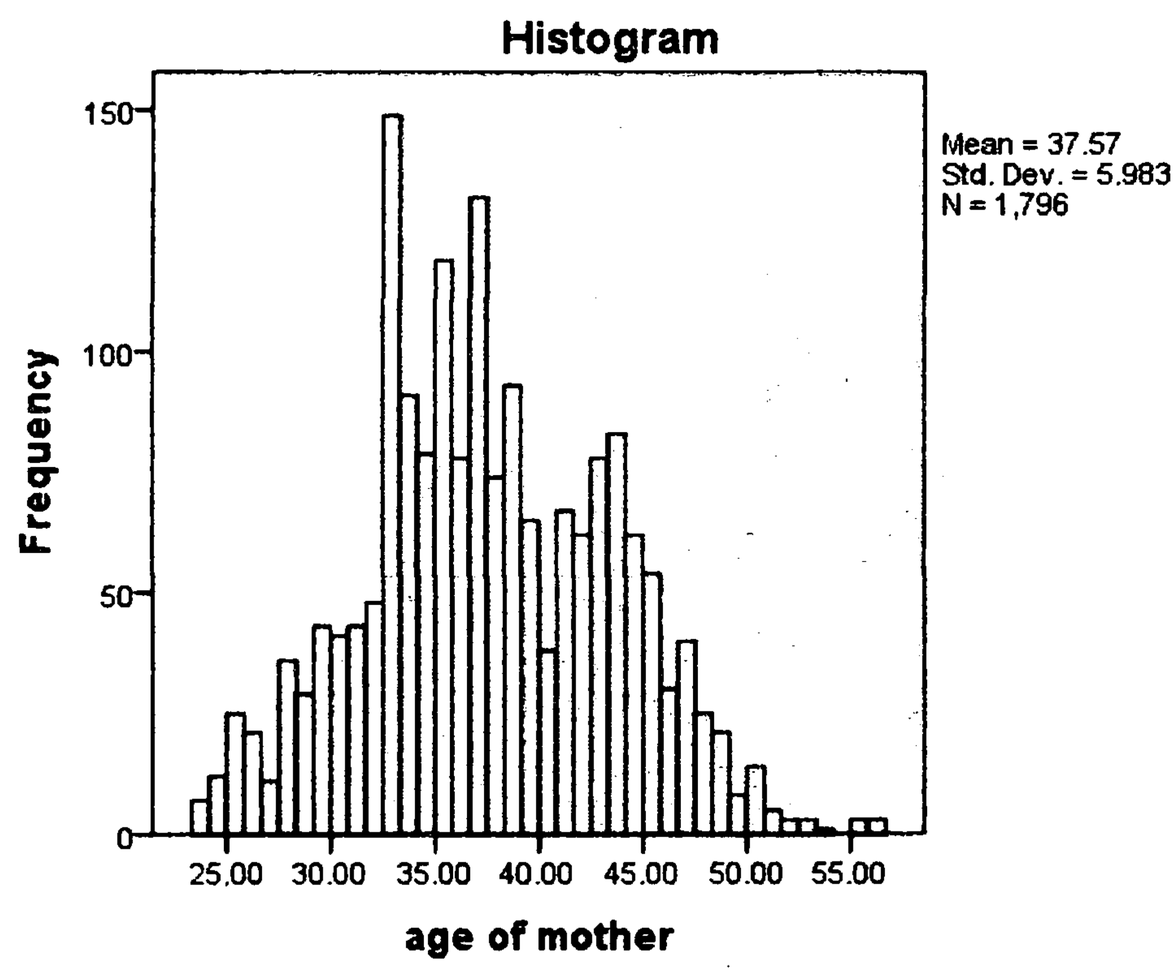
Age of the child

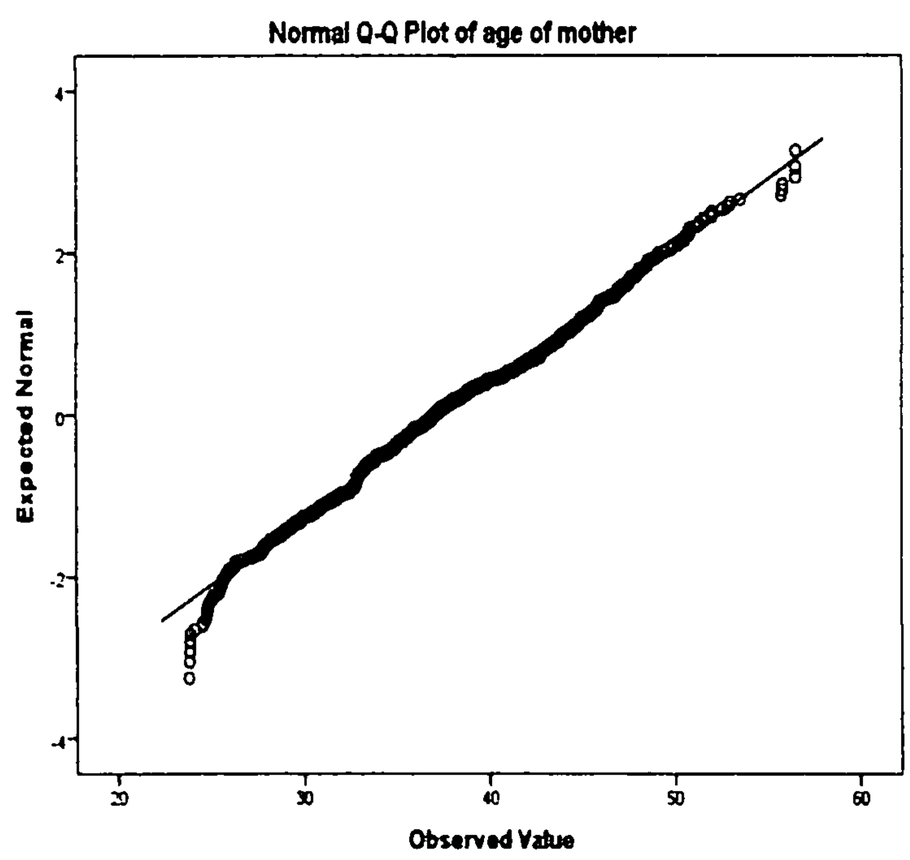


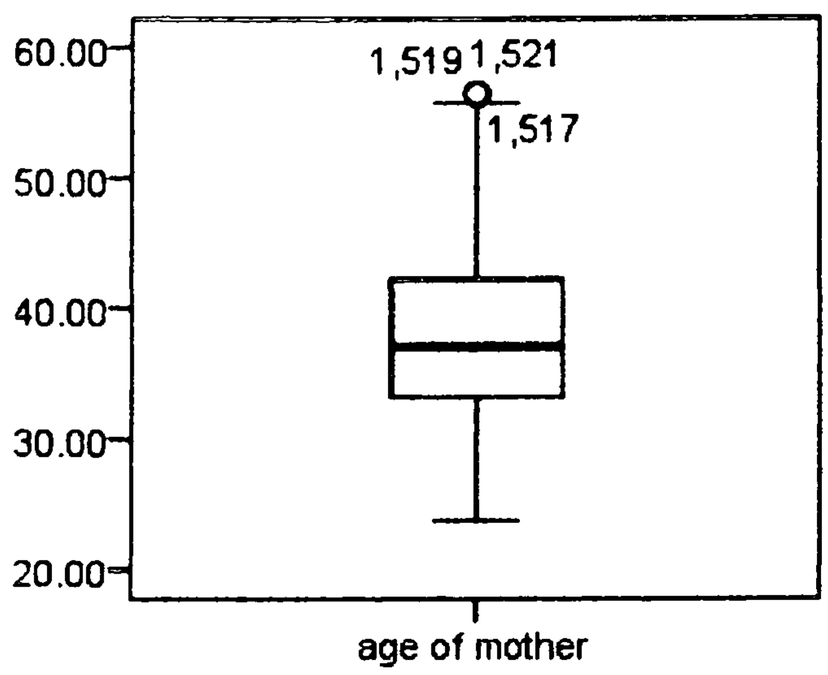



10.0
9.5
9.0
8.5
8.0
7.5
7.0
complete age

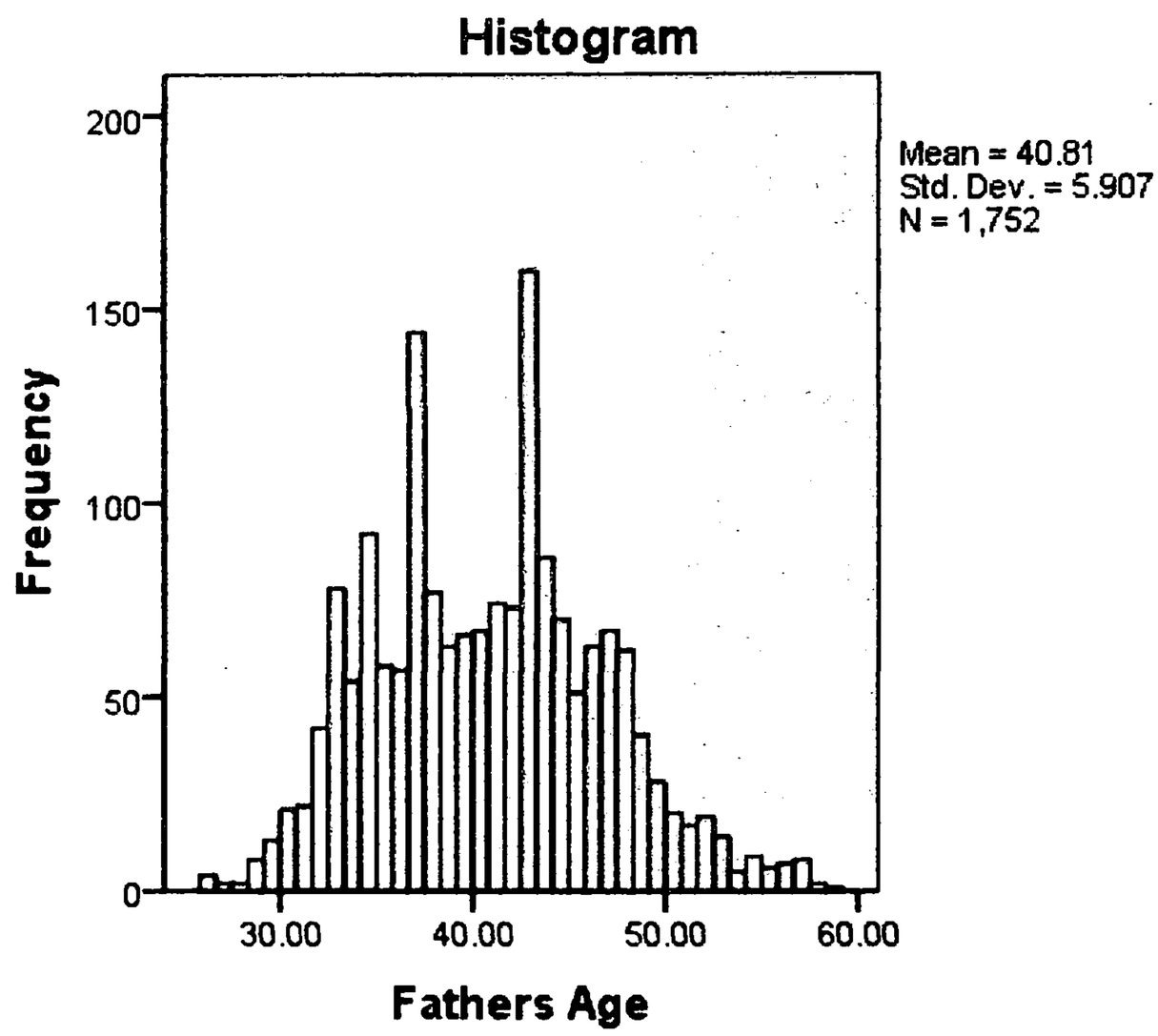
Mother's age

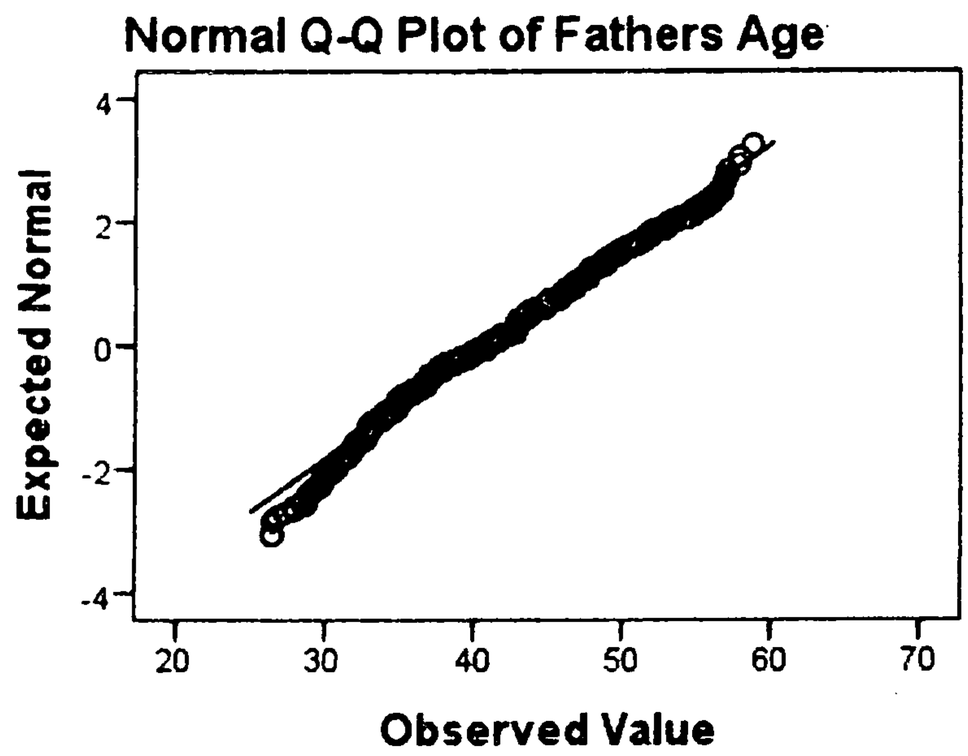

Histogram
Mean = 37.57
Std. Dev. = 5.983
N = 1,796
Frequency
150
100
50
0
25.00
30.00
35.00
40.00
45.00
50.00
55.00
age of mother

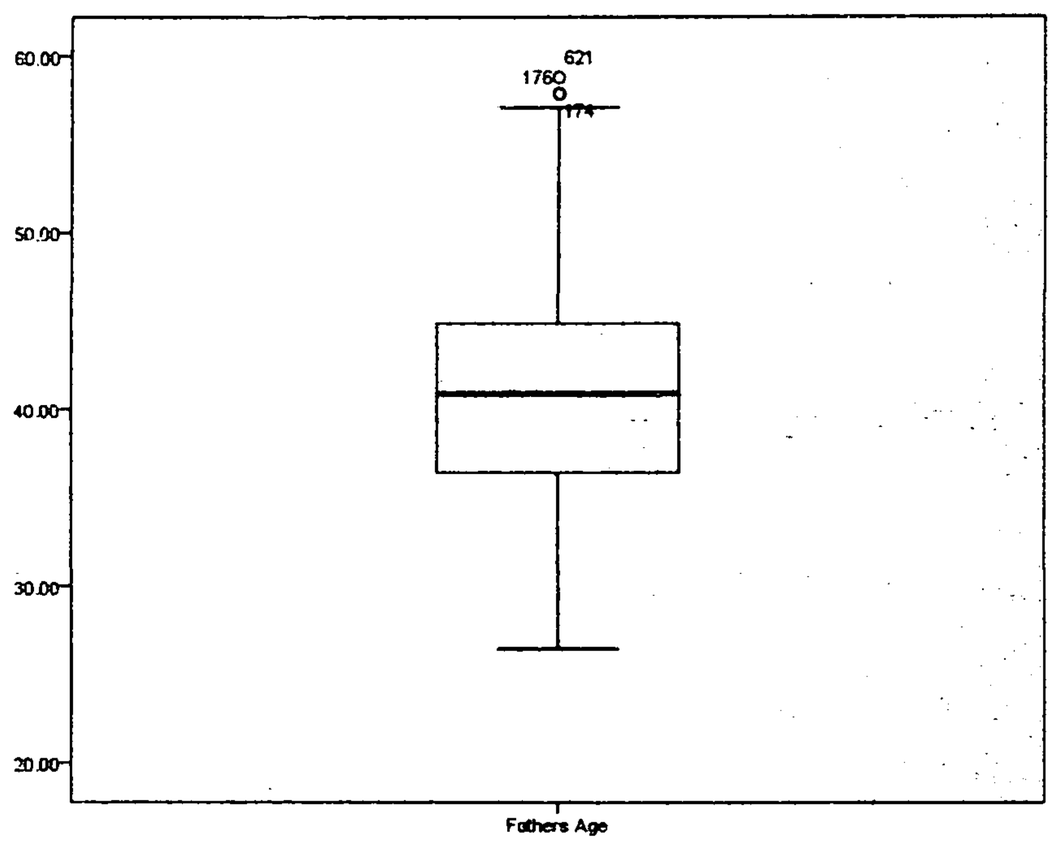

Normal Q-Q Plot of age of mother
Expected Normal
Observed Value



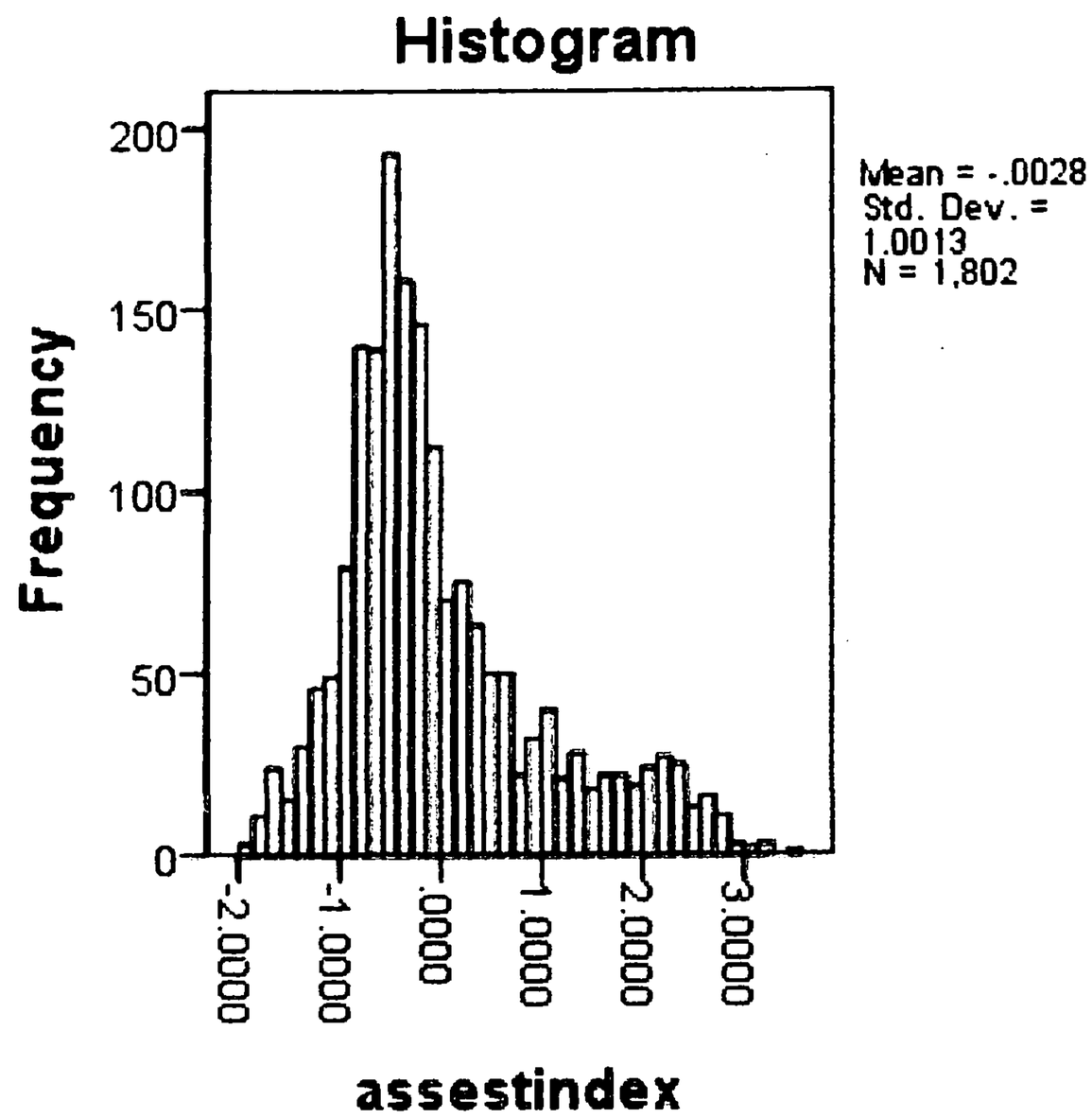
Age of the father

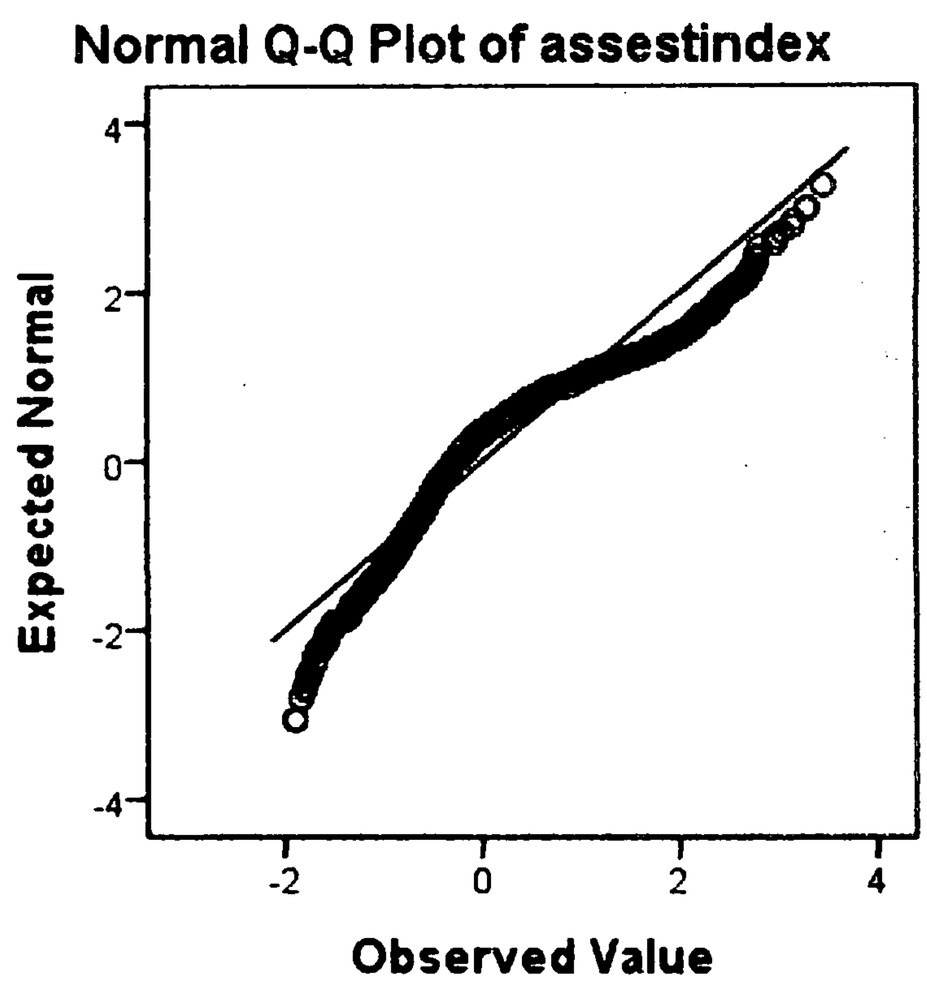



Normal Q-Q Plot of Fathers Age
Expected Normal
4
2
0
-2
-4
20
30
40
50
60
70
Observed Value


60.00
50.00
40.00
30.00
20.00
621
1760
174
Fathers Age

Asset index


Histogram
Mean = -.0028
Std. Dev. =
1.0013
N = 1,802
Frequency
200
150
100
50
0
-2.0000
-1.0000
.0000
1.0000
2.0000
3.0000
assestindex


Normal Q-Q Plot of assestindex
Expected Normal
4
2
0
-2
-4
-2
0
2
4
Observed Value

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