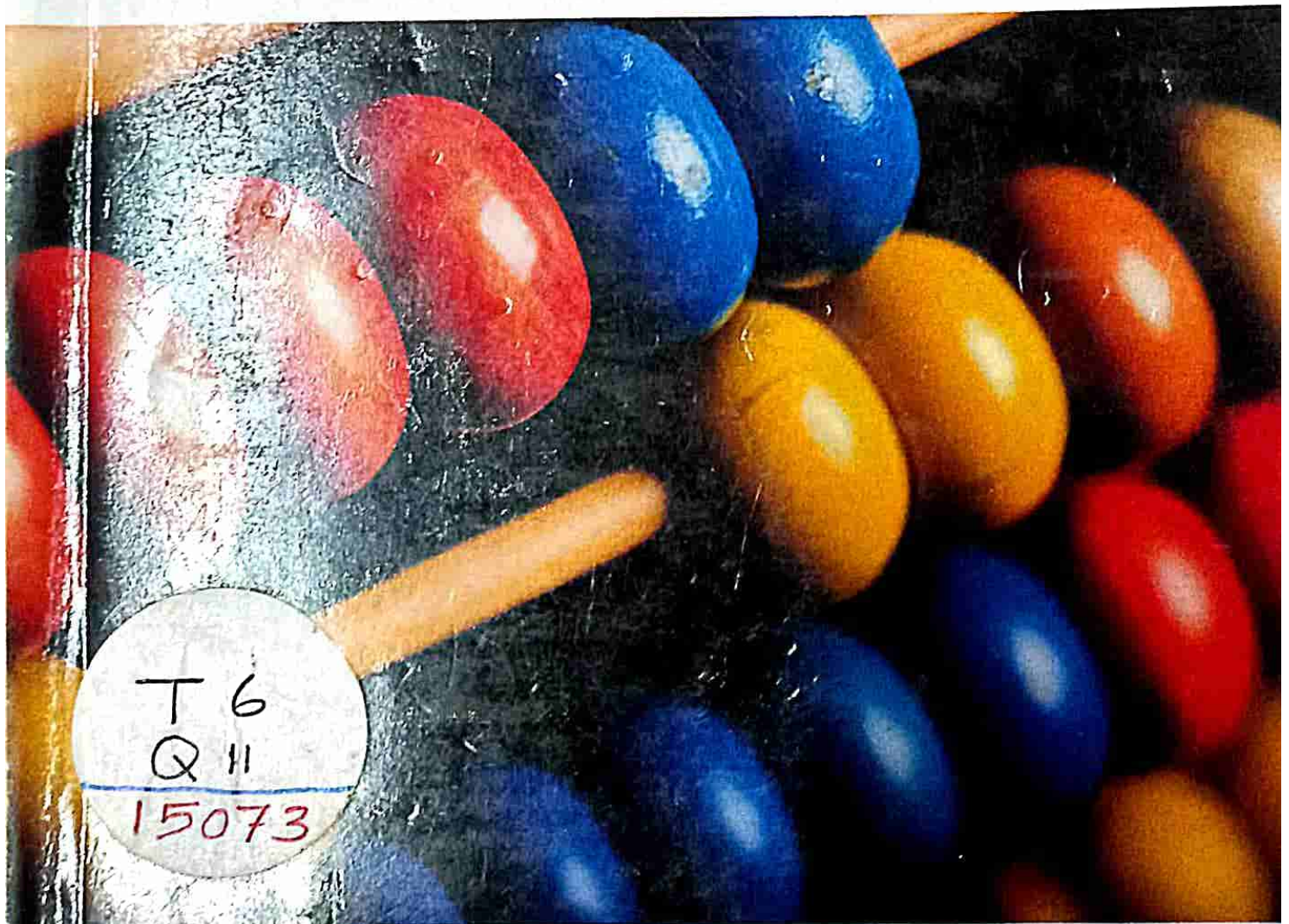


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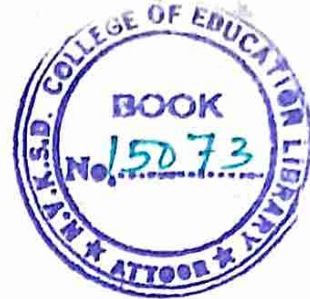
FOCUS ON MATHEMATICS LEARNING DISABILITY



**B. William Dharma Raja
S. Praveen Kumar**

SPECIAL EDUCATION

Focus on Mathematics Learning Disability



B. William Dharma Raja
S. Praveen Kumar

*Donated by
Dr Praveenkumar. S.*

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PREFACE

In the present era, special education is being considered as an important field of study. All around the globe, there has been significant gains in special education services and policies supporting children with disabilities. But among the various categories of disabilities, learning disability is the one in which least importance is given to or which is ignored. A learning disability like dyscalculia is often ignored or not all identified.

The book is designed with the intention to address some of the basic issues related to learning disabilities in general with a special focus on dyscalculic problems. Writings in the area of learning disabilities represent an important dimension of creating awareness about those special wards who need special attention to develop their academic skills. This book outlines the essentials of the condition called dyscalculia and offers certain practical ways in which these difficulties can be addressed.

Chapter 1 of this book introduces the concept of disability and the various types of disabilities. *Chapter 2* focusses on learning disabilities and provides a discussion of prevalence and causative factors of learning disabilities and the problems of learning-disabled wards. *Chapter 3* discusses about integrated and inclusive education and also the need of inclusive settings for learning-disabled children. *Chapter 4* concentrates on analysis of dyscalculic problems by discussing about its types and causes. *Chapter 5* presents an overview of learning styles and the different learning styles that are suited to dyscalculics according to their needs. *Chapter 6* deals with the use of technology for the benefit of dyscalculics. *Chapter 7* reviews the researches done on dyscalculia and addresses the need for conducting intensive studies on this area to meet the needs of dyscalculics. *Chapter 8* helps the clients of education such as

parents, teachers, administrators and researches on adoption of strategies to overcome the problems of these special children.

This book will be useful to all those involved in the field of special education, especially, teacher educators and students of special education. It is hoped that this book will be of help to teachers and parents dealing with children with learning disabilities. It may also be helpful to researchers who wish to do researches in the area of learning disabilities.

The authors are indebted to all those sources which have been consulted covertly and overtly in preparing this book. Also suggestions and comments for the improvement of this book are most welcomed and appreciated.

**B. William Dharma Raja &
S. Praveen Kumar**



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1

DISABILITIES

One sees these days not only diversity on cultural or linguistic fronts but also on the needs of children attending schools with varying abilities or disabilities. Children with various kinds of disabilities or handicaps are found in various schools. In most of the schools, teachers can find students with diversities in terms of physical or mental abilities or disabilities, students with specific learning difficulties, challenging behaviours or behavioural disorders and so on.

The categories of students with various disabilities or severe learning disorders get isolated or excluded in regular school settings in the sense that the curriculum, teaching-learning materials, examination systems, educational facilities etc are not supportive to these students. These children who are practically ignored in our educational system need to be taken care of. It is a great challenge on the part of teachers and educational specialists to deal with those children with disabilities through the use of innovative educational strategies.

1.1 DISABILITY – THE CONCEPT

Disability is a lack of ability relative to a personal or group standard or norm. It is the functional consequence of an impairment or change in the body or human functioning (<http://en.wikipedia.org/wiki/Disability>). A disability may be present from a person's birth or it may occur during the lifetime. It may include physical impairment, sensory impairment, mental disorder or various types of chronic disease. Disability can be defined as a physical, sensory or intellectual impairment that hinders the performance of activities of daily living, education, work and full participation (Gupta & Sindhu, 2007: 9).

A disability reflects the consequence of impairment in terms of functional performance and activity (Panda, 1997: 2). When

impairment results into a specific type of disability, the disability may in turn result in the formation of a specific condition known as handicap. It reflects the disadvantages experienced by the individual as a result of impairments and disabilities. A handicap results from the environmental or functional demands placed upon an individual in a given setting. It is the effect of a disability on an individual's functioning in specific circumstances and may limit one's social functioning or adjustment to his environment (Mangal, 2007: 12).

Disabilities may be short-term, long-term or permanent depending on the part of the duration of the functional limitation. They limit one's ability to perform certain task. A disability results from a medical, social or learning difficulty that interferes significantly with the students' normal growth and development (Ysseldyke & Algozzine, 2006: 7). The problem of disability has an important social dimension as far as the relationship between the individual and his environment is concerned. It is the interaction of the environment which determines the effect of disability on a person's daily life. A disability produces pronounced changes in the pattern of life and work of the individual.

The Individuals with Disabilities Education Act (IDEA), a United States federal law 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 that involve 13 specified categories of disability. Under IDEA (2004), it was implemented that special education and related services should be designed to meet the unique learning needs of eligible children with disabilities, from preschool through age 21 and that students with disabilities should be prepared for further education, employment and independent living (http://en.wikipedia.org/wiki/Individuals_with_Disabilities_).

Disability is a global problem and the magnitude of disability varies from country to country. Disability in children can be caused by malnutrition, infection, trauma at birth, in infancy and childhood, environmental exposure to toxic agents and chronic illnesses.

Simple preventive measures such as anticipatory guidance, nutritional counselling, newborn screening, parental education and routine immunisations are the key components of preventive care (Mathur, 2010: 33). It is very important that these disabled persons be made active participants in the developmental process. These persons who are excluded need to be integrated into the mainstream.

1.2 TYPES OF DISABILITIES

Types of disabilities include various physical and mental impairments that can hamper or reduce a person's ability to carry out day to day activities. Disability can be divided into a number of categories which include the following :

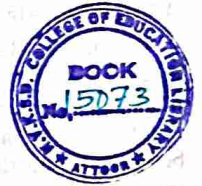
- Mobility and physical impairments
- Orthopaedic impairments
- Mental illness
- Brain disability
- Visual disability
- Hearing disability
- Speech handicap
- Cognitive or learning disabilities
- Emotional disturbance
- Autism
- Attention Deficit Hyperactivity Disorder

(i) Mobility or physical impairments

Mobility or physical impairments refer to a wide range of conditions that limit that may limit physical capabilities of students including paralysis, arthritis, muscular dystrophy, multiple sclerosis, respiratory and cardiac disease etc. Any of these conditions may affect strength, speed, endurance, coordination and dexterity. Students with this disability may find it difficult to get to and from classes, upstairs, narrow spaces etc (<http://www.tntech.edu/disability/types.disorders.html#top>).

(ii) Orthopaedic impairments

The orthopaedically handicapped are those who are disabled



by impairments which interfere with the functional use of hands, arms, legs, feet and other body parts. Orthopaedic impairment interferes with the normal functioning of bones, joints and muscles. About 0.09 percent of the school-age populations are found to have orthopaedic impairments (Ysseldyke & Algozzine, 2006: 18).

(iii) Mental illness

Mental illness is a widespread and debilitating illness which affects many people with psychiatric disorders accompanied by observable behaviours such as disruptive behaviour, slow reactions, hyperactivity, drowsiness etc (<http://www.tntech.edu/disability/types.disorders.html#top>). Mental retardation is a condition of subnormal mental development which is characterized by limited intelligence and social inadequacy. About 0.96 percent of the school-age populations are said to be classified in this category (Ysseldyke & Algozzine, 2006: 18).

Mental retardation has many causes. It can occur as a result of head injury, an illness or because of a congenital or genetic abnormality. Generally persons are considered to be retarded when they have significantly low intellectual functioning with IQ scores below 70 versus the average IQ of 90-110. Retarded children are impaired in their ability to adapt to the environment and usually experience failure. Very often, the retarded children have trouble with short-term memory (Tilson, 2004: 56).

(iv) Brain disability

Brain disability is another type of disability which occurs due to brain injury. This injury is caused by an external physical force resulting in total or partial functional disability and psychosocial impairment (Tilson, 2004: 59).

Children with brain injury are often characterized by high distractibility or undue fixation of attention on irrelevant stimuli. Many tend to be restless, uninhibited, emotionally unstable, and lacking in persistence (Skinner, 2001: 128). The magnitude of brain injury ranges from mild to severe forms of injury (<http://www.disabled-world.com/disability/types>).

(v) Visual disability

Visual disabilities are those that result in blindness. Visual impairment includes all levels of vision loss and may range from individuals with very poor vision to individuals who can see light but no shapes. According to Barraga, "A visually handicapped child is one whose visual impairments interfere with his optimal learning and achievement, unless adaptations are made in the method of presenting learning experiences, the nature of materials used and in the learning environment" (Mangal, 2007: 179). About 0.04 percent of the school-age populations are found to have visual impairments (Ysseldyke & Algozzine, 2006: 18).

Blindness is caused by certain environmental and genetic agents. These etiological agents include infections, diseases, accidents, poisoning, tumours and cancer. However much of the incidence of blindness is attributed to prenatal factors. Total blindness is easy to recognize and define, but partial blindness is rather difficult to recognize and define (Kar, 1992: 7).

(vi) Hearing disability

Hearing disability includes people who are completely or partially deaf. Hearing impairment indicates some damage of the hearing mechanism, as a result of which the affected child may get disabled in terms of the functional use of the hearing senses. Hearing impaired children suffer from one or the other types of hearing losses (Mangal, 2007: 201). About 0.11 percent of the school-age populations are found to have orthopaedic impairments (Ysseldyke & Algozzine, 2006: 18).

Hearing losses may range from mild to profound and may be unilateral or bilateral (Tilson, 2004: 59). Auditory defects can be found in either one or both ears. Sometimes children have no power of hearing at all. Hearing influences learning and other forms of maturation (Kar, 1992: 9).

(vii) Speech handicap

Speech handicap is another problem that refers to minor and major speech and language problems. Children with this disability

may stammer, may be quiet and may have long gap in completing sentences (Sharma, 2008: 60). Students with speech impairments have special learning needs in areas requiring functional use of language and communication skills. About 1.73 percent of the school-age populations are found to have speech impairments (Ysseldyke & Algozzine, 2006: 18).

Language disorders range from mild speech defects such as articulation disorders to severe communication disorders that affect both expressive language and receptive language (Tilson, 2004: 58).

(viii) Learning disabilities

Learning disabilities are disorders that affect a broad range of academic and functional skills. These disorders interfere with the skills of learning and cause problems in academic performance (http://en.wikipedia.org/wiki/Learning_disability). Learning disability is a permanent neurological disorder that affects the manner in which individuals with normal to above average intelligence receive, retain and express information. Students with learning disabilities have special learning needs in areas requiring the functional use of listening, speaking, reading, writing, reasoning and arithmetic skills. This is the largest category in special education with 3.9 percent of the school-age populations with learning disabilities (Ysseldyke & Algozzine, 2006: 18).

Students with learning disabilities have normal intelligence but do poorly in their schoolwork. A learning-disabled child is not mentally retarded but has learning difficulties because of physical, emotional or social problems. Usually such children have normal cultural advantages and adequate learning opportunities, yet they fail to learn according to their abilities (Tilson, 2004: 53). More details are given in chapter 2.

(ix) Multiple handicap

Multiple handicap refers to more than one handicap in the child. These disabilities may be either congenital or acquired (Singh & Dash, 2005: 7). Students with multiple disabilities have special learning needs in more than one area requiring functional use of

Disabilities

skills. About 0.17 percent of the school-age populations are found to have multiple disabilities (Ysseldyke & Algozzine, 2006: 18).

Under the multiple disabilities category, a student must have at least two disabilities as defined under special education guidelines (Tilson, 2004: 60). For example, a child may be blind and deaf, blind and orthopaedically handicapped, deaf and orthopaedically handicapped and so on.

(x) Emotional disturbance

Emotional disturbance is another problem found among the schoolchildren. An emotionally disturbed child has certain inner tensions which create anxiety, frustration, fears and impulsive behaviour (Sharma, 2008: 60). Students with serious emotional disturbances have special learning needs in areas requiring functional use of social and emotional skills. About 0.09 percent of the school-age populations are found to have emotional disturbances (Ysseldyke & Algozzine, 2006: 18).

Students with emotional disturbance may have normal or above normal intelligence and would be capable of the same academic work as their peers if disruptive emotions or behaviours did not interfere. They are often frustrating and irritating to regular education teachers and classmates because they disrupt others' learning. Students with emotional disabilities often have no friends and they also do not get along well with their teachers (Tilson, 2004: 56).

(xi) Autism

The National Trust Act, 1999 defines autism as a condition of uneven skill development primarily affecting the communication and social abilities of a person, marked by repetitive and ritualistic behaviour (Singh & Dash, 2005: 8). Autism is a specific developmental disability that significantly affects verbal and non-verbal communication and social interaction skills. Autism disorders include impairment of social interactions, impaired language or communication skills, repetitive behaviour, restricted range of interests, poor motor skills etc (Ysseldyke & Algozzine, 2006: 19).

Students with the neurological disorder of autism usually develop symptoms by the age of three. Autism affects 1 person in 500 and the most affected are males (Tilson, 2004: 52).

(xii) Attention Deficit Hyperactivity Disorder

Attention Deficit Hyperactivity Disorder (ADHD) is another type of disability that affects children. Children with this disability are found to be hyperactive, inattentive or impulsive. The symptoms of ADHD include careless mistakes in schoolwork, trouble in organizing tasks and activities, forgetfulness in daily activities, excessive talking, interrupting conversations etc (Krithika, 2009 : 1).

ADHD is one of the most frequently monitored developmental syndromes and is known to occur across several cultures. About 5 percent of school-age populations are found to have this disorder (Chadha, 2008: 32).

1.3 SPECIAL EDUCATION FOR DISABLED CHILDREN

The identification of children with special educational needs is very much crucial at an early stage to help them cope with challenges in later life. There are some individuals who find it difficult to learn without special learning needs which arise out of sensory, intellectual, psychological or socio-cultural deficits. Such persons can be educated using special instructional methodology and instructional material and learning aids specific to special learning needs (Jangira & Mukhopadhyay, 1988: 1317). These needs have given rise to the component of education known as special education.

The term 'special education' includes all aspects of education which are applied to exceptional children – physical, mental, disadvantaged and gifted children. It includes all those aspects of education which are specific in addition to the regular programme for all children (Sharma, 2008: 9). It is different from general education in that it is so designed as to cater to the special requirements of children who need to be assisted to catch up with the rest of the class through the use of special gadgets or tools and instructional strategies that seek to bring out the best in them.

Special education is instruction designed for students with disabilities or talents or gifts who have special learning needs. Today's special education takes account of the fact that different students have different special needs. Some need help in dealing with the social and psychological problems they face as a result of their exceptionality. Special educational programmes not only challenge them intellectually, but also help them deal with their feelings of alienation. Other exceptional students need special services because of what they are not able to do, because some disabling condition limits their ability to learn in the typical educational programme (Yssedyke & Algozzine, 2006: 8).

The focus of special education is on learning, not just to pass exams, but to make the child a more effective and independent learner (Krithika, 2009: 1). The students with special learning needs require a modification of school practices or special educational services to develop to maximum capacity. As backward children and talented children need specific facilities for their development, educationists stress the importance of special education for them (Prameela, 2005: 8). Special teaching facilities are very much needed to meet the personal and social needs of these children.

Special education is quite vast in its objective, methodology and scope. It is goal-directed in the sense that it always carries purposeful instructions and well thought, well planned learning experiences to the children to help them in the realization of their needs and attaining maximum adjustment and progress as possible. It is also specialized in nature since it needs special teachers, special aids and special learning environment for making the special students learn. Also it is universal in the sense that it covers the needed education for each and every type of exceptional or special individual, without having any discrimination on the basis of age, caste, colour, sex, language, culture, socio-economic conditions, regionality or nationality (Mangal, 2007: 30-31).

1.4 KNOWLEDGE OF SPECIAL EDUCATION FOR TEACHER EDUCATORS

The destiny of a nation lies in the hands of a teacher. From this

it is evident that teacher educators play a pivotal role in the progress of a knowledge society. Teacher educators need to be providers of not only theoretical knowledge but also practical skills so as to equip them with the necessary inputs to deal with the special learning problems of children at various levels of schooling. So teacher educators must be exposed to different kinds of studies and training undertaken by experts in special education. They gain this exposure not only through reading or study but also through seminars, symposia, refresher courses or national and international conferences held for the dissemination of such knowledge. They also need to be lifelong researchers and do innovative experiments to corroborate the ideas they come out with (Kumar & Raja, 2010: 289).

Various educational services may help disabled learners to overcome their problems. Special educational programmes can be designed to meet the special needs of these learners. In addition, these educationally disabled students need a great deal of structured practice and immediate corrective feedback to develop their skills (Kumar & Raja, 2009 a: 12). So the teacher educators have to train the student teachers on how to deal with children who need special care and attention.

Using innovative instructional strategies like multimedia instructional strategy may facilitate learning in disabled learners. By these specialized approaches to teaching, most disabled learners can be helped to learn normally (Kumar & Raja, 2008: 93). The student teachers need to be made to realize the significant parts that audio-visual aids and other multimedia equipment play in enhancing the levels of comprehension for these learners.

Recognition of a pupil's disability and the creation of a congenial atmosphere help the disabled learners to lessen the severity of their disability. Today's special educators are called upon to create this kind of protective learning environment in a modern school that seeks to promote inclusive education. Teachers need to provide their students with positive role models and consistently treat individual differences and needs with patient acceptance and special effort. There needs to a healthy interaction between the

teachers and parents to identify the special needs of these children (Kumar & Raja, 2009 b: 18). It is the responsibility of teacher educators to turn schoolteachers into good counsellors for the context of their interaction with administrators, parents and even the peers of these children.



LEARNING DISABILITIES

Education is considered to be a powerful instrument in developing the basic skills that are needed for learning. Various skills such as listening, thinking, speaking, understanding, reading, writing, reasoning, calculating etc, are essential to achieve in academics. All pupils are unique individuals with different patterns of strengths and weaknesses. They may have multifarious abilities or disabilities in different areas of learning. They differ considerably in their cognitive abilities. Some children learn quickly while others may struggle even to master basic concepts and academic skills. Some may excel in one area but may perform poorly in some other area of learning. They also show a variety of emotional characteristics. Some appear to be more confident about their abilities while others may lack self-confidence because of their weaknesses in learning.

In schools, teachers come across certain children who have diverse learning abilities and special learning needs. Some of the learners achieve high and some may lag behind in their learning. Most students have problems in school at one time or other. Some children, despite being normal have difficulty in learning or remembering the school subjects. This difficulty in learning is observed mostly in academic areas such as reading, writing or arithmetic. This inability might be the result of a learning disability.

Disorders like reading and writing disabilities, arithmetic disabilities etc are either ignored or not understood and the children suffer for no fault of theirs. Children with learning disabilities are low achievers and they are found to be unable to cope with the school work. Different kinds of learning disabilities can be found among such schoolchildren and there may be a great deal of variation between these individuals. These individuals find it difficult to learn without special care. Children with such problems

may be slow learners, average learners or even gifted ones. Also they may have normal hearing and vision. But they may lack the ability to acquire the basic academic skills. These children are ignored in the classroom due to lack of skills and may be often considered to be lazy, inattentive or stupid by their teachers.

The difficulties that children face in the learning process have begun to attract serious attention. It has become a real educational handicap and a widespread issue in today's society. It is a great challenge on the part of teachers and trained educational specialists to deal with those children with learning disorders through the use of innovative educational strategies.

2.1 HISTORY OF LEARNING DISABILITIES

Learning disability is an umbrella term coined in the 1960's. In the year 1962, Samuel Kirk first used the term to describe the children who had specific learning deficits (Reddy & Sujathamalani, 2003: 38). He suggested the word 'learning disabilities' to describe all the child's behavioural symptoms that arise from dysfunction of the central processing mechanisms. This term described a group of children who had disorders in the development of language, speech, reading and associated communication skills needed for social interaction. Children with sensory and emotional handicap are excluded from this category (Panda, 1997: 179).

Learning disability is the most recent addition to the categories of special education. Among students with disabilities, learning-disabled is the largest group currently being identified and provided special education services. Students with learning disabilities may be identified at any age, but most of them are first noticed in early elementary school grades (Ysseldyke *et al*, 1998). No area of special education has experienced so much rapid growth, extreme interest and frantic activity as learning disability. The number of children with learning disabilities has increased rapidly in the recent years making this category the largest in special education (Baral, 2005: 9). Among the group of students who receive special education, nearly half are included in the specific learning disabilities category (Balamurali, 2009: 176).

2.2 CONCEPT OF LEARNING DISABILITIES

A learning disability is found across all ages and in all socio-economic classes. Learning disabilities may affect individuals differently at different stages of life—early childhood, elementary school years, adolescence and adulthood. Students with learning disabilities may be identified at any age, but most of them are first noticed in early elementary school grades (Ysseldyke & Algozzine, 2007: 247).

Learning disability is a challenging area of special education and a real problem in today's society. It is a problem which is always associated with academic performance. The global concept of learning disabilities includes problems in listening, concentrating, speaking, thinking, memory, reading, writing or social skills (Santrock, 2001). There are a variety of skills impacted by learning disabilities which include language and reasoning abilities as well as calculation and motor skills.

A learning disability is not a type of mental retardation as mistaken by many people. Learning disabilities do not include problems that are primarily the result of intellectual disabilities, emotional disturbances or visual and auditory disabilities. Even though a learning disability may occur with other handicapping conditions or environmental influences, it is not the direct result of these conditions or influences. The learning-disabled have significant problems in developing academic skills that are not due to handicapping conditions such as sensory impairment, mental retardation and social or emotional disturbances (Panda, 1997: 179).

The learning-disabled are those who function at high intellectual level, but who have a specific academic deficit coupled with an executive processing deficit. Such deficits often involve memory and perception, resulting in weaknesses in reading, writing or mathematics (Biswas, 2002). The study of learning disability or specific learning dysfunction is one of the most controversial, dynamic and significant areas in special education. The field of learning disabilities is distinctly multidisciplinary, a fact which has influenced the controversy surrounding every aspect of the field, from defining the learning-disabled to planning intervention strategies (Smith *et al*, 1983: 338).

Learning-disabled children are ignored in the classroom due to lack of skills and may be often considered to be lazy, inattentive or stupid by their teachers. There is a great difference between their expected performance and their actual performance since there is a great discrepancy between their ability and achievement. Such children may have difficulty in receiving accurate information and expressing it correctly. There is a great difference between their expected performance and actual performance. Children with learning disabilities may be very slow and lag far behind when compared to other children of their age. This isn't because the child is stupid, lazy or careless. The child just learns differently (Chadha, 2006: 2).

The famous scientist Albert Einstein had inability to remember even the timetable in school. Unlike most of his contemporaries, he was not very well in reading and spellings often defeated him. He began attempts to speak only at the age of three and had trouble with language throughout the elementary school days. To most of the teachers, he was a borderline retarded and some of them even dared to recommend him to attend a trade school. Actually, he was suffering from dyslexia (Das, 2006: 1).

Wernher Von Braun, the father of rocketry, flunked 9th grade Algebra. Being a gifted child, he suffered strange childhood incongruencies in development. Wernher Von Braun had dyscalculia in his early school days and later on he could overcome it and rise high in life (http://www.braingym.ie/main/page_conditions_dyscalculia.html)

Thomas Alva Edison was a brilliant scientist and inventor. He was thrown out of school when he was 12 because he was thought to be dumb. He was noted to be terrible at mathematics, unable to focus, and had difficulty with words and speech. It was very clear, however, that Edison was an
Contd.

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 extremely intelligent student despite his poor performance in school. Hard work and perseverance helped Thomas Edison focus his keen insight and creative abilities on the development of ingenious tools that have laid the foundation for our modern society (<http://www.dyslexiaonline.com/famous/famous.htm>).

Leonardo Da Vinci was also believed to suffer from a number of learning disabilities including dyslexia and attention deficit disorder. Some believe that the initiation of many more projects than he ever completed suggest that he had attention deficit disorder. Strong evidence in Da Vinci's manuscripts and letters corroborates the diagnosis of dyslexia. It appears that Leonardo wrote his notes backwards, from right to left, in a mirror image. In addition to the handwriting, the spelling errors in his manuscripts and journals demonstrated dyslexia-like language difficulties. Da Vinci overcame his learning disabilities by funneling his creative talents into visual depictions of his thoughts (<http://www.dyslexiaonline.com/famous/famous.htm>).

The famous statesman Winston Churchill could be called academically disadvantaged. He failed grade eight, did terrible in math and generally hated school (http://dyslexiamylife.org/who_els.html).

Learning-disabled children are found nearly in every classroom. They do not normally acquire the basic skills of reading, writing or arithmetic from regular classroom instruction. The learning-disabled have learning problems consisting of a number of subtypes. A student with a specific learning disability may be strong in one area but may perform poorly in another area of learning. They may be disabled in learning in spite of the availability of all the conventional learning styles and socio-cultural opportunities.

Consequently, their self expectations, level of aspiration and general motivational levels get unnecessarily diminished (Kumar & Raja, 2009 b: 14).

The difficulties in learning to read, write, or calculate occur despite adequate intelligence, sensory integrity or emotional development. It is represented as discrepancy between the learner's achievements and his/her ability to learn. Unexpected underachievement has been attributed to intrinsic neurological factors which indicate that students with learning disabilities require specialized instruction to perform at expected levels.

2.3 MEANING OF LEARNING DISABILITIES

Many children with special educational needs, found in various schools may face difficulties in acquiring academic skills such as reading, spelling, writing, speaking, understanding, listening, thinking or arithmetic. Some of these children excel in many areas other than the problem area. Others are merely slow in acquiring school related skills. These children are described by a wide variety of labels such as learning-disabled, slow learners, educationally handicapped and children with specific learning disabilities (Karanth & Rozario, 2003: 17).

Learning disorders damage a child's ability to learn. One of the objectives of school education is to impart the knowledge of 3 R's - Reading, wRiting and aRithmetic. But in most schools, it can be found that there are certain students who have learning disabilities which impact the ability to learn the basic skills of reading, writing or arithmetic. If a student has significant ongoing problems with the "3 R's", then he or she may be called learning-disabled (Vashistha & Bhardwaj, 2006: 115).

Learning disabilities are disorders in one or more of the psychological processes involving understanding or in using spoken or written language. Children with special learning disabilities exhibit a disorder in one or more of the basic psychological processes involved in using spoken or written language. These may be manifested in disorders of listening, thinking, talking, reading, writing, spelling or arithmetic (Nakra, 1996: 8). The U.S office of

Education defines a learning disability as a disorder in one or more of the psychological processes involved in understanding or in using language, spoken or written which may manifest itself in an imperfect ability to listening, think, speak, read, write, spell or to do mathematical calculations (Nakra, 1996: 10).

Learning disabilities are problems that affect the brain's ability to receive, process, and analyze or store information. These problems can make it difficult for a person to learn as quickly as someone who isn't affected by learning disabilities (Lakshmi, 2008: 18). Often, learning disabilities are described in terms of the specific domain that is affected. They are described in a number of ways, depending on the perspective and purpose of the analysis. There is a strong genetic component in the development of a learning disability. The difficulties in the acquisition of basic skills are caused by irregularities in the way the brain receives and processes information (Hannell, 2006: 116).

2.4 PROBLEMS OF LEARNING-DISABLED CHILDREN

Learning-disabled children are found to have a variety of disorders which may affect their performance in academics. The characteristics that children with learning disabilities exhibit are specific learning problems in the area of reading, writing, spelling or arithmetic, disorders of speech and language, disorder of memory and thinking, perceptual impairment, general co-ordination deficits, emotional liability, hyperactivity, impulsivity etc (Reddy & Sujathamalini, 2003: 38).

Children with learning disabilities suffer from severe learning problems in the same way as experienced by mentally handicapped children or physically handicapped children in terms of their mental abilities or physical abilities respectively. Learning-disabled children face a host of academic and non-academic difficulties. Academic difficulties include problems in reading, spelling, writing, and mathematics. Non-academic difficulties include motor problems, perceptual problems, phonological processing difficulties and language problems. In addition to these primary characteristics of learning disabilities, there are also secondary consequences of

learning disabilities such as poor motivation, self-esteem, self-efficacy and metacognition (Karanth & Rozario, 2003: 18-19).

Children with learning disabilities exhibit a disorder in one or more of the basic psychological processes involved in using spoken or written language. These may be manifested in disorders of reading, writing or arithmetic. Children with learning disabilities exhibit a wide range of symptoms. These include problems with reading, comprehension, spoken language, written language, mathematics, reasoning, memory etc. Hyperactivity, inattention and perceptual coordination may also be associated with learning disabilities but are not learning disabilities themselves.

The symptoms of learning disabilities manifest in one or more of the areas such as reading, spelling, written language, visual and auditory processing, mathematical computation, problem-solving etc. The symptoms (<http://www.tntech.edu/disability>) that are commonly related to learning disabilities are listed below :

- Slow reading and writing
- Poor handwriting
- Reversal of letters and numbers
- Slowness in completing work
- Poor organization of skills
- Difficulty with abstract reasoning or problem solving
- Disorganized thinking, impulsive behaviour
- Poor peer relationships
- Difficulty in making decisions
- Difficulty in temporal concepts
- Reversals in reading and writing
- General awkwardness
- Poor visual-motor co-ordination
- Difficulty in organizational, time management and social skills
- Difficulty in copying materials
- Frequent misspellings and grammatical errors

- Difficulty in paying attention in class
- Difficulty in recalling sequence of operations etc

2.5 TYPES OF LEARNING DISABILITIES

Specific learning disabilities call for focused instruction and guidance. A child with a learning disability has problems in most types of subject matter while a child with a specific learning disability has a major problem with one type of subject material like arithmetic (Jaya & Geetha, 2004: 1). A specific learning disability is marked by significant difficulties in the acquisition of basic skills in reading, written language or mathematics. These difficulties occur despite adequate instruction and normal intelligence. A specific learning disability is due to a dysfunction in the way the student processes and receives information (Hannell, 2006: 116).

There are different kinds of learning disabilities such as *dyslexia* (difficulty in reading and spelling), *dysgraphia* (difficulty in writing), *dyscalculia* (difficulty with mathematical calculations), *dyspraxia* (difficulty with acquisition of patterns of movement), *dysphasia* (difficulty in speaking and understanding), *dysnomia* (difficulty with memory retrieval), *dysarthria* (difficulty with motor speech) and so on. These are called specific learning disabilities. They are specific in the sense that each of these disorders significantly affects a relatively narrow range of academic and performance outcomes (Mangal, 2007: 233).

2.5.1 Dyslexia

The term 'dyslexia' has been derived from the Greek words 'dys' and 'lexis' which means difficulty with words. It refers to difficulty with words spelt, words pronounced, words written and association of meanings with words (Pollock & Waller, 1997: 1). Dyslexia is a learning disability that causes difficulty in reading and spelling, but does not affect intelligence. According to the World Federation of Neurology, dyslexia is a disorder manifested by difficulty in learning to read despite conventional instruction, adequate intelligence and socio-cultural opportunity (Nakra,

1996: 80). It is basically a reading disability or inability to read which indicates that there is something wrong with the child (http://www.slowlearner.co.in/learning_disability.htm).

The specific deficits in the majority of dyslexics are in phonological coding, although visual-spatial problems can be found in a minority of poor readers (Dutta, 2000: 12-13). The symptoms of dyslexia include slow or inaccurate reading, poor spelling, poor writing or mixing up similar words. Dyslexic children may also have difficulty in recognizing words or letters, in associating sounds with letters or in making a word out of a combination of letters. They face severe problems when complex language skills are required such as grammar, understanding textbook material and writing essays (http://www.ldonline.org/article/Dyslexia_Basics).

2.5.2 Dysgraphia

Dysgraphia is a learning disability that causes difficulty in writing. It is a learning disorder marked by special difficulties in learning to write, chiefly in forming sequences of letters into words and sentences (Vashistha & Bharadwaj, 2006: 120). Dysgraphia is the disability in learning to write which is out of harmony with the other intellectual accomplishments and manual skills of the individual (Nakra, 1996: 124). Dysgraphia can occur as difficulties with spelling, poor handwriting and trouble in expressing thoughts on paper. It is a learning disorder resulting from the inability in expressing thoughts in writing and graphing (<http://www.ldonline.org/article/12770>).

The symptoms of dysgraphia include mixture of upper and lower case letters, irregular letter sizes and shapes, pain while writing, talking while writing etc. Moreover spelling mistakes, punctuation errors, irregular letter sizes and shapes, slowness in writing and copying, poor handwriting etc are the various symptoms found in dysgraphic students (<http://en.wikipedia.org/wiki/Dysgraphia>). Other symptoms include incorrect pencil grip, reversing letters and numbers, writing words or letters out of order, inconsistent spellings, inadequate space between letters or words, omission or substitution of letters or words while writing, difficulty

in organizing thoughts on paper, avoiding writing or drawing tasks (http://www.slowlearner.co.in/learning_disability.htm).

2.5.3 Dyscalculia

Dyscalculia is a learning disability that affects mathematical calculations. The word dyscalculia means difficulty in performing mathematics calculations (Vashistha & Bharadwaj, 2006: 120). It is a condition which can be defined as the inability to develop mathematical concepts, difficulty in implementing calculation procedures or to reason with numbers. Dyscalculia is a type of specific learning disability that refers to innate difficulties in learning or comprehending mathematics. It refers to calculation and number memory deficits. It also refers to mathematical reasoning abilities as well as difficulties with arithmetic operations (<http://en.wikipedia.org/wiki/Dyscalculia>).

Children with dyscalculia suffer from various learning problems such as inability in differentiating between sizes, shapes and quantities, inability to do counting, difficulty with fundamental operations of addition, subtraction, multiplication and division, difficulty in telling time, difficulty with problem solving skills etc. (http://www.slowlearner.co.in/learning_disability.htm). Arithmetic involves recognizing numbers and symbols, memorizing facts, aligning numbers and understanding abstract concepts like place value and fractions. Any of these may be difficult for children with dyscalculia. Problems with numbers or basic facts are likely to occur in the early school grades while problems with reasoning are found in the later grades (<http://www.ldonline.org/article/>). More details are given in the chapters from 4 to 8.

2.5.4 Dyspraxia

Dyspraxia is a learning disability that causes difficulty with patterns of movement. The word 'dyspraxia' comes from the Greek words 'dys' which means impaired or abnormal and 'praxis' which means action or deed. It is also called as motor learning difficulty. Dyspraxia denotes one or all of a heterogeneous range of development disorders affecting the initiation, organization and performance of action. It denotes the partial loss of the ability to

coordinate and perform certain purposeful movements and gestures, in the absence of other motor or sensory impairments like multiple sclerosis or Parkinson's disease (<http://en.wikipedia.org/wiki/Dyspraxia>). Dyspraxia generally refers to difficulty in coordination. Dyspraxia means a difficulty with the acquisition of patterns of movement. It can affect hand or eye coordination, especially handwriting and organization (Pollock & Waller, 1997: 1).

The symptoms of dyspraxia include difficulties in learning basic movement patterns, inability in establishing the correct pencil grip, difficulty in developing a desired writing speed, handaching while writing, poor balance, difficulty combining movements into a controlled sequence, difficulty in remembering the next movement in a sequence, problems with spatial awareness, trouble in picking up and holding onto simple objects due to poor muscle tone. Cross-laterality (confused directionality), ambidexterity (use of both right and left hands), and a shift in the preferred hand are also common in pupils with dyspraxia. Dyspraxic children may also have trouble determining the distance between them and other objects (<http://en.wikipedia.org/wiki/Dyspraxia>).

2.5.5 Dysphasia

Dysphasia is a learning disability that causes difficulty in speaking and understanding. It is a language disorder in which there is impairment of speech and of comprehension of speech. The term *aphasia* is also used to refer to this disorder. Learning to interpret and express can occur but only with great difficulty (<http://en.wikipedia.org/wiki/Dysphasia>). Dysphasia is a language disorder which indicates loss of language due to brain damage or dysfunction (Reddy *et al*, 2005: 237). When a person is unable to comprehend the spoken word, it is receptive dysphasia which is believed to be the result of injury, disease or maldevelopment of the brain (Bains, 2003: 89-90). When the person is unable to express words in speech, it is called as expressive dysphasia. Depending on the area and extent of the damage, someone suffering from aphasia may be able to speak but not write, or vice versa, or display any of a wide variety of other deficiencies in language

comprehension and production, such as being able to sing but not speak.

The symptoms of dysphasia include inability to comprehend language, inability to pronounce not due to muscle paralysis or weakness, inability to speak spontaneously, inability to form words, inability to name objects, poor enunciation, excessive creation and use of personal neologisms, inability to repeat a phrase, persistent repetition of phrases, substituting letters, syllables or words, inability to speak in a grammatically correct fashion, alterations in inflexion, stress, and rhythm, incomplete sentences, inability to read, inability to write and so on (<http://en.wikipedia.org/wiki/Dysphasia>).

2.5.6 Dysnomia

Dysnomia is an inability to retrieve names or recall appropriate words for oral and written language (Dakshinamurthy, 2009: 14). This disorder can affect speech skills, writing abilities, or both. Normal individuals occasionally suffer from problems in recalling words. This only becomes a medical condition when the recalling problems interfere with daily life. Dysnomia can develop because of brain trauma and it impairs an individual's ability to succeed in speech and writing tasks (<http://en.wikipedia.org/wiki/Dysnomia>).

Individuals with dysnomia often have an auditory memory problem. They are not able to remember what they hear. Some have a problem with remembering what they see or experience (<http://dutchcorner.blogspot.com/2007/10/dysnomia.html>). Dysnomics have difficulty retrieving words or may replace a word with a synonym in an attempt to express their thoughts. They will take longer time to complete tests or leave timed tests incomplete. They may pause or appear to struggle when trying to recall words or names (<http://en.wikipedia.org/wiki/Dysnomia>).

2.5.7 Dysarthria

Dysarthria is a motor speech disorder resulting from neurological injury, characterized by poor articulation. Dysarthric speech is due to some disorder in the nervous system

(<http://en.wikipedia.org/wiki/Dysarthria>). This disorder is associated with the production of speech. It is due to a weakness or non-coordination of the speech muscles (Dakshinamurthy, 2009: 13).

The symptoms of dysarthria in children are slurred speech that is not articulated clearly, slowed speech, excessive loud or soft speech, difficulty in controlling the speech volume, speaking with a lot of effort and lacking breath control, difficulty in controlling pitch (<http://www.buzzle.com/articles/dysarthria-in-children.html>). Speech of individuals with dysarthria is always slow, weak, imprecise or uncoordinated. Children with dysarthria often have difficulties with language, learning and other aspects of motor development (Dakshinamurthy, 2009: 13).

2.6 CAUSES OF LEARNING DISABILITIES

There is no specific cause of a child's learning disability. Scientists believe that most learning disabilities result from minor damage to the brain. A child may also inherit a learning disability. Disabilities can also result from a lack of the early learning experiences that stimulate mental growth and development. These experiences include hearing language and manipulating objects. Learning difficulties could be either inherited or acquired. They are neither caused by cultural and linguistic differences nor by poor instruction. Learning difficulties are not due to visual, hearing or motor handicaps, mental retardation or emotional disturbance although they may occur concurrently with any of these (Raja, 2002: 57).

There is a great deal of confusion regarding the exact causes of learning disabilities. The causes of learning disabilities are not well understood and sometimes there is no apparent cause for a learning disability (http://en.wikipedia.org/wiki/Learning_disability). Depending on the types of learning disabilities found in the children a number of researches have been conducted to find out the possible factors or causes of learning disabilities.

Generally the factors causing learning disabilities may be found to fall in three categories namely genetic or hereditary factors,

environmental factors, and organic or physiological factors (Mangal, 2007: 235). Hereditary or genetic influences can cause learning problems among children. Experts have noticed that learning disabilities tend to run in families and they think that heredity may play a role (Lakshmi, 2008: 19). Environmental factors may also be responsible for learning disabilities. Unstimulating environment at home may develop learning disability (Rao, 2005: 10). Organic factors or physiological factors also have a role in the cause of learning disabilities. Learning disabilities arise due to minimal brain dysfunction which occurs in the central nervous system (Panda, 1997: 179).

In addition to that, learning disabilities may also be caused by educational or psychological factors. Educational factors include unskilled and inefficiently trained teachers, too high or low expectation of teachers towards students and inappropriate materials and curriculum. Learning disabilities may be caused by psychological factors such as poor perception and lack of conceptualisation, unhealthy classroom climate and lack of scholastic motivation (Rao, 2005: 10).

2.7 INTELLIGENCE AND LEARNING-DISABLED CHILDREN

A misconception that was quite prevalent in the past but quickly dying out as a result of research and spreading awareness is that a student with a learning disability lacks in intellect. The fact is that children with learning disabilities are as smart and in certain cases even smarter than their peers. Learning-disabled children have intelligence in the near average, average or above average range. But they are unable to acquire and use information efficiently because of weaknesses in memory, attention, perception, language and motor skills. According to Tandon, children with learning disabilities have an average IQ of at least 90 to 110 (Saravanabhavan, 2008: 222).

Children with learning disabilities have near average, average or above average intelligence but they are unable to acquire and use information efficiently because of weaknesses in memory,

attention, perception, language and motor problems. Learning disabilities are intrinsic to the individual and may affect learning and behaviour in any individual, including those with potentially average or above average intelligence (Raja, 2002: 56).

Learning-disabled children may have average or above average intelligence and they also have normal hearing and vision. And also they may be slow learners, average learners or even gifted children. But they apparently cannot use information transmitted by the senses to the brain as accurately as most other children. Therefore they may do poorly in school or not as well as they can (Kumar & Raja, 2008: 87).

In spite of having average or above average intelligence, many children perform poorly in academics. A child who is otherwise intelligent but does not meet the expectations of parents or teachers in academic activities has been the subject of research all across the globe (Karanth & Rozario, 2003). This inability to acquire academic skills might be the presence of a learning disability, a disorder that interferes with the development of the basic skills needed for learning. Such disorders damage a child's ability to learn. Children with such disorders are ignored in the classroom due to lack of skills and may be often considered to be lazy, inattentive or stupid by their teachers. There is a great difference between their expected performance and their actual performance since there is a great discrepancy between their ability and achievement. Children with learning disabilities may be very slow and lag far behind when compared to other children of their age. This isn't because the child is stupid, lazy or careless. The child just learns differently (Chadha, 2006: 2).

Impairments of skills in the areas of reading, writing and calculation among children which occur despite appropriate levels of intelligence are called specific learning disabilities (Karanth & Rozario, 2003). Specific learning disabilities call for focused instruction and guidance. A child with a learning disability has problems in most types of subject matter while a child with a specific learning disability has a major problem with one type of subject material like arithmetic (Jaya & Geetha, 2004: 1).

A specific learning disability is marked by significant difficulties in the acquisition of basic skills in reading, written language or mathematics. These difficulties occur despite adequate instruction and normal intelligence. A specific learning disability is due to a dysfunction in the way the student processes and receives information (Hannell, 2006: 116).

2.8 LEARNING DISABILITIES AND EMOTIONAL PROBLEMS

Emotions play a great role in the development of a child's personality. The intellectual and social development of an individual is controlled by emotional behaviour and experiences. Emotion is perhaps the most complex of all dynamic processes underlying human behaviour. According to English and English, "Emotion is a complex feeling accomplished by characteristic motor or glandular activities" (Prasad, 2006).

Emotional stability is an important and useful state of being. It is the ability of the character to remain stable in times of stress. With emotions managed and under control, one would be able to handle any situation in life in a successful manner. Emotions serve as a guide in one's life. With a well rounded life, one would have better emotional stability, allowing one to correctly interpret situations (<http://www.drjerm.com/Emotional-Stability/Emotional-Stability.php>).

The day-to-day difficulties experienced by students with learning difficulties may give rise to emotional disturbance. Students who experience significant difficulties in learning despite the fact that they are intellectually bright as their peers may lose self-esteem through continued difficulties and failures in the classroom. The day-to-day difficulties experienced by students with learning difficulties may give rise to emotional disturbance (Hannell, 2006: 118).

2.8.1 Emotional Problems of Learning-disabled Students

Learning-disabled children are found to have various emotional problems. Children with learning disabilities often show signs of frustration and low self-confidence. Learning-disabled children

have problems with social relationships and have unreasonable self-expectations. Also they appear to be lazy and emotionally disturbed. They also exhibit various other characteristics such as frequent shifts in emotional moods, distractibility, inattention etc (Neilson, 2002: 104).

Learning-disabled children are more anxious and withdrawn, have behaviour problems, and are less socially skilled. They have lower levels of aspiration and motivation than their non-disabled peers. They often have frequent temper outbursts, but for no reason. They are also found to be emotionally liable and unstable. Emotional instability arises mainly due to lack of contact with the outside world which generates frustration.

Researchers have found that in addition to academic difficulties, students with learning disabilities have social skills deficits and are likely to be rejected or neglected by their peers than students without learning disabilities. Kazemi (2006) on studying the psychological factors in learning disabilities found that low social adjustment of students with learning disabilities leads to social inefficacy which then leads to heightened depression. Albert and Miranda (2005) while examining the social skill differences among at-risk youth diagnosed with learning disability found that the social skills learned by the youth participants regardless of their disability is dependent on their environment.

The complex interaction of the learning-disabled children and the society may be recognized as a source of handicapping emotional problems. Societal expectations produce a damaged sense of self on the emotional development of such children. Once a child learns that he/she has limited ability to initiate actions successfully, the child may become unable to act, may compensate for it by becoming aggressive or may try to hide his/her inability through overcompensation (Reid & Hresko, 1981).

2.8.2 Developing Emotional Stability of Learning-disabled Students

Various learning experiences are to be provided to children in order to develop their physical, mental and emotional abilities.

Emotional intelligence is what gives a person a competitive edge (Singh, 2001). In the words of Daniel Goleman, emotional intelligence is "the capacity for recognizing our own feelings and those of others, for motivating ourselves, for managing emotions well in ourselves and in our relationships".

The components of emotional intelligence namely self-awareness, self-regulation, motivation, empathy and social skills (Goleman, 1998) are needed to develop the emotional stability of learning-disabled students. *Self-awareness* refers to the awareness of the self as separate from the thoughts that are occurring at any point in time. *Self-regulation* or self-control is the ability to control one's emotions, behaviour and desires in order to efficiently manage one's future. *Motivation* is the activation or energization of goal-orientated behaviour. *Empathy* is the capability to share another being's emotions and feelings. A *social skill* refers to any skill facilitating interaction and communication with others.

Since the learning-disabled child represents a whole person, including a psychological self which is as important as the child's academic self, any programme which attempts to deal with only the educational aspects is inadequate. Apart from teaching the children to read, write and do arithmetic, teachers must also provide conducive learning environments to children, which are supportive to their emotional development and stability. For many children with emotional problems, supportive services or intervention outside the classroom are essential. Brown (2002) on assessing the impact of a holistic residential intervention of students with learning disabilities found that the students had improved on the course of the school year as perceived by parents, dorm parents and themselves.

Teachers and parents have a great role to play in bringing emotional development among learning-disabled children. Home atmosphere exercises a good amount of influence over the emotional stability of such children. Teachers should seek active co-operation of parents in making the home atmosphere suitable for their proper emotional development. They need to co-operate together in designing appropriate programmes at home and school to bring

about positive emotions for learning-disabled children. Also instead of accusing students of being unmotivated and lazy, parents and teachers need to observe the children more closely at home and school and have them evaluated by trained personnel for the presence of any type of learning disability (Saravanabhavan, 2009: 6).

There is no greater gift a teacher can give to his students than laying the foundation for their emotional health, positive self-esteem etc through fostering emotional stability in them. Developing emotional stability provides the fuel to mould a child's self-esteem and feelings of self-worth through positive approaches towards problems confronted in life. It has the power to transform children's misguided actions into more fruitful work. It focuses on strengths and positive attributes and acceptance for effort. Murik (1994) on examining a set of curricular strategies aimed at reducing the emotional disturbances and remedying the reading disabilities on ten teenagers found that designing curricular strategies which serve to satisfy a child's need for emotional security can facilitate learning.

Appropriate guidance and counselling may be required for learning-disabled children to reduce their anxiety and frustration and to develop confidence, positive attitude and high self-esteem. Children need to understand and be guided by their teachers in coping with their learning problems. Counselling by teachers can assist students with learning disabilities to develop greater awareness of their disability and to understand how they have to adapt and adjust to their limitations and strengths. It is hoped that by motivating the youth for introspection and self-analysis, the desired results would be achieved (<http://www.rkmissiondel.org/inside/activities/education.htm>).

Teachers can help students to promote self-determination which help them to make effective choices and decisions. It is necessary for students to understand their strengths and limitations together with a belief that they are capable and effective which are essential for self-determination. Children need to know how to handle mistakes in a positive manner. The stigma attached to learning

disabilities leads many students to hide their disabilities, inhibiting the development of self-confidence and belief in themselves (<http://www.ericdigests.org/2004-2/self.html>).

It is essential to identify students with learning disabilities as early as possible to prevent or alleviate the frustration and failure these students face. Early diagnosis is important so that students with learning disabilities do not become terribly frustrated and discouraged. Students with learning disabilities may try to compensate for their problems and develop bad learning habits or they may begin avoiding certain subjects out of fear of not being able to handle the work. To prevent these things from happening, early intervention programmes are essential (Woolfolk, 2004).

Without developing emotional stability, students will not be able to face life with confidence and courage. The purpose of positive intervention programmes will be of great help to pupils to overcome their disabilities and to make effective choices and decisions in their ways of learning. It is by being emotionally stable that students can have the power to cope with their learning problems. Hence, the focus should be on how to convert the learning-disabled children into a resourceful sector so that they could become assets and not liabilities.

2.9 LEARNING DISABILITIES AND SELF-ESTEEM

Self-esteem refers to a favourable or unfavourable attitude towards the self. Psychologists usually regard self-esteem as an enduring personality characteristic. Self esteem is a concept of personality and for it to grow, one needs to have self-worth. Self-esteem exerts a powerful influence on people's expectations, their judgements about themselves and others and their behaviour. People with high self-esteem generally enjoy a great deal of self-confidence and have a realistic assessment of their strengths and weaknesses. In contrast, people with low self-esteem are generally less willing to put their ideas about themselves to the test and are never convinced of their self-assessment (Prema & Raja, 2005).

Self-esteem reflects the extent to which persons develop an attitude about themselves. It is something experienced as a part of,

or background to, all of the individual's thoughts, feelings and actions. It is affected by a wide range of influences that range from formative childhood experiences in relation to one's standards or ideals. Lack of self-esteem and a negative self-image are reflected in failure-oriented people who downgrade themselves. Repeated failures in the school years exert one's most damaging effects on self-esteem (Martin, 1977).

2.9.1 Problems with Low Self-esteem

Difficulties from learning disability can cause problems in self-esteem. There are various consequences of learning disabilities such as little motivation, low self-esteem, less self-efficacy etc (Karanth & Rozario, 2003: 18-19). Students who experience significant difficulties in learning despite the fact that they are intellectually bright as their peers may lose self-esteem through continued difficulties and failures in the classroom. Frustrated with their learning difficulties, most of these children act disruptively and acquire negative feelings of self-concept (Jaya & Geetha, 2004: 2).

The learning-disabled children may often become very frustrated and lose motivation because of their continual struggles with learning. Low self-esteem may be a consequence of enduring learning difficulties and failing to achieve academically at any age level. Students may be disabled in learning in spite of the availability of all the conventional learning styles and socio-cultural opportunities. Consequently, their self expectations, level of aspiration and general motivational levels get unnecessarily diminished (Hannell, 2006: 118).

Peterson (1991) while studying student behaviour, self-esteem and academic achievement among regular and special education students found that the learning-disabled displayed significant behaviour problems compared to the regular education group. A study conducted by Blake (1989) reveals that children with learning disabilities have less self-esteem compared to children without learning disabilities. Use of a self-esteem scale to study the verbal skills among students in general education, students with learning disabilities and those with mild or moderate handicaps respectively

revealed significantly lower self-report scores for the subjects with learning disabilities (Debra, 1989).

2.9.2 High Self-esteem as a Coping Strategy

Self-esteem is a critical factor for an individual's academic achievement, learning motivation, emotional well-being and social adjustment. While studying the effects of inclusion of students with learning disabilities in academic and non-academic activities on self-esteem, it is found that school-based activities and community-based activities make the students feel good about themselves and increase their self-esteem (Chang, 2002). Snowden (2003) while studying the effects of inclusion on the anxiety and self-esteem of special education students in the regular classroom found that self-esteem could support academic success and could help to improve instruction for special education students, particularly those enrolled in inclusive classrooms.

Self-esteem determines the extent to which individuals see themselves as competent and satisfy their needs. High self-esteem helps one to feel better about themselves. Those with high self-esteem are more likely to value their looks, abilities and so forth. Psychologists have studied that academic achievement can be boosted by raising self-esteem with positive images. It helps one to succeed through positive mental attitudes. Thus boosting a child's self-image may also boost school achievement (Myers, 2002). A child with a high self-esteem considers himself or herself as worthy of other children. Only such children can take advantage of education and improve themselves (Prema & Raja, 2005).

Research continually shows a drop in self-esteem through transition from elementary to middle school. Miller (2002) in their investigation found that a learning environment which is learner-centred results in higher self-esteem. While studying the academic success among at-risk students during the transition from elementary to middle school, self-esteem is found to be a significant factor for school success (Robert, 2002).

Self-esteem is the personal evaluation of oneself and the resulting feelings associated with the self-concept. Thurman (2000)

on their findings from student interviews reveal that academic self-concept of ability may produce a more positive correlation between academic achievement and self-esteem. Healthy self-esteem is a capacity to see oneself as valuable and competent and having certain unique talents and a worthwhile personality. According to Berne and Savary (1991), self-esteem is enhanced in children when they know that they have sufficient capacity to accomplish a task. Children with healthy self-esteem are usually self-confident which make them successful.

Healthy self-esteem is an essential component for learning. Regardless of age, the self-esteem of a learner facilitates learning. Learning is growth – intellectual, physical, psychological, social, spiritual and combinations of those. In every aspect of this learning process, there is the potential to maintain or increase self-esteem. Self-esteem in most students mirrors the appraisals of others, in particular parents and teachers. Teachers' views clearly affect learners' achievements. Positive appraisals over an extended time tend to increase the level of learning. Positive attitudes about oneself can help cope with learning disabilities. Hence children with such learning disorders need to be encouraged to make the maximum utilization of their potentialities.

Children who believe in their own competence and effectiveness and who have an internal locus of control cope better and achieve more than those with a helpless, pessimistic outlook. Facing failure, children with high self-esteem sustain their self-worth by perceiving other people who also fail. The children at this level are able to function well in interpersonal situations. Thus they develop the desire for achievement and competence, reputation and prestige (Aggarwal, 1994).

2.10 EVALUATION TECHNIQUES FOR LEARNING-DISABLED CHILDREN

Techniques of evaluation are those ways and means that help to measure and assess teaching-learning outcomes. Evaluation of pupil's progress is a major aspect of the teacher's job. A good picture of where the pupil is and how he/she is progressing is fundamental

to effective teaching by the teacher and to effective learning by the pupil (Lal, 2007). It is on the basis of techniques of evaluation that teachers and researchers pass their judgements on the performance of students in various curricular and co-curricular activities.

All techniques of evaluation can be broadly classified into two broad categories such as quantitative and qualitative. The quantitative techniques of evaluation are highly objective, reliable and valid. These techniques can be used to assess the cognitive and psychomotor objectives (Sharma, 2005: 352). The quantitative techniques include ability tests, achievement tests, diagnostic tests, intelligence tests, aptitude tests, attitude scales, interest inventory etc. The qualitative techniques are subjective and reliable but can be used for assessing the affective objectives. The qualitative or non-testing devices include techniques like observation, rating scale, checklist, interviews etc. Various quantitative and qualitative techniques can be used for evaluating the performance of learning-disabled children. These techniques can be used to assess the cognitive, affective and psychomotor behaviours of such children.

Learning-disabled children suffer from the inability or incapacity in their process of learning and understanding. The *ability tests* can be designed to assess the degree of their ability to learn and understand (Mangal, 2007: 238). These tests can be used to test the abilities of learning-disabled children such as reading ability, writing ability or mathematical ability.

Achievement tests aim to measure the extent to which the objectives of a course have been achieved (Sharma, 2005: 357). They can be used to assess the degree of achievement of children on the basis of different objectives such as knowledge, understanding, application, skill etc. Achievement tests are very useful in assessing how a child performs in academic subjects such as arithmetic, writing and reading. Most achievement tests are used to provide information about a student's academic skill in comparison to other students of same age, grade and schools all over the country (Nakra, 1996: 212). The achievement tests can be classified into two types namely standardized achievement tests and teacher made tests. The standardized tests are structured by an

outside agency and are readily available for administration. The teacher made tests are constructed by the individual teachers for assessing the degree of children's achievement or diagnosing their learning disabilities (Mangal, 2007: 239).

Diagnostic tests help to identify the areas of learning in which a learner needs a remedial course. They give a profile of what the learner knows and does not know in a given area of learning (Sharma, 2005: 357). With the help of the norms given in these tests, one can assess the relative educational standard of the children of the same age or grade and thus may be acquainted with the educational deficits and deficiency of a particular child. As a result, a valid and reliable diagnosis of the learning disability can be done in various areas of scholastic performance such as language, mathematics, social or experimental skills (Mangal, 2007: 238).

The intelligence of an individual is manifested through *intelligence tests*. Intelligence tests help in revealing the potentialities of an individual and in this way make possible the prediction of one's success in a particular field (Mangal, 1985: 248). These tests measure the general ability and level of functioning in areas such as discrimination, sequencing, memory, vocabulary, motor skills, analysis, abstract reasoning, pattern completion and general knowledge. The Wechsler Intelligence Scale for Children-Revised and the Stanford-Binet Intelligence Scale are best known intelligence tests. The WISC-R is used more often to assess children with learning disabilities (Nakra, 1996: 206).

Aptitude tests can be used to measure the aptitudes of individuals in specific field or activities. The different types of aptitude tests are mechanical aptitude test, musical aptitude test, professional aptitude test, scholastic aptitude test and so on. Aptitude tests enable to locate the field of activity in which one is most likely or least likely to be successful (Mangal, 1985: 291). Such tests can be used for learning-disabled children to predict their degree of achievement that can be expected from them in any activity.

An information form that attempts to measure the attitude or

belief of an individual is known as *attitude scale* (Best & Kahn, 1993: 245). Such scales can be used for learning-disabled children to measure their attitude towards academic areas such as mathematics, language etc.

Observation technique is indispensable in school evaluation. It is used at all stages of education but most useful for evaluating the small children at primary stage (Sharma, 2005: 357). As a data gathering device, direct observation can make an important contribution to descriptive research. Certain types of information can be best gathered through direct examination by the researcher (Best & Kahn, 1993: 222). Observation technique can be effectively implemented to observe the behaviour of learning-disabled children.

The *checklist* is used for evaluating interest, attitudes and values of the students. It includes certain statements of *yes* and *no* type. The student has to check either of the two. Each statement of the checklist evaluates a specific objective of learning (Sharma, 2005: 353). It can be used to study the behaviour of learning-disabled children.

Cumulative records are prepared in schools for each and every student. The cumulative record of a student includes the educational progress, results of monthly tests, attendance, participation in games, sports, co-curricular activities and physical health (Sharma, 2005: 353). Using cumulative records, the necessary information about the learning-disabled children can be gathered.

Different types of evaluation techniques can thus be used for evaluating the learning-disabled children. Both qualitative and quantitative techniques can be effectively used to screen children with learning disabilities and also in assessing their learning outcomes. Such techniques can be used by teachers to improve their teaching skills and also to adopt different instructional methods to suit the needs of disabled learners. Also it helps to enhance the learning of such pupils when various instructional techniques are adopted to cater to their specific needs. So it is imperative to adopt various evaluation techniques to help these academically weak learners to improve in academics.

2.11 TREATING LEARNING-DISABLED CHILDREN

With more and more emphasis on classroom performance in this era of perfect competition, teachers and parents need to apply the best known techniques to make the children intellectually superior. To tap the full potential of children, we need to maintain the brain well. Nowadays, Brain Gym Exercises are becoming popular that help to keep the brain fully functioning to its optimum capacity. According to Dr. Paul Dennison, an educational therapist, the human body has acupressure points which when activated will substantially improve the functioning of the brain. When properly applied, Brain Gym exercises help to overcome learning difficulties in reading, spelling or mathematics (*The Hindu*, October 13, 2008).

With early recognition and specialized approaches to teaching, most disabled learners can be helped to learn normally. For the development of language and arithmetic skills, early intervention programmes are essential. Early intervention is needed for schoolchildren who are at a risk of developing a handicapping situation or other special need that may affect their development. Early intervention programmes help in provision of services to such educationally handicapped children for the purpose of lessening the effects of the condition. Since the child's early learning provides the foundation for later learning, early intervention would help prevent the child from developing additional problems or disabilities (Reddy & Poornima, 2008: 3).

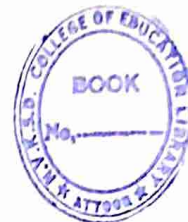
Parents and teachers need to be aware of the various learning blocks the children face in their day-to-day life and how they hamper their progress. Learning disabilities like dyslexia and dyscalculia are highly prevalent among the schoolchildren and they have become hindrances in today's educational scenario. Awareness about learning difficulties alone helps parents and teachers to give appropriate remedial measures to the children and create the kind of climate which is conducive to their learning.

Special educational programmes can be designed to meet the special needs of these learners in the light of recent researches. With proper parental care and teachers' guidance, dyslexics or dyscalculics can be made to read, write or to do arithmetic

calculations in correct ways. In addition, these educationally disabled students need a great deal of structured practice and immediate corrective feedback to develop their word recognition skills or numerical skills.

Diagnosis and care of developmentally disabled children in most schools are both deficient to say the least. There is close to no effort on the part of parents, teachers or educational specialists for correct treatment or adoption of strategies to remove the learning blocks that hamper their educational progress. It is possible to enable these children to be enabled and equipped with the skills they need and to empower them to catch with the rest of their peers through different teaching strategies. It is highly desirable that our schools sensitize their staff to the need to develop in these children the skills they normally fail to develop.

Children with these learning disabilities require special assistance on the part of teachers, educational specialists and even parents. The effects of learning disabilities can be controlled with appropriate support, guidance, and interventions at home and at school. It is becoming imperative for teachers and educational specialists to devise certain teaching strategies that help educationally disabled children to overcome their problems and enable them to learn well.



3

LEARNING DISABILITIES AND INCLUSION

In most of the schools, teachers can find students with specific learning difficulties, in the similar way as students with diversities in terms of physical or mental abilities or disabilities. The categories of students with various disabilities or severe learning disorders get isolated or excluded in regular school settings in the sense that the curriculum, teaching-learning materials, examination systems, educational facilities etc are not supportive to these students. These children who are practically ignored in our educational system need to be taken care of.

Education is the fundamental right of every child. All children need to be educated for the success and growth of democracy. Children with disabilities or difficulties in learning have sometimes greater potential than their normal peers and so their needs have to be seriously addressed so as to make them contribute to the welfare and well being of society. Providing education to children with special needs in special schools does not give a lasting solution to the problems faced by them. Such special schools are fewer in number and fail to make their products integrate into the mainstream. The establishment of special schools has turned out to be not only expensive but also exclusive in a very negative way. So these children who become victims of exclusion on account of their learning handicaps need to be treated on equal terms along with their more fortunate peers. This can be done through creation of inclusive settings in the school.

3.1 INCLUSIVE EDUCATION

The goal of education for children with disabilities is to prepare them for a happy, productive and useful civil life. Perspectives on the disabled and on their education have been changing. This

perspective on disability gives foundation to a new form of education that would neither require disabled children to get isolated nor fit in the regular school system not designed for them known as the inclusive education (Maitra & Saxena, 2008: 4). The term 'inclusion' has become a more usual way of describing the extent to which pupils categorized as having special educational needs are truly integrated. It refers to the extent to which a school community welcomes pupils as full members of the group and values them for the contributions they make (Farrell & Ainscow, 2002: 3).

The philosophy of inclusive education is a paradigm shift from segregation to mainstreaming and integration to inclusion. Inclusive education is not a special education approach that shows how children with disabilities can be integrated in mainstream education but it looks into how to transform regular education system in order to respond to different learners in a constructive and positive way (Pradhan, 2002:102). Inclusive education is neither segregating exceptional children to educate in special schools nor integrating them with ordinary students to the maximum extent but providing education to the exceptional children along with other children to fulfil the objectives in a democratic way (Mohan, 2004:190).

Inclusive education helps in improving the general education system itself as every child with special educational need can be benefited. Development of the capacity of the general educational system to meet the educational needs of children with a disability is a main feature of inclusive education. Inclusive education proves to be a realistic approach to maximize educational services for disabled children, to enhance communication between disabled and non-disabled children, to promote child-to-child learning, to facilitate them to come to the school from home with other non-disabled children (Gupta & Sindhu, 2007:14).

The National Policy of Education (1986) advocates providing inclusive education for the mildly handicapped and special education for the severely handicapped children. It is estimated that around 4 percent of Indian population suffers from varying degrees and nearly 20 percent suffers from milder forms of

disability (Madankar, 2007: 8). The disabled children should be provided education with normal children instead of providing them education in special schools. They must feel that they are not inferior to normal children and this is possible only through inclusive education. It proves to be an alternative system with more openness and flexibility to accommodate learners with disabilities. A study on the impact of inclusive settings on reading and mathematics achievement of special education students in inclusive settings indicates that placement settings of special education students had a significant impact on their achievement (Siegel, 2007).

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Inclusive education is an ideology and not a programme. Readiness of the general education system to accept prime responsibility for education of children with disabilities, encouragement provided by the community for including children with disabilities in schools, readiness of parents of children with disabilities to admit the children in local schools, basic knowledge of general classroom teachers about the education of children with disabilities, openness to admission of all types of disabled children in schools irrespective of the extent of disability, higher enrolment rate of children with disabilities on par with that of non-disabled children, ability of general classroom teachers to modify teaching

learning strategies to teach children with disabilities etc are considered to be the main parameters of the success of inclusive education concept (Mani, 2010: 11).

3.1.1 Need for Inclusion

Inclusion of students with special educational needs is becoming a matter of priority in the current educational scenario. The concept of inclusion has emerged from the need and desirability of providing equal educational opportunities to all children. This envisions the imparting of education with teachers keeping in mind the diverse nature of their individual needs. The goal of inclusion is to prepare students to participate as full and contributing members of society. Inclusion involves increasing the participation of students in different cultural settings, and communities in local schools (Reddy & Poornima, 2009: 1).

It has now been advocated that disabled children should be educated in mainstream schools along with non-disabled peers. For bringing the disabled and the disadvantaged closer to the school, it is important to remove the barrier by bringing the concept of inclusion (Maitra & Saxena, 2008: 4). For inclusion to be seen to be effective, all pupils must actively belong to, be welcomed by and participate in a mainstream school and community (Farrell & Ainscow, 2002: 3).

Inclusion is a more precise and refined form of mainstreaming and integration. In the process of integration and mainstreaming, it is the children who adapt themselves according to the environment of the school whereas in the process of inclusion, it is the school which adapts its policies and facilities according to the needs and requirements of the children. Once inclusiveness is achieved, integration and mainstreaming will no longer be required since there will not be anyone left out to be integrated or mainstreamed into the regular education settings (Sarkar & Kumar, 2009: 49).

Inclusion is a philosophy that brings diverse students, educators and community members together to create schools and other educational institutions based on acceptance, and belongingness to community. It recognizes that all students are learners who benefit

from meaningful, challenging, engaging and flexible curriculum that helps them to be successful in society. Effective inclusion improves the educational system for all learners by placing them together in general education classrooms regardless of their learning ability, linguistic ability, learning style etc (Salend, 2005: 6). In a case study (Krause & James, 2000) on inclusive practices of students with severe disabilities, the identified themes such as physical integration, practice of individualizations etc for inclusive practices and their components establish the foundation of improved status for children with disabilities within their school and community.

Social inclusion is concerned with reducing inequalities between the least advantaged groups and the rest of the society by closing the opportunity gap (Gopal, 2009: 14). Collective action by school authorities, ministry of social justice and corporate groups becomes imperative if we want to have inclusive societies. So these children who become victims of exclusion on account of their disabilities, learning handicaps, Socio-economic deprivation etc need to be treated on equal terms along with their more fortunate peers.

Children with disabilities have as much right to education as anyone else. It is the duty of the schools to provide for them (Chopra, 2009: 4). So it is necessary for schools to practise inclusion. Providing education to children with learning disabilities in special schools does not give a lasting solution to the problems faced by them. Such special schools are fewer in number and fail to make their products integrate into the mainstream. The establishment of special schools has turned out to be not only expensive but also exclusive in a very negative way. This can be done only through creation of inclusive settings in the school.

A more exciting and innovative way of thinking about inclusion is based on the belief that all children have the right to belong to the general education classroom. Inclusive education addresses the common goals of decreasing and overcoming exclusion through the acceptance of the right to education of children in all categories. Creation of inclusive settings paves the way to empower the

differently abled to cultivate their skills and make their contribution to society like their peers.

3.1.2 Teachers as Leaders in Inclusive Settings

A leader is one who influences a group towards a particular result. Leaders are recognized by their capacity to care for others, clear communication and a commitment to persist. According to Winston Churchill, "A leader is a person in a group who directs and coordinates task-oriented activities" (Thomas, 2007). Leadership can be defined as one's ability to get others to willingly follow. Every educational institution requires good teachers and leaders at all levels.

To actively engage as leaders in teaching, learning and professional development, teachers need to be provided with the requisite knowledge and skills to deal with emotional and behavioural problems and set right intellectual deficiencies. Teachers as leaders facilitate, empower, and support life-long learning and pedagogical excellence among students. They can engage experts in different educational fields to strengthen student performance. Teacher leadership is not a formal role, responsibility or set of tasks. It is a leadership in which teachers are empowered to stimulate efforts and have skills for the attainment of goals set by their wards. A case study on the nature of teacher leadership reveals that a teacher leader was perceived to be an accomplished teacher inside the classroom, one who is open to current educational theory and practice and one who is open to high expectations while offering them care and support (Suranna, 2000).

Schools vary in the degree to which they support the leadership of teachers. The ideas and opinions of teachers are both valued and respected within the school. Teachers are recognized by both their peers and administrators for the leadership roles they take and the contributions they make. Also teachers are encouraged to take initiative in making improvements for their students and be innovative (<http://www.plsweb.com/>). There are processes for formal recognition of school teachers who aid in moving the school ahead or for those who enhance the performance of students. The

findings of the study conducted to determine the impact of administrator and teacher leadership on the development of exemplary arts programme and its role in school point to the deterministic power of teacher over its programmes (Zoderayo, 2000).

Teachers have a very important role to play in moulding the mindset of children with disabilities in such a way as to enable them to convert their challenges into chances for the balanced development of their psyches. They need to abstain from finding fault with their children when they lag behind in their studies and they must find out with the help of experts what hampers their progress. They should identify the innate potentialities of their children and encourage them to develop their potentialities to the maximum extent possible. When differently-abled students get enthused and encouraged to use their special skills, there is likely to be less focus on their disabilities.

What is needed in the ultimate analysis to overcome disability on the academic front is a positive image of oneself which alone sustains one's sense of worth. The preservation of this sense alone helps one to hike one's self-esteem which in turn contributes to academic success. Recognition of a pupil's learning disability and in the creation of a congenial atmosphere helps the disabled learner to lessen the severity of his or her disability. By choosing materials and activities suited to their level of learning and by stimulating their urge to bring out their best, teachers can help these pupils to turn their difficulties into special opportunities to be model achievers. When this category of pupils experience success, their self-confidence level is raised along with their self-esteem which in turn makes it easy and feasible for them to find their way for the attainment of their goals (Kumar & Raja, 2009 b: 18). If schoolteachers gain the insight into the difficulties their pupils face and display the qualities of leadership needed to bring these children out of their isolated world and help them bring out their best, these children can be enabled to integrate into the rest of society and achieve positions of eminence.

3.2 INTEGRATED EDUCATION

Education must be a part of the child's total programme and it requires successive integration to help him/her to develop intellectually, socially, emotionally as well as physically. The success of an educational programme depends upon integration in school setting. In integrated settings, the focus is on how to fit the children into the regular education programmes (Sankar & Kumar, 2009: 49). Integrated education focuses on the deficiencies of the child. For comprehensive planning of each child, it is necessary to define specifically as possible, the child's educational assets and liabilities, to attempt to determine causes of educational disability and to search for methods of correction or compensation.

In integrated education, the disabled children attend classes along with normal children. The term 'integration' signifies the process of integration of disabled children in the same educational setting. It is similar to mainstreaming which refers to integrating the differently abled children into regular classes and helping them through specialized techniques. It is based on the philosophy of equal opportunity that is implemented through individual planning to promote appropriate learning, achievement and social normalization (Prameela, 2005: 7).

Integrated education is defined as an educational programme in which exceptional children attend classes with normal children on either a part or full-time basis. Such strategy is always thought of as social integration or academic integration or both. It means the placement of disabled children in ordinary schools with some specialised educational help and services (Mohan, 2004:188). Integrated education is an educational system where children with disabilities get an equal opportunity for education with other children with full participation and the needed supportive services which include fulfilment of their special needs (Vijayan & Geetha, 2006: 25).

Integration of students with special needs is becoming a matter of priority in many countries, including India. Integrated education emerged out of compulsion in the process of bringing more children

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with disabilities under the umbrella of educational services (Madhusudhana, 2009: 52). The government of India launched the first major scheme to promote integrated education called Integrated Education for Disabled Children in 1974. It was primarily directed at education for children with visual and hearing impairments. Project Integrated Education was the second government scheme in 1987. It was a more broad-based version, including children with learning disabilities and severe disabilities (Ruth, 2009: 121).

Integrated education programme purports to provide educational opportunities for the disabled children in common schools to facilitate their retention in the school system. Under the scheme, educational programmes are provided to disabled children who can be integrated in the general school. Through this programme, children are given benefits such as boarding and lodging charges, allowances for books and stationary, uniforms, transport, escorts for severely handicapped etc. Also support services like resources or itinerant teachers are provided. The objective of integrated education is to integrate the handicapped with the general community at all levels as equal partners, to prepare them to face life with courage and confidence (Murickan & Kareparambil, 1995: 721). Disabled children who are placed in special schools should also be integrated in common schools once they acquire the communication skills and daily living skills at functional level.

The general education system acknowledges the fact that education of all types of children including that of children with disabilities should come under the mainstream education. In the special school concept, the special education component is apart from the general education whereas in integrated approach, it is a part of the general education. Inclusive education goes one step further in which the special education is an integral part of the general education system (Vijayan & Geetha, 2006: 25).



DYSCALCULIA

The basic academic skills that are needed for learning are reading, writing and arithmetic. Arithmetic skill is the one that is very much needed for doing calculations in mathematics. Building a solid foundation in mathematics requires different skills. Mathematics is a subject which requires various skills such as perceptual reasoning, verbal reasoning, counting and calculating. It is essential to develop these skills among the schoolchildren for their academic achievement.

Not all children are made the same. Learners with multifarious arithmetic-related disabilities are found in most schools. These children may face difficulties in one or more areas of skills of arithmetic. As a result, the schoolchildren may lag behind in their course of learning. They may find it difficult to achieve the basic skills of doing arithmetic calculations. Dyscalculia or arithmetic disorder is a less widely known disability, similar and potentially related to other learning disabilities like dyslexia, dysgraphia, dysphasia or dyspraxia and is often not identified. Learning disabilities like *dyscalculia* are either not understood or ignored in schools.

Dyscalculia is a learning disorder that causes severe difficulty in making mathematical calculations. If basic mathematical skills are not mastered, schoolchildren may find it difficult in moving on to more advanced mathematical applications. Most children in schools may lack the ability to acquire one or more of these skills. Learning disabilities like dyscalculia cut across class, age and intelligence. But it is found that some children, despite having an average level of intelligence have real difficulty in acquiring mathematical skills.

4.1 DYSCALCULIA - HISTORY

The word "dyscalculia" comes from the Greek and Latin which

Dyscalculia

means "counting badly". The prefix "dys" comes from Greek and means "badly". The suffix "calculia" comes from the Latin "calulare" which means "to count". Thus the term dyscalculia was considered as a difficulty with regard to counting (<http://en.wikipedia.org/wiki/Dyscalculia>).

Dyscalculia was first discovered in 1919 by Salomon Henschen, a Swedish neurologist who found that it was possible for a person to have impaired mathematical abilities that did not affect intelligence in general. It is also referred to as developmental arithmetic disorder and "number blindness". Dyscalculia is a lifelong condition that is likely to show up early (<http://www.connectwithkids.com/>).

A study was first conducted on children in 1974 by Ladislav Kosc in Bratislava on dyscalculia. His findings showed that Dyscalculia is a structural disorder of mathematical abilities. Later many studies were conducted on dyscalculia and various results were got regarding the symptoms of dyscalculia, the problems faced by children in learning arithmetic and the overlapping of dyscalculia with other learning disabilities (<http://stgabss.net/SpecialNeeds/index.php/>).

4.2 DYSCALCULIA - THE CONCEPT

Dyscalculia is a learning disorder which hinders the ability to acquire arithmetic skills that are needed to perform mathematical calculations. It is a specific learning disability in which pupils face severe problems in the acquisition of mathematical skills. Many of the children with learning disabilities may be found to exhibit serious learning difficulties in mathematics primarily related to mathematical calculations and mathematical reasoning. The difficulties that children face in the learning process have begun to attract serious attention. It has become a real educational handicap and a widespread issue in today's society (Kumar & Raja, 2009 b).

Dyscalculia may affect somewhere between 3% and 6% of the total population. These statistics refer to children who are purely dyscalculic i.e. they only have difficulty with mathematics but may have good or even excellent performance in other areas of learning



(<http://www.achievableability.org.uk/>). Though such children have a problem with calculations, they may be good at other academic subjects (<http://www.indiaparenting.com/>). Dyscalculic children may also have good reading, writing and speaking skills. Children with arithmetic difficulties are found at all age levels and early identification is very important (Nakra, 1996: 157).

Dyscalculia can occur developmentally as a genetically linked learning disability which affects a person's ability to understand, remember or manipulate numbers or number facts. It occurs in pupils across the whole IQ range and the sufferers often have difficulties with time, measurement or spatial reasoning (Kumar & Raja, 2008). However it is a lesser known of all the learning disorders and is often not recognized. Much less research has been done in the area of mathematical disorders compared to other learning disorders. Research in the analysis and remediation of problems related to mathematics has been rather neglected (Nakra, 1996: 157).

As with other types of learning disabilities, dyscalculia is said to involve the language and visual processing centers of the brain (<http://en.wikipedia.org/wiki/Dyscalculia>). Various neuropsychological deficits are associated with arithmetical disabilities. The neuropsychological profiles of dyscalculia resemble that of acquired mathematical disability due to brain damage. It is characterized by misreading arithmetical operations, difficulty with place values and decimals, number omissions, number rotations etc. Researches show that visuospatial functions and right hemisphere functioning affect the numerical information and skill in interpreting information (Karanth & Rozario, 2003: 58).

Dyscalculia involves disturbances of quantitative thinking stemming from dysfunction of the central nervous system. Studies of traumatically brain-damaged adults indicate that specific areas of damage are associated with specific arithmetical disabilities. A difficulty in mathematics may be related to visual spatial confusion. Visual processing disorder is a condition that affects the ability to learn mathematics. Spatial dysfunction is associated with the parietal-occipital regions of the brain which results in numerical

confusion and an inability to discriminate notational signs and symbols. Dysfunctions associated with the left temporal lobe are characterized by difficulties with complex operations involving a sequence of steps, or mental or oral calculations or reasoning (Nakra, 1996: 159). Lesions of the parieto-occipital areas of the left hemisphere are likely to be related to disabilities in counting, ordering or reading numbers. Posterior right hemisphere lesions may result in spatial difficulties associated with poor computation skills (Reynolds & Janzen, 2000: 633).

4.3 DYSCALCULIA – MEANING

Students with learning disabilities frequently have difficulty with mathematics computation and problem solving. Many of the learning-disabled children may be found to exhibit serious learning difficulties in mathematics primarily related to mathematical calculations and mathematical reasoning. Dyscalculia is the most widely used term for the learning problems and difficulties in mathematics faced by the learning-disabled children (Mangal, 2007: 249).

The word 'dyscalculia' means literally a 'disorder in calculation' (Hannell, 2005: 2). It is used to describe the specific difficulties in learning mathematics. Dyscalculia is a broad term that refers to a wide range of life-long learning disabilities involving mathematics or simply, severe difficulties in mathematics. It is a condition that affects the ability to acquire mathematical skills. It includes all types of mathematics problems ranging from inability to understand numbers to inability to apply mathematical principles to solve problems. Dyscalculia involves inability to understand the meaning of numbers and quantities (<http://learningdisabilitiesabout.com/>).

Specific learning disabilities like dyscalculia calls for focused instruction and guidance. A child with a learning disability has problems in most types of subject matter while a child with a specific learning disability has a major problem with one type of subject material like arithmetic (Jaya & Geetha, 2004:1). Dyscalculia is a specific learning disability that is marked by

significant difficulties in the acquisition of mathematical skills in many ways, it is the mathematical equivalent of dyslexia which is a specific difficulty with literacy. It is a condition that affects the ability to acquire arithmetic skills (<http://www.achievenability.com/extra13.html>).

Dyscalculia is a type of specific learning disability that refers to innate difficulties in learning or comprehending mathematics that refers to calculation and number memory deficits. It also refers to mathematical reasoning abilities as well as difficulties with arithmetic operations (<http://en.wikipedia.org/wiki/Dyscalculia>). According to Rao (2003), dyscalculia is a mathematical disability which can be defined as the inability to develop mathematical concepts, difficulty in implementing calculation procedures or to reason with numbers (Karanth & Rozario, 2005: 54).

A student with any degree of mathematical difficulty may be considered to have "dyscalculia" by some educational specialists (<http://www.as.wvu.edu/~scidin/>). Dyscalculia refers to a wide range of life-long learning disabilities involving mathematics. There is no single form of mathematical disability and difficulties vary from person to person and affect people differently in school and throughout life (<http://www.ncld.org/>).

4.4 DYSCALCULIA – TYPES

Dyscalculia is observed in children in many types and subtypes. Dyscalculia which occurs during the later stages of life is known as *acalculia*. It is acquired due to injuries caused in the brain. However it is not acquired during the normal stage of learning. The term *acalculia* is generally used to describe an acquired disorder of calculating ability resulting from brain damage (Reynolds & Janzen, 2000: 633).

Mathematical learning difficulties that share features with acquired dyscalculia but without evidence of cerebral trauma are called as *developmental dyscalculia* (Munro, 2003). Underachievement due to developmental disability has a neurological foundation. The students lack particular cognitive or information processing strategies necessary for acquiring and using arithmetic

Dyscalculia

knowledge. In cases of developmental dyscalculia, the mathematical abilities fail to develop within the normal limits of time and sequence (Reynolds & Janzen, 2000: 633).

The different types of developmental dyscalculia are:

- (i) Verbal dyscalculia
- (ii) Practognostic dyscalculia
- (iii) Lexical dyscalculia
- (iv) Graphical dyscalculia
- (v) Ideognostic dyscalculia
- (vi) Operational dyscalculia
- (vii) Sequential dyscalculia

Verbal dyscalculia refers to the difficulty with verbal use of mathematical concepts. Children with this type of dyscalculia may be able to carry out normal mathematical calculations. However they may not be able to verbally name the signs, symbols or to do counting of the numbers and different items.

Practognostic dyscalculia refers to the difficulty in converting one's arithmetic knowledge to actions or procedures in relation to quantities.

Lexical dyscalculia is the difficulty in reading mathematical symbols and numbers.

Graphical dyscalculia is nothing but the difficulty in writing mathematical symbols.

Ideognostic dyscalculia denotes the difficulty in comprehending mathematical ideas and relationships.

Operational dyscalculia refers to the difficulty in performing basic arithmetic operations. It is also associated with difficulty in applying rules of mathematics during mathematical operations. Children with this type of dyscalculia also have confusion in mathematical symbols.

Sequential dyscalculia refers to difficulty to count numbers according to sequence. It is also associated with difficulty in calculating time, checking schedule, tracking direction and taking measurement.

4.5 DYSCALCULIA – CAUSES

Numerous investigations are being done by scientists to know the exact causes of dyscalculia. Investigations are done in several domains such as neurological deficits and deficits in working memory. Learning disabilities like dyscalculia may be inherited or can be caused by problems with brain development. Exposure to prenatal or environmental traits may also play a role. Other causes may be short term memory being disturbed or reduced making it difficult to remember calculations (<http://en.wikipedia.org>).

Dyscalculia involves disturbances of quantitative thinking stemming from dysfunction of the central nervous system. It does not include limited intellectual capacity, primary language disorders, anxiety or poor teaching as causes of arithmetic failure (Reynolds & Janzen, 2000: 633). This disorder results out of the harm caused to certain parts of the brain. Right hemisphere deficits may result in problems in acquiring mathematical skills (<http://www.indiaparenting.com/>).

Some researches conducted on dyscalculia show indications of congenital or hereditary disorders as causes of dyscalculia. On the basis of research conducted by Hosc in 1974, it was found that dyscalculia is a structural disorder of mathematics which has its origins as a genetic or constitutional disorder (Nakra, 1996: 159). Thus there is a strong genetic influence on the development of mathematical skills. Environmental factors also play their part in the transmission of a talent or difficulty in mathematics (Hannell, 2005: 4). There are various environmental factors like lack of motivation, lack of learning readiness, poor teaching etc which can be responsible for dyscalculia. All these factors may be responsible for the occurrence of learning disabilities like dyscalculia. They may affect the learners directly or indirectly.

4.6 INTELLIGENCE AND ARITHMETIC-DISABLED CHILDREN

No two children in a classroom are alike. Each and every child has his/her own unique quality or trait which differentiates them from one another. Pupils with varying abilities can be found in a

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particular classroom or school. They differ from one another in their ability to understand, reason, express ideas and so on. The teacher in a school can easily find these differences among children. Some students learn with high speed while some others learn at a very slow pace. Thus there are wide individual differences among pupils and it is intelligence which contributes significantly to these varying differences.

If we try to analyze the factor which determines the success of an individual's activities, we can by all means say that cognitive or mental abilities have a dominant role to play in the success or failure of the activities. It can be said that intelligence is the major factor which contributes towards achievement, adjustment and character formation. Intelligence helps an individual to meet the general life situations in a successful way. According to Stern, "Intelligence is a general capacity of a person to adjust his thinking to new requirements. It is a general mental ability to new problems and conditions of life" (Mangal, 1985: 231).

In spite of having average or above average intelligence, many children perform poorly in academics, especially in arithmetic. A child who is otherwise intelligent but does not meet the expectations of parents or teachers in academic activities has been the subject of research all across the globe (Karanth & Rozario, 2003: 30). Children with learning disabilities experience even greater difficulty in mathematics than their peers with normal abilities. Recent investigations in this field have shown a person of normal intelligence can easily cope with this subject. Mathematical ability has nothing to do with general intelligence and it requires no talent at all (Geetha, 2006: 8).

Dyscalculic children may have average or above average intelligence and also they may be slow learners, average learners or even gifted children. These children are at-risk for being seen as less capable than they are. However they have the general ability to learn that is comparable to or higher than many of their peers (<http://www.learningdisabilities.about.com>). But they apparently cannot use information transmitted by the senses to the brain as accurately as most other children. Therefore they may do poorly in school or not as well as they can.

Intelligence goes on growing up to 16 or 18 years of age, the Intelligence Quotient (IQ) for most of the individuals remains constant (Mangal, 1985: 246). Primarily, IQ provides a ratio of knowing how bright an individual is as compared with his/her age. Dyscalculic learners who are weak in mathematics cannot be considered as less intelligent. Dyscalculia can be found in a percentage of any IQ, from low through high. It occurs in pupils across the whole IQ range and the sufferers often have difficulties with time measurement or spatial reasoning. In most cases, the IQ level of dyscalculic learners is found to be normal. An individual could be low functioning in mathematics and yet have above normal intelligence. According to Kosc, true dyscalculia can be measured using the formula

$$\text{Math Quotient} = \frac{\text{Mathematical age}}{\text{Chronological age}} \times 100$$

Individuals whose quotient is seventy to seventy-five or lower but who shows average or above average intelligence, are said to display dyscalculia (Nakra, 1996: 160).

4.7 CHARACTERISTICS OF DYSCALCULIC CHILDREN

Children with learning disabilities like dyscalculia fall across a spectrum. All students are unique and have their own defining characteristics. Characteristics like visual deficits, spatial processing problems, auditory-processing deficits, motor disabilities, memory deficiencies, attention deficits, expressive and receptive difficulties, cognitive and metacognitive issues etc manifest themselves when they are learning mathematics.

Visual processing or perceptual disorder refers to a hindered ability to make sense of information taken in through the eyes. Difficulties in visual processing affect how visual information is interpreted or processed. Types of visual processing deficits affecting performance in mathematics include problems in spatial perception, reversals, figure ground, visual discrimination etc (Sliva, 2004: 18).

Spatial perception denotes the ability to accurately perceive objects in space with reference to other objects. Students with spatial

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processing problems may have trouble in putting decimals in right place, concept of fractions and differences in size and shape. They may also have difficulties with identifying spatial patterns and in representing three-dimensional figures in a two-dimensional way. Students with perceptual deficiencies are also found to have the problem of reversals in which they find difficulty in reversing digits and regrouping and transposing them (<http://www.dyscovery.co.uk/>).

Figure ground is the ability to identify an object from a background of other objects. Students with figure-ground difficulties typically lose their place on a page, mix up parts of different mathematical problems, and have difficulty in reading multi-digit numbers, differentiating numbers and in copying shapes or symbols (Jaya & Geetha, 2004: 6).

Auditory processing disorder refers to hindered ability to analyse, interpret and process information obtained through the ear. Students with auditory processing disorder have difficulties in sorting out auditory information. These students may exhibit several difficulties while learning mathematics. Auditory discrimination deficits interfere with a student's ability to decipher numbers that are spoken. Students with auditory processing disorder have difficulties in writing numbers on dictation, hearing number patterns etc (Jaya & Geetha, 2004: 6).

Attention deficits are characterized by serious and persistent difficulties in attention span, impulse control and sometimes hyperactivity. These disorders cause difficulties maintaining attention to steps in algorithms or problem solving as well as to essential instruction in a mathematics classroom. The students with this disorder have difficulty in switching from one operation to another or may be attending to too many things at once (Sliva, 2004: 21).

Motor skill deficiencies refer to the hindered ability to use and coordinate large and small body muscles in order to move and manipulate objects. This type of disability shows itself when students write numbers and letters illegibly, slowly and inaccurately. Students with this disorder have difficulties in writing in small

spaces because they tend to write rather large. Also they face difficulties in writing numbers legibly, and with speed and accuracy (Jaya & Geetha, 2004: 7).

Students with dyscalculia also have difficulties with expressive or receptive language processing. Expressive difficulties include difficulties in oral drills in arithmetic, completing counting tasks and in explaining verbally why a problem is solved in a certain manner. Receptive difficulties include difficulties in relating arithmetic terms to meaning and in solving word problems (Sliva, 2004: 22-23).

Memory deficits refer to a hindered ability in remembering information. This difficulty may also contribute to students performing poorly when reviewing past material and when asked to complete a variety of problems on several different concepts. Memory deficits may manifest themselves as short term memory and long term memory. Deficits of long term memory include remembering routine work, recalling tables or linking different mathematics topics (<http://www.edfac.unimelb.edu.au/eldi/>).

Cognition refers to the ability to comprehend and infer information and metacognition refers to the ability to think. Students who have difficulties in these areas lack awareness of basic skills, strategies and resources necessary to complete mathematics tasks. These students have difficulty in organizing information and identifying, selecting and generalizing appropriate strategies to solve a mathematical problem (Sliva, 2004: 24-25).

4.8 SIGNS AND SYMPTOMS OF DYSCALCULIC CHILDREN

Dyscalculic children are found to exhibit various signs and symptoms. Dyscalculic symptoms include as poor understanding of mathematical signs and symbols, reversal of numbers, inability to remember and grasp mathematical concepts, rules, formulae and sequences etc. There are a range of warning signs that dyscalculics may have in their mathematical difficulties (Hannell, 2005). These include:

- Slowness in giving answers to mathematics questions in comparison to other learners

Dyscalculia

- Difficulties in mental calculations
- Using fingers to count simple totals, mistakes in interpreting word problems
- Difficulty to remember basic mathematics facts
- Losing track when counting or saying multiplication tables
- Difficulty in remembering the steps in a multistage process
- Difficulties with position and spatial organization

The most prominent symptoms (<http://stgabss.net/SpecialNeeds/index.php/>) are listed below:

- Difficulty in adding, subtracting, multiplying and dividing
- Difficulty in following directions (east, west, north, and south)
- Difficulty in conceptualizing time and judging the passage of time
- Difficulty in estimating measurement of objects
Eg. Difficulty in measuring the length of lines or angles
- Inability to understand the concept of fractions, place value and quantity, number lines, carrying and borrowing
Eg. Inability to understand the fractions like $\frac{2}{3}$ or $\frac{1}{3}$
- The other symptoms (<http://www.ncl.org/>) of dyscalculia are:
 - Confusing the mathematical signs and symbols
Eg. Confusing the signs + and \times or confusing the symbols > and <
 - Difficulty in comparison of sizes and shapes
Eg. Difficulty in comparing the sizes of objects like pencils
 - Difficulty in performing basic arithmetic skills like counting
Eg. Difficulty in counting various objects (counting as 9 or 11 instead of 10)
 - Problems in differentiating between left and right
 - Inability to work with decimals
 - Inability to estimate number quantities
 - Difficulties with measures and conversion of one measurement to another

- Difficulty in identifying similar signs and numerals
Eg. Difficulty in identifying the numbers 6 and 9
- Difficulty in identifying similar geometrical shapes, difficulty in identifying three-dimensional figures
Eg. Difficulty in identifying shapes like square or rectangle
- Inability to organize objects in a logical way
- Inability to comprehend financial planning or budgeting
- Difficulty in converting one's arithmetic knowledge to action
- Difficulty with verbal use of mathematical concepts

4.9 PROBLEMS FACED BY DYSCALCULICS

There are numerous learning problems faced by dyscalculics in doing mathematical calculations. Mathematical disabilities comprise computational problems in addition, subtraction, multiplication or division and failure in application of mathematical rules and conceptual problems such as poor understanding, difficulty in discriminating relevant and irrelevant aspects of problems of mathematics, poor number sense, poor discrimination between shapes, sizes and quantities, poor spatial orientation etc. Dyscalculics have disturbances related to reading and writing numerals and symbols, and also disturbances in visual-motor integration, either for writing or for non-verbal motor skills (Chadha, 2006).

Many students with disabilities have histories of academic failure that can be attributed to helplessness in learning mathematics. Mathematics deficiencies emerge in the early years and continue throughout the school life (Sliva, 2004: 5). Arithmetic involves recognizing numbers and symbols, memorizing facts, aligning numbers and understanding abstract concepts like place value and fractions. Any of these may be difficult for children with dyscalculia. Dyscalculia affects a person's ability to understand, remember or manipulate numbers or number facts.

Dyscalculia exists in a number of different varieties, each involving specific difficulties in solving mathematical tasks. Dyscalculics often require excessive mental strain to carry out even

simple arithmetic tasks. They count using their fingers as a visual aid far into the upper grades. Along with these automatization difficulties, linguistic difficulties may also be involved with dyscalculia. These may manifest as difficulties in understanding numbers or numerical symbols. Another form of dyscalculia involves planning difficulties that lead to failure to carry out computations effectively. Dyscalculics may have difficulties with following a clear strategy in solving arithmetic problems (<http://www.dyscalculiainfo.org/index.htm>).

Dyscalculic learners face severe difficulties in learning mathematics. Students with dyscalculia have a difficult time in visualizing numbers and often mentally mix up the numbers, resulting in what appear to be "stupid mistakes". Another problem that the dyscalculic learners face is sequencing. Students who have difficulty in sequencing or organizing detailed information often have difficulty in remembering specific facts and formulae for completing their mathematical calculations (<http://www.as.wvu.edu/~scidis/dyscalcula.html>).

Arithmetic involves recognizing numbers and symbols, memorizing facts, aligning numbers and understanding abstract concepts like place value and fractions. Any of these may be difficult for children with learning difficulties in mathematics. Difficulty may be found in performing basic arithmetic skills such as adding, subtracting, multiplying and dividing. Dyscalculic learners confuse mathematical signs and symbols and have difficulty in grasping and remembering mathematical concepts, rules, formulae and sequences. When reading, writing and recalling numbers, they make several mistakes such as number additions, substitutions, transpositions, omissions and reversals. Dyscalculia affects a person's ability to understand, remember or manipulate numbers or number facts and the sufferers often have difficulties with time, measurement or spatial reasoning. Dyscalculic learners may have difficulty only with mathematics but may have good or even excellent performance in other areas of learning (Kumar & Raja, 2008: 90).

Dyscalculic learners may have difficulty in understanding

simple number concepts, lack an intuitive grasp of numbers, and have problems in learning number facts and procedures. There is no single form of mathematical disability and difficulties vary from person to person and affect people differently in school and throughout life (<http://www.ncl.org/>).

It has been estimated that lack of competence in the four computational skills such as addition, subtraction, multiplication and division account for ninety percent of the difficulties experienced by dyscalculic learners (Jaya & Geetha, 2004: 8). In order to be functional in these skills, students need a great deal of rehearsal, repeated teaching and learning to ensure that they internalize these skills.

The child with arithmetic disability has problems in calculations, even simple arithmetic because of an inability to manipulate number relationships. Numerical problems seem difficult for them even when they are very simple for normal children to do. The disability becomes evident when they start learning numbers and simple addition or subtraction. If the problem is severe, such children will not be able to learn numbers, symbols and their relationships (Kumari *et al*, 2004: 216).

Young dyscalculics can have difficulty in number sense, in sorting objects by size or shape, and in comparing and contrasting certain mathematical concepts. Dyscalculic learners confuse mathematical signs and symbols and have difficulty in grasping and remembering mathematical concepts, rules, formulae and sequences. When reading, writing and recalling numbers, they make several mistakes such as number additions, substitutions, transpositions, omissions and reversals (<http://www.ncl.org/>).

Dyscalculics are at risk of being seen as less capable than they are even when they have general ability to learn that is comparable to or higher than many of their peers. They may have specific skill weaknesses in some areas. They are sometimes self-conscious and may withdraw from others and avoid mathematical tasks. Behaviour problems may result because of their avoidance and frustration (<http://learningdisabilitiesabout.com/od/learningdisabilitybasics/p/Dyscalculia.html>).

As mathematics learning continues, school children with mathematical learning disabilities may have difficulty in solving basic mathematical problems. They may struggle to remember and retain basic mathematical facts and could have trouble figuring out how to apply their knowledge and skills to solve mathematical problems. If basic mathematical skills are not mastered, many teenagers and adults with dyscalculia may have difficulty in moving on to more advanced mathematical applications.

4.10 VISUAL PERCEPTUAL DIFFICULTIES OF DYSCALCULICS

As with other types of learning disabilities, dyscalculia is said to involve the language and visual processing centers of the brain. A mathematical difficulty may be related to visual spatial confusion. Researches show that visuospatial functions and right hemisphere functioning affect the numerical information and skill in interpreting information. The tactile perceptual, visual spatial organization and psychomotor skills are the building blocks of higher order formation and problem solving abilities in children (Karanth & Rozario, 2003: 56).

Visual processing disorder is a condition that affects the ability to learn mathematics. Pupils with visual spatial difficulties may understand the essential mathematical facts but may have difficulty in putting them down on paper in an organized way. Visual spatial difficulties can also make it difficult to understand what is written on a board or in a textbook challenging (<http://www.ldonline/>).

The most noticeable difficulty faced by the dyscalculics involves the inability to visualize and identify numbers and mathematical situations. Young children who are dyscalculics can have difficulty in number sense, in sorting objects by size or shape, and in comparing and contrasting certain mathematical concepts. Dyscalculics have a difficult time in visualizing numbers and often mentally mix up the numbers, resulting in what appear to be "stupid mistakes". Also they may have spatial problems and difficulty in aligning numbers to proper columns. They may have poor ability to picture mechanical processes such as the location of numbers on the face of a clock (<http://www.as.wvu.edu/>).

In order to solve mathematical problems, a child has to learn the foundation skills of mathematics like visual perception and visual memory. Visual perceptual difficulties include identification of similar signs and symbols, identification of similar geometric shapes etc (<http://www.dyscovery.co.uk/>). Children who confuse the signs +, -, × etc may have a problem of visual discrimination of forms or visual discrimination of position in space. A child who has directional confusion such as remembering or differentiating right and left may have a problem with visual discrimination of position in space (<http://www.learninginfo.org/dyscalculia.htm>).

Dyscalculics may have disturbances in visual-motor integration, either for writing or for non-verbal motor skills. Frequently dyscalculics are poor in social perception and in making judgements. They may be unable to pick up or give non-verbal cues, often a part of social communication. Some dyscalculics are found to have a disturbance in body image and lack a strong sense of direction (Reynolds & Janzen, 2000: 633).

4.11 DYSCALCULIA AND OTHER LEARNING DISABILITIES

Damage to the dominant hemisphere leads to dyscalculia, associated with disorders of language, particularly dyslexia and dysgraphia. Dyscalculia generally is more marked in left-hemisphere lesions and frequently is associated with difficulty in reading and writing number symbols (O'Hare *et al*, 1991: 357). However, dyscalculia can occur in posterior left-hemisphere lesions, without the conditions of dyslexia, dysgraphia, dysphasia or intellectual deficit. Several researches indicate that specific learning difficulties can also co-occur from independent causes (Gifford, 2006: 39).

Researches in the area of mathematical disabilities are less as compared to the area of reading and writing disabilities. The focus is largely on reading and writing and less attention is given to the quantitative aspects of thinking (Nakra, 1996: 157). Perhaps it is because mathematics is seen as an intrinsically challenging subject, where it is more normal and therefore acceptable to have difficulties

(Hannell, 2005: 4). If the disability is due to a specific developmental dyscalculia, the child may well not be referred for assessment because such a disability is much more socially acceptable than an inability to read or write, and is not thought to be a serious educational problem (Gordon, 2002: 1992).

A few studies claim that dyscalculia is more common in children than dyslexia or word blindness. But unlike dyslexia, very little is known about its prevalence, causes or treatment (<http://www.topnews.in/>). Recent evidences show that dyscalculia is just as common as dyslexia or dysgraphia and yet it is not as widely recognized by teachers, parents, school authorities or by the government. Hence dyscalculic learners require special education in the same way as dyslexia or dysgraphia (<http://www.bdadyslexia.org.uk/dyscalculia.html>).

4.12 INFLUENCE OF DYSLLEXIA ON DYSCALCULIA

Difficulties in reading may cause problems in doing mathematical calculations. It is necessary to clarify the relationship between arithmetic and reading disabilities. It is possible that memory processes involved in learning letter clusters are those also used to learn arithmetic symbolism. Research studies show that rapid retrieval of abstract knowledge from long term memory is also likely to be shared both by literacy and arithmetic learning.

As mathematics learning continues, schoolchildren with language processing disabilities may have difficulties in solving basic mathematics problems. Language processing disabilities can make it hard for a person to get a grasp of the vocabulary of mathematics. Without the proper vocabulary and a clear understanding of what the words represent, it is difficult to build up mathematical knowledge.

There is a considerable overlap between the two disorders - dyslexia and dyscalculia. Dyscalculia is like dyslexia for numbers which refers to the inability to visualize words or symbols (<http://www.bdadyslexia.org.uk/dyscalculia.html>). Children who have difficulty in literacy skills also have trouble with mathematics. It has been estimated that 40 percent of dyslexic children can also

have trouble with learning Mathematics (Pollock & Waller, 1994: 122).

Disabilities in mathematics are as complex as those associated with reading and may be dependent on reading abilities. A difficulty with mathematics may be due to an individual's ability to process language or read numbers. Researches suggest that somewhere between 20 and 60 percent of pupils have both the disorders. Deficits in language and memory may create problems in the acquisition of mathematics and literacy skills (Hannell, 2005: 4). It has been estimated that five percent of elementary schoolchildren have a disability in reading while six percent have disability in mathematics. In the majority deficits, reading and calculation deficits are seen together (Karanth & Rozario, 2005: 52).

Dyscalculia is like dyslexia for numbers which refers to the inability to visualize words or symbols. But unlike dyslexia, very little is known about its prevalence, causes or treatment. Compared with dyslexia, very little research has been focused on the problems of dyscalculic children's difficulties and how to overcome them. Recent evidences show that dyscalculia is just as common as dyslexia and yet it is not as widely recognized by teachers, parents, school authorities or by the government (<http://www.topnews.in/>). Hence dyscalculic learners require special education in the same way as dyslexia.

4.13 TREATING DYSCALCULIA

The poor quality of learning at elementary stages gives children a weak foundation and it directly affects their learning at the high school stage and even carries over further. Many children are found to be mathematically handicapped rather than being slow learners. Learning achievement surveys taken by the National Council of Educational Research and Training (NCERT) recently show that mathematics teaching calls for more attention to help children acquire the basic skills of mathematics (*The New Indian Express*, 2008). So the task of teaching mathematics to students is a challenging one.

Ignorance about learning disability like dyscalculia is very

much prevalent these days and does a lot of harm through delay in intervention. Parents, teachers, administrators and educational planners at all levels have a great role to play in the minimization of difficulties in learning. Teachers need to provide their students with positive role models and consistently treat individual differences and needs with patient acceptance and special effort. They can bring to the attention of their pupils the anecdotes from the lives of great personalities like Thomas Alva Edison, Albert Einstein and Winston Churchill who in spite of their special difficulties in learning like dyslexia, dysgraphia or dyscalculia rose to achieve their spectacular goals in their careers as scientists, mathematicians or statesmen (Kumar & Raja, 2009 b: 18).

Visual perception, visual memory and logical thinking are the most important foundational skills needed for learning mathematics. These fundamental skills have to be mastered by means of adequate training and practice. Visual perception and visual memory are important mathematical skills to master visual spatial relationships. To be really competent in acquiring mathematical skills, one needs to visualize clearly numbers and mathematical situations (Kumar & Raja, 2008: 93). Special help can be given to dyscalculics to visualize mathematical problems. They can be helped to understand the problem by looking at visual information provided through pictures, charts, diagrams etc (Kumar & Raja, 2009 c: 243).

Most individuals with dyscalculia need help from a teacher, tutor or therapist specially trained in using multisensory or structured approach to teaching. It is important for these individuals to be taught by a systematic and explicit method that involves several senses at the same time with visual, auditory, tactile and kinesthetic elements. Special education services may help dyscalculic learners to overcome their problems. There is a great need to generate a base of qualified special educators equipped with skills to diagnose the learning disability and craft a coping strategy (*The Hindu*, October 30, 2008).

Schools can implement certain academic accommodations and modifications to help the educationally backward children to catch up with the rest of the class. For instance, introducing mathematical

laboratories may go a long way in helping these learners to resolve their problems. They can also benefit from visual representations of pictures, diagrams etc and through the use of various media (Kumar & Raja, 2009 a: 93).



DYSCALCULIC STUDENTS' LEARNING STYLES

Learning is one of the important mental functions of human beings. It relies on the acquisition of different types of knowledge supported by perceived information. It is thought to be a process of acquiring knowledge, attitudes or skills from study, instruction or experience. Learning prepares the learner to deal with any situation with new knowledge, skills or new methods of approach. The changes in the process of learning are always produced through some activity, experience or training. Through learning, the behaviour of an individual is changed through direct or indirect experiences. The scope of learning is very wide. Learning modifies one's behaviour cognitively, conatively, or affectively. It occurs in schools and everywhere else that children experience their world.

There are different types of learning such as perceptual learning, conceptual learning, associative learning, appreciative learning, skill learning etc. Many factors are responsible for the learning such as factors related to the learner, factors related to the learning material etc. The factors related to the learner could be both physiological or psychological which influence the learner's physical state, intelligence, interest, mental health, learning capacity etc. Factors related to the learning material include way of presentation of the content, appropriateness of the content etc. Also school factors like physical features of the school, school environment, teaching methods and techniques etc influence learning.

5.1 LEARNING STYLES – MEANING

A style is a preferred way of using one's abilities. Learning styles are not abilities but they are preferences in how one uses his/her ability (Santrock, 2001: 145). They are preferred ways of

studying and learning such as using pictures or text, working alone or with other people, learning in structured or unstructured situations and so on. Some proponents of learning styles believe that students learn more when they study in their preferred setting and manner (Woolfolk, 2004: 121).

A way a student learns can be considered as a learning style. It is a student's consistent way of responding to and using stimuli in the context of learning. Learning styles are characteristic ways of approaching material, based on a person's cultural background and unique pattern of abilities (Feldman, 2004: 185). Learning style is a component of personality characteristic that is innate and affected by an environmental factor and evolves over a period of time. According to Curry, an individual's learning style is a distinctive and habitual manner of acquiring knowledge, skill or attitude through study or experience (Bhardwaj & Gupta, 2006: 75).

5.2 DIFFERENT TYPES OF LEARNING STYLES

There are different types of learning styles. Some people learn best through one learning style while most people learn best through a combination of two or more learning styles, but everybody is different.

A well-balanced intelligent child is able to develop all the types of learning styles. There are many ways to train the different types of learning styles, but training the cognitive skills is found to be more important. Even though most learners use a combination of all learning styles, they usually have a clear preference for one. Knowing and understanding the types of learning styles is important for students of any age. The students have to understand their type of learning style earlier so that learning becomes easier and less stressful in the future. But it is important to train and practise the other types of learning styles so that the children can utilize them as effectively as possible (<http://www.learningrx.com/types-of-learning-styles-faq.htm>).

5.2.1 Kolb's Theory of Learning Styles

Kolb's learning theory explains about four learning styles which

are based on four approaches to learning such as concrete experience, reflective observation, abstract conceptualization and active experimentation. The four learning styles explained by Kolb on the basis of these approaches are the converging, the diverging, the assimilating and the accommodating learning styles respectively (<http://www.businessballs.com/kolblearningstyles.htm>).

Convergers are characterized by abstract conceptualization and active experimentation. Pupils with convergent learning style think about things and try to put out their ideas to see if they work in practice. Divergers tend towards concrete experience and reflective observation. Pupils with divergent learning style take experiences and like to gather information. Assimilators are characterized by abstract conceptualization and reflective observation. Pupils with assimilating learning style have the most cognitive approach who prefer to think than to act. Accommodators use concrete experience and active experimentation. Pupils with accommodating learning style have the most hands-on approach who prefers to do things than to think (http://www.en.wikipedia.org/wiki/Learning_styles).

5.2.2 Multiple Intelligences Theory of Learning Styles

According to multiple intelligence theory, there are nine basic types of intelligence such as Visual-spatial, Verbal-linguistic, Logical-mathematical, Bodily-kinesthetic, Musical-rhythmic, Interpersonal, Intrapersonal, Naturalistic and Existential.

Visual-spatial area deals with spatial judgement and the ability to visualize with the mind's eye, so to speak (http://en.wikipedia.org/wiki/Theory_of_multiple_intelligences).

Verbal-linguistic area has to do with words, spoken or written. People with high verbal-linguistic intelligence display a facility with words and languages. They are typically good at reading, writing, telling stories and memorizing words along with dates. They tend to learn best by reading, taking notes, listening to lectures, and discussion and debate. They are also frequently skilled at explaining, teaching and oration or persuasive speaking. Those with verbal-linguistic intelligence have high verbal memory and recall, and an ability to understand and manipulate syntax and structure.

Logical-mathematical area has to do with logic, abstractions, reasoning, and numbers. While it is often assumed that those with this intelligence naturally excel in logical or numerical activities, a more accurate definition places less emphasis on traditional mathematical ability and more on reasoning capabilities, abstract patterns of recognition, scientific thinking and investigation, and the ability to perform complex calculations. Pupils who have bodily-kinesthetic intelligence should learn better by involving muscular movement (e.g. getting up and moving around into the learning experience), and are generally good at physical activities. They may perform well in practical activities and in general they are good at building and making things. They often learn best by doing something physically, rather than reading or hearing about it. Those with strong bodily-kinesthetic intelligence seem to use what might be termed muscle memory – they remember things through their body.

Musical-rhythmic area has to do with rhythm, music, and hearing. Those who have a high level of musical-rhythmic intelligence display greater sensitivity to sounds, rhythms, tones, and music. Since there is a strong auditory component to this intelligence, those who are strongest in it may learn best via lecture. Language skills are typically highly developed in those whose base intelligence is musical. In addition, they will sometimes use songs or rhythms to learn.

Interpersonal area has to do with interaction with others. In theory, people who have a high interpersonal intelligence tend to be extroverts, characterized by their sensitivity to others' moods, feelings, temperaments and motivations, and their ability to cooperate in order to work as part of a group. They communicate effectively and empathize easily with others, and may be either leaders or followers. They typically learn best by working with others and often enjoy discussion and debate.

Intrapersonal area has to do with introspective and self-reflective capacities. People with intrapersonal intelligence are intuitive and typically introverted. They are skillful at deciphering their own feelings and motivations.

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Naturalistic area has to do with nature, nurturing and relating information to one's natural surroundings. Careers which suit those with this intelligence include naturalists, farmers, and gardeners.

Existential area has to do with philosophical issues of life. They learn best by thinking about analytical questions.

5.3 LEARNING STYLES AND DYSCALCULIA

It is commonly believed that most pupils favour some particular method of interacting with, taking in and processing stimuli or information. Some students respond to visual forms of information like pictures, diagrams etc while others respond to verbal, written or spoken explanations. These are the varied learning styles of students. Pupils with dyscalculia display a range of individual learning styles. Thus students have an array of preferred learning styles and their own unique profile of intelligence (Hannell, 2005: 41).

Visual learners

Visual learners are those who learn through seeing things. They learn best by looking at graphics, watching a demonstration or reading. Visual learners prefer to learn mathematics through pictures, diagrams or visual displays such as overhead transparencies, videos, flipcharts and handouts etc.

Sung (1999) on analyzing the learning style preferences of students in a junior high school found that the students had two or more learning style preferences and the visual numerical style was preferred to all the other styles. On studying a sample of college students enrolled in first and second semester calculus classes, it was found that the majority of visual learners to the website the aspect that contributed to most of their learning (Husch, 2001).

Auditory learners

Auditory or aural learners are those who learn through hearing things. They learn best through lectures, discussions, talking things through and listening to what others have to say. These learners often benefit from reading text aloud and using a tape recorder.

Auditory learners prefer to learn mathematics through sounds,

auditory patterns etc. On studying the learning styles of students in a high school, it was revealed that majority of the learners learned best by oral explanations or auditory learning styles who were average learners with a normal level of intelligence (Castolo & Rebusquillo, 2007).

Kinesthetic learners

Physical or tactile or kinesthetic learners are those who learn through experiencing or doing things. They learn best through a hands-on approach. These learners learn through moving, doing and touching. They process information through experience by actively exploring the physical world around them.

For kinesthetic learners, mathematics that allows them to handle real objects, move around and remain physically active will hold their interest much more effectively than extended periods of deskwork. It was found that kinesthetic learning style had a strong significant effect on the academic performance of students (Castolo & Rebusquillo, 2007). Wood (2002) while studying the effects of individualized plans supplemented by learning-style profiles on the mathematics achievement of special education students found that there were significant differences in the scores of students who received tactual and kinesthetic lessons on geometry and algebra when compared with those students who received traditional lessons.

Verbal learners

Verbal learning refers to the learning of language skills. Verbal learners learn best by saying, hearing and seeing words. Tactile or kinesthetic learners are those who learn through experiencing or doing things. They process information through experience by actively exploring the physical world around them (<http://www.learningrx.com/>). For verbal learners, mathematics that uses words and relates to language-rich areas will be more appealing.

Logical learners

Logical learners are those who learn by using logic and

reasoning through categorizing, classifying and working with abstract patterns or relationships. Logical learners look for mathematical patterns and logical sequences and may enjoy learning mathematics in a methodical way or in a systematic order.

Interpersonal learners

Social or interpersonal learners are those who learn in groups or with people. They learn best in a group situation actively and interactively (<http://www.lessonstutor.com/sml.html>). Interpersonal learners like to learn mathematics collaboratively.

Intrapersonal learners

Solitary or intrapersonal learners are those learn through self-study. They learn best in self-paced instruction, individualized projects etc by working alone (<http://www.lessonstutor.com/sml.html>). Intrapersonal learners may vary in their application in learning mathematics. Sometimes these learners may be preoccupied with their own internal thinking and at other times they connect with the mathematics that is going on in the classroom around them (Hannell, 2005: 42-47).

5.4 VISUAL LEARNING FOR DYSCALCULIC LEARNERS

Visual learning is the type of learning style in which learning certain facts and concepts occur through seeing or observing things. Visual learners often tend to keep an eye on the teaching done in the class and watching the lecture or demonstration or lecture closely. They understand or like instruction done through charts and are good with sign language. Learning techniques for the visual learners include using charts and flashcards, using diagrams for teaching, taking notes or making lists, watching videos etc (<http://www.homeworktips.about.com/>).

The visual learners need to see the teacher's body language and facial expression to fully understand the content of a lesson. They tend to sit at the front of the classroom to avoid visual obstructions. They may think in terms of pictures and learn best from visual displays such as diagrams, illustrated textbooks, overhead transparencies, videos, flipcharts and handouts. During

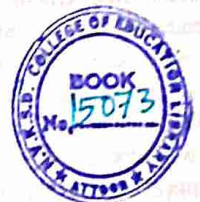
a lecture or classroom discussion, the visual learners often prefer to take detailed notes to absorb the information (<http://www.ldpride.net/learningstyles.M1.htm>). For them, it is easy to look at charts and graphs, but they may have difficulty focusing while listening to an explanation. For visual learners, mathematics that allows them to learn through pictures, diagrams etc will be more appealing and hold their interest much more effectively.

Visual learning may prove to be very much useful for dyscalculic learners to get rid of their difficulties in learning. It involves the use of charts, graphs, pictures, diagrams, videos, transparencies, flipcharts, handouts etc in the learning process. Visual learning fosters better understanding, organization and imagination. A student when given visual scope for learning remembers pictures, diagrams, symbols, formulae etc. Data handling, graphical representation and visualization are important mathematical skills which can be taught productively for children with learning disabilities like dyscalculia. Data handling can be suitably introduced as a tool to understand the process and represent and interpret day-to-day data. Use of graphical representations of data can be encouraged among students for effective learning. Activities in practical mathematics help students immensely in visualization. The spatial reasoning and visualization skills of students should be enhanced (NCERT, 2005: 17).

Visual learning helps to improve the arithmetic skills of dyscalculics to a great extent. Mathematics teachers need to adopt visual learning strategies in the classroom for the benefit of dyscalculic learners. Introducing mathematics laboratories in schools may go a long way in helping the arithmetic-disabled children to overcome their problems in learning. Students can benefit greatly through the use of different visual media for learning mathematics. The use of videos and transparencies may help such learners immensely in visualization. These media can stimulate their interest to learn through the creation of a congenial environment for learning. Video representations too may help to overcome the problems faced by the dyscalculic children.

Visual perception, visual memory and logical thinking are the

most important foundational skills of mathematics. These fundamental skills have to be mastered by means of adequate training and practice. Visual perception and visual memory are important mathematical skills to master visual spatial relationships. Logical thinking alone makes problem solving possible. To be really successful in mathematics, one needs to visualize clearly numbers and mathematical situations (Kumar & Raja, 2008: 90).



TECHNOLOGY FOR DYSCALCULICS

Technology makes desired improvement in the teaching-learning process by making it effective and efficient. The extensive use of technology enables teachers and learners to identify and use various strategies that integrate with their teaching and learning processes. Technology deployed in education can help to remove inequities between the schools of developing nations and developed nations and between rural and urban areas. It can maximize and individualise learning and make it more productive and relevant.

The use of instructional media is an essential component of educational technology which contributes to the efficiency as well as effectiveness of the teaching-learning process. The use of various media increases the number of creative opportunities and challenges for education. It involves the use of various technological devices in the educational activities. It helps the learners to attain the objectives of educational technology such as individualizing instruction, providing quality education, offering equal educational opportunity etc and to enrich or add variety to traditional form of learning. The multimedia instructional strategies have the potential to facilitate better communication and retention in the teaching-learning process. The use of different media in the teaching and learning processes helps to meet the diverse needs of the learners.

Children with learning disabilities like dyscalculia are found in most schools. Technology can play a very important role in the learning of such pupils with arithmetic disabilities. The use of technological devices helps in the development of academic skills to reach normalcy. Teaching with the help of technological devices brings desired improvement in the teaching-learning process by making necessary modifications in the teaching and learning skills.

It could bring a change in the behaviour of the learners by maximizing their learning facilities.

6.1 IMPORTANCE OF TECHNOLOGY

Technology can greatly aid the process of mathematical exploration for students with learning disorders. It must be understood that there is a spectrum of technology use in mathematics education and calculators or computers are at one end of the spectrum; the use of pictures, blackboards, graph paper, abacus or geometry boxes is at the other end. Innovations in the design and use of such material must be encouraged so that their use makes school mathematics enjoyable and meaningful (NCERT, 2005: 12). Michaelson & Thomas (2007) suggests that certain practical methods and instructional designs can be implemented in the classroom to address the specific learning needs of dyscalculic learners.

Dyscalculia can be detected at a young age and measures can be taken to overcome the problems faced by younger students. An awareness that there are certain teaching methods and practical approaches which are effective with such children is essential for class teachers particularly of elementary schools. The use of technology like multimedia instructional strategy or computer-assisted instruction may facilitate the process of mathematical exploration for dyscalculic learners. By these specialized approaches to teaching, most dyscalculic learners can be helped to learn normally. It is therefore imperative for dyscalculic learners to receive the highest quality of Mathematics education possible.

Innovative use of technology may help disabled learners to overcome their disability to a large extent and clever use of such technology can help engage such students with learning disorders. Chen (2004) on evaluating the efficacy of mathematics interventions for children with learning disabilities studied that technology-based intervention categories were highly effective for group design studies but moderately effective for single subject design studies and they could be effectively implemented to students with learning disabilities in mathematics.

6.2 MULTIMEDIA INSTRUCTION FOR DYSCALCULICS

Multimedia is media and content that uses a combination of different content forms. The term 'multimedia' describes multiple forms of media and content. Multimedia represents the convergence of text, pictures, video and sound into a single form. Multimedia is simply multiple forms of media integrated together. Multimedia includes a combination of text, audio, still images, animation, video, and interactivity content forms (<http://en.wikipedia.org/wiki/Multimedia>).

Multimedia approach to teaching is a strategy that comprises more than one instructional technique for teaching a particular unit. The use of instructional media is an essential component of teaching-learning process. It contributes to the efficiency as well as effectiveness of the teaching-learning process. The use of different media increases the number of creative opportunities and challenges for education. The use of different educational media used for teaching and learning activities helps to provide individual differences among pupils. They include the things which are manipulated, seen, heard, read or talked about and the instruments which facilitate such activities.

Educational media are used as tools, both for teaching and creating awareness in learning. The various educational media include projected media such as slides, transparencies, projectors etc and non-projected media such as charts, real objects, models etc. All these include audio media such as audio tape, recorders etc, visual media such as videotapes, television, computers, motion pictures etc, and realia (real objects) such as models, kits, globes specimens etc.

The opaque projector is a projected media which can instantly project any material that have a flat surface. Teachers may use the opaque projector to enlarge picture, drawings, maps etc. The bulletin board is often the most active and exciting display element in the classroom. It invites and sustains creative work by students and enable them to share their learning experiences. A drawing or photograph can be used to convey a particular message (Dale, 1969). Projected media also includes the media such as computers which

can be used for projection with the help of LCD projector. Multimedia computers can present any type of auditory or visual materials including speech, text, music, animations, photographs or videos alone or in different combinations. They can link different types of representations such as pictures with sounds, oral readings with written text, videos with subtitles or any other combinations that might reinforce teaching and learning. They can also provide enormous flexibility, allowing the user to set the speed of speech, decide whether written text is also read aloud, choose the language presented in text and speech, or decide whether to repeat the presentation (<http://www.neirtec.org/>). This flexibility can be valuable in presenting educational tasks to dyscalculics to improve their mathematical skills. Computer technology provides visual learning which involves the use of different video and powerpoint presentations with attractive pictures, diagrams and graphs along with mathematical formulae, mathematical statements or rules. All these provide variety in learning to dyscalculic learners.

The media such as charts, realia, models etc come under the category of non-projected media. *Charts* are graphic representations of abstract relationships such as chronologies, quantities and hierarchies. A chart should have a clear, well-defined instructional purpose. In general, it should express only one major concept or configuration of concepts. *Realia* are the instructional aids most closely associated with direct purposeful experience. As such, they are ideal media for introducing learners to a new subject. Real objects may be used as a means of presenting information, raising questions, and giving hand-on learning experiences. Models are three-dimensional representations of a real thing. It may be complete in detail or simplified for instructional purposes. Models of almost anything can be made for classroom use (Heinich *et al*, 1985: 172).

The use of various educational media may help to overcome the academic difficulties of children with arithmetic disabilities. A study (Dutta, 1990) which attempted to diagnose the problems in reasoning faced by the students in learning geometry and their prevention revealed that the experimental group taught by audio-

visual materials and techniques achieved significantly more than the control group taught by the conventional method and that learning through audio-visual materials caused more prolonged retention than through the conventional method. Innovations in the design and use of such materials must be encouraged so that their use makes learning enjoyable and meaningful. By choosing materials and activities suited to their level of learning and by stimulating their urge to bring out their best, teachers can help the pupils with learning disabilities to turn their difficulties into special opportunities to be model achievers (Kumar & Raja, 2009 b: 18).

Innovative use of technology may help dyscalculic learners to overcome their disability to a large extent. It is very essential for school teachers to adopt innovative methods of teaching to meet the needs of dyscalculic learners. Schools can implement certain academic accommodations and modifications to help the educationally backward children to catch up with the rest of the class. For instance, introducing mathematical laboratories may go a long way in helping these learners to resolve their problems. Students can also benefit from visual representations of pictures, diagrams etc and through the use of various media (Kumar & Raja, 2009 a: 12).

The use of technology like multimedia instructional technology may facilitate the process of mathematical exploration in dyscalculic learners. By these specialized approaches to teaching, most disabled learners can be helped to learn normally (Kumar & Raja, 2008: 93). Mohankumar and Rajaguru (2001) on evaluating the effect of using multimedia instructional strategy for learning-disabled children studied that multimedia instruction facilitated the learning-disabled students in learning algebra concepts rather than their counterparts in conventional teaching group.

Heo (2007) investigated an experimental study on the impact of multimedia anchored instruction on the motivation to learn of students with and without learning disabilities in a general classroom setting which included 80 randomly selected seventh-grade students with 28 students having a learning disability and findings of the study indicate that students with learning disabilities

who received the anchored instruction improved in their motivation to learn and also in their academic achievement to a level similar to students without learning disabilities. In a study (Vasanthi, 1991) done on the development of a multi-media instructional system for remedial measures in fractional numbers, it was found that the multimedia instructional system helped the students in improving their performance on the computational skills in fractional numbers.

6.3 COMPUTER TECHNOLOGY FOR DYSCALCULICS

Computer-supported instruction refers to the instruction by the teacher with the support of computer in which the features like text, images, graphics, animation etc are incorporated (Kumar & Raja, 2009 d: 37). In other words, it is the instruction with computer as teaching aid. It encourages active learning and meets the diverse needs of the learners through the use of technology in education. It can cater to the individual needs of many students at a time. This type of instruction produces learning experience effectively and efficiently. A good amount of information stored in the computer is made available to the learner than any other media (Mohanty, 2003).

Computers can present any type of auditory or visual materials including speech, text, music, animations, photographs or videos alone or in different combinations. They can link different types of representations such as pictures with sounds, oral readings with written text, videos with subtitles or any other combinations that might reinforce teaching and learning. They can also provide enormous flexibility, allowing the user to set the speed of speech, decide whether written text is also read aloud, choose the language presented in text and speech, or decide whether to repeat the presentation (<http://www.neirtec.org/>). This flexibility can be valuable in presenting educational tasks to dyscalculics to improve their mathematical skills.

Clever use of computer technology can help engage such students with learning disorder like dyscalculia to overcome their disability to a large extent. A study conducted by Lugo (2004) explores how multimedia computer technology could be a potential

supplemental teaching aid that teachers use in addition to traditional classroom instruction. Technology can greatly aid the process of mathematical exploration and clever use of such technology can help engage such students with learning disorders. Calculators are typically seen as an aid for the calculations regarding arithmetical operations. If ordinary calculators can offer possibilities such as doing arithmetical operations, calculating squares, square root etc, the potential of using computers for mathematical exploration is far higher (NCERT, 2005: 11).

Computer-based education has a very important role to play as an advanced technological instruction. It employs different instructional techniques and meets the diverse needs of the learners through the use of technology in education. Computer-assisted instruction encourages active learning and can cater to the individual needs of many students at a time. This type of instruction produces learning experience effectively and efficiently. A good amount of information stored in the computer is made available to the learner than any other media (Mohanty, 2003).

Nwaizu and Ifeanyi (1990) on assessing the level of retention of students with specific learning disabilities while using computer-assisted instruction and teacher-assisted instruction to teach multiplication skills, it is revealed that students had higher retention level of multiplication facts mastered during computer-assisted instruction than during teacher-assisted instruction. On conducting a study (Calhoon, 2000) to know the effects of computer-based test accommodations on mathematics performance assessment scores for secondary students with learning disabilities, the results suggested that providing a reader, either human or computer significantly increases mathematics performance assessment scores for students with learning disabilities.

6.4 WEB-BASED INSTRUCTION FOR DYSCALCULICS

Web-based instruction is a growing trend in the field of education. The rapid growth of information and communication technologies (ICTs) has led to the development of web-based education. It is a type of education in which the medium of

instruction is computer technology. It makes learning much easier as one need not be physically present in the classrooms all the time. Web-based training is delivered over the internet using a web browser. It includes interactive methods such as bulletin boards, chat rooms, instant messaging, video conferencing and discussion threads (Bharathi et al, 2009: 3).

Web-based instruction refers to providing a learning environment that is mediated and supported via the Internet/Intranet and connected to a computer with hyperlinks to resources outside the instructional domain. Not only can learning occur through interactions with the materials but also through a community of learners using chat, threaded discussion, e-mail, whiteboards, or other programmes which provide a combination of these environments. One aspect of the web-based instruction is the incidental learning that frequently occurs. In a traditional face-to-face instructional environment, learning is considered to be intentional and there is usually very little incidental learning (<http://www.proofofconcepts.com/>).

Web-based technologies have created a number of new options for teaching and learning. Possibilities range from using information technology in a traditional classroom setting to a distance education model where there are no formal meetings in an actual classroom (Kumar, 2008). Web-based instruction utilizes the attributes and resources of the World Wide Web to create a meaningful learning environment where learning is fostered and supported. Web-based instruction organized in a nonlinear format that allows learners to reference material based on their individual needs and uses a wide variety of media through sound, animation, text, and video (<http://www.moresteam.com/>).

Web-based instruction is designed so that the computer displays lessons in response to interactions of the learner or the user. Computers and the web allow learners to view, retrieve, and store information at any place and at any time (<http://www.proofofconcepts.com/>). Web-based instruction is delivered via the computer using the internet, making it capable of instant updating, distribution, and sharing of information. As a

special type of hypermedia learning system, Web-based instruction represents a non-linear instructional medium that may encourage deeper processing and cognitive flexibility in learners. The use of hypermedia may not only lead to deeper learning by encouraging trainees to think about how new information is related to existing knowledge but may be a superior medium to the extent that it offers a cluster of learning modes through text, audio, graphics, synchronous and asynchronous communication that can be tailored to individual learning styles (<http://www.moresteam.com/>).

There is a need to create a more inclusive web-based environment as technology advances and more and more students with learning disabilities like dyscalculia attend web-based classes. A study (Tandoh, 2002) which investigated the strategies and limitations students with learning disabilities namely dyslexia, dysgraphia and dyscalculia face in a web-based instruction environment and the contributions of web-based instruction course designers and their impact on web course design revealed that learning through the web helps to increase students' motivation, self-esteem and a sense of autonomy. Educational technologies like web-based learning can help dyscalculic children in overcoming their learning problems and permit a greater number of opportunities for learners' epistemological styles, pace of learning, flexibility, self-correction and modification of learning.

Web-based instruction may lead to greater instructional effectiveness including media variety, facilitation of web exploration, and learner ease and flexibility of use. Opitz (2002) on determining the effects of web-based learning modules for adolescents with learning disabilities found that web sites created using universal design guidelines that adhere to federal recommendations for web accessibility may assist all types of students in improving the accuracy of response when using information from a website.

Awareness about learning disabilities like dyscalculia is very much essential to investigate about new technologies like web-based learning that can be most appropriately used to facilitate the learning of disabled children. Web-based technologies have the

potential to create an interactive, collaborative learning environment in which students experience confidence and success. It can help students with learning disabilities in developing motivation and self-esteem by allowing students to take more responsibility for their learning (Kumar, 2010: 504).

6.5 THEATRE EDUCATION FOR DYSCALCULICS

Theatre education is a medium of theatre for exploring various issues with young pupils. It evolved as a specific form during the 70s and 80s. It is used to describe any work by professional theatre workers in an educational setting. Theatre education is an educational strategy which has been recently introduced in many educational institutions. It has been introduced as a novel method which aims to unite the classroom education and the theatrical concepts. The aim of theatre education is to use theatre and drama to create a wide range of learning opportunities for the young pupils. Also it aims to mitigate the gap between the educators and the educated. It provides opportunities for the development of academic skills such as reading skills and mathematical skills as well as literacy and social skills (<http://dictionary.babylon.com/>).

Theatre education has emerged as an innovative strategy in the current educational scenario. The term theatre education includes everything from the education of academics in the history of theatre and drama to the training given to young children in theatre appreciation. School drama education varies from a subject in its own right to integration as a learning methodology across the curriculum in many elementary classrooms. Professional touring theatres for young audiences and a few resident companies in major cities educate through curriculum and social issue plays (<http://www.thecanadianencyclopedia.com/>).

Theatre education seeks to create a wide range of learning opportunities across the whole curriculum. This type of education is considered as a unique hybrid of performance and child-centred learning (<http://www.flipcart.com/>). Theatre education is considered to be an educational medium which involves the active participation of all learners. It is active in the sense that it engages students'

attention, energy and creativity. It is also collaborative since it paves way for students' thinking and learning together (<http://wiki.projectbamboo.org/display/>).

Theatre education provides a conducive learning environment to the pupils in its most effective way as it is both visual and auditory in a sophisticated fashion. It integrates educational technology in the teaching and learning processes through the use of a variety of techniques to enhance teaching and learning. It helps the students to engage themselves in meaningful learning experiences. It considers individual differences and provides opportunities to all individuals to learn and contribute to their potential (<http://www3.ashland.edu/>).

Theatre education starts with an educational topic or debate and develops a show around it. There are a number of companies across the globe that specializes in producing theatre to be performed in schools. Such productions often have drama workshops attached and may involve the pupils in the performance itself. Since the groups specialize in educational work, the performances are designed with particular aspects of the curriculum in mind. Some will always link their work to a particular key stage while others design various projects for different ages (<http://www.teachernet.gov.uk/>). Theatre can empower individuals and communities. It is a force that can unite, uplift, teach, build communities, inspire and heal (<http://www.artslynx.org/heal/theatre>).

Theatre education greatly helps to improve academic performance. Drama activities improve reading comprehension and both verbal and non-verbal communication skills. Students who participate in drama often experience improved reading comprehension, maintain better attendance records and stay generally more engaged in school than their peers who do not experience the arts. Also it was studied that students who took courses in drama study or appreciation scored, on average, 55 points higher on verbal component and 26 points higher on mathematics component than their non-arts classmates (<http://www.aate.com/>).

Dramatic activities are now perceived as having several distinct

functions in the classroom. The primary focus is on the use of creative drama and improvisation to aid in the child's mental, physical and emotional development. Theatrical devices are often used in the classroom to teach academic subjects. Professional theatre companies tour to schools presenting plays which may be on the reading curriculum or which may be used to promote discussion on social or health issues. In secondary schools, plays are still presented with the educational intents of teaching language skills, fostering self-confidence, and developing a knowledge and appreciation of drama and theatre (<http://www.thecanadianencyclopedia.com/>).

Numerous studies have demonstrated a correlation between drama involvement and academic achievement. The findings of the study (Bell, 2007) on exploring the drama lives of children of adolescent boys highlight the values of involvement in creative activities, freedom of choice, the assumption of responsibility, working on collaborative enterprises and the development of a sense of competency and implications are suggested for educators to help increase involvement of both boys and girls in drama and theatre work. The study (Alrutz, 2003) which explored how drama techniques affect student learning in the science classroom revealed that drama-based science lessons accommodated multiple learning styles improving students' access to science content and perceptions of their learning experiences and abilities.

The novel idea of theatre education is to familiarize educators with the concept of learning and using the experiential methodology of theatre to fulfil the educational needs (<http://www.hindu.com/edu/>). A study (Jacobs, 2003) done on the possibilities of hope in drama for drama teachers revealed that doing drama in partnership with students maintained or strengthened hope and that repetition and renewal of experiential knowledge together with skill and wisdom in teaching practice sustain and maintain hope.

A study (Wuertz, 2003) which examined why students chose to attend the specialized visual and performing arts high school in central Florida through in-depth interviews with two currently enrolled students and their parents revealed that quality of the

experiences in schools helped students to determine a career path and that the students saw themselves involved in theatre as professionals or as patrons. Jackson (2004) on investigating about variables that promote and/or inhibit theatre programme development in public schools studied that there were six variables that inhibit theatre programme development and that there were twenty variables that promote theatre programme development.

Theatre education is used to broaden the base of knowledge, hone skills, facilitate age-specific learning etc. It helps to build a bond between classroom education and theatrical tools which benefits both educators and theatre buffs alike. It takes a four-dimensional vision to theatre education programme successful. The four components go into the success of this programme are thorough familiarity with the system of education, the use of experiential gains, openness to innovative ideas and presence of experts from the world of theatre (<http://www.hindu.com/edu/>).

Theatre education proves to be an effective strategy for the benefit of learning disabled children. Theatre education with an innovative approach to training and an extensive programme of workshops provides a ladder of opportunity for children with learning disabilities leading from appreciation to participation through personal development to independence (<http://www.artslynx.org/heal/theatre>).

A study conducted by Kaliski (1978) on theatre workshop for children with learning disabilities discusses the benefits of the workshop including improved oral and written language. A study (Clopton & Davis, 1979) done on the impact of drama on children with special needs describes two drama programmes designed for children with specific learning disabilities and based on the needs of these children to achieve and develop a positive self-image.

Many theatrical companies across the globe today specialize in performances designed to cater to the needs of children with learning disabilities. There are a number of companies that specialize in theatre education and in addition there are a number of companies that aim their performances at specialized groups. For example, Oily Cart Children's Theatre in UK works with

students with multiple learning disabilities (<http://www.teachernet.gov.uk/>). Since 1981 Oily Cart has been taking its unique blend of theatre to young children in schools and venues across the UK. Innovative, multi-sensory and highly interactive productions for young children with profound and multiple learning disabilities were created by the theatre. By transforming everyday environments into colourful, tactile 'wonderlands', they invite their audience to join them in a world of the imagination. Using hydro-therapy pools and trampolines, aromatherapy, video projection, and puppetry together with a vast array of multi-sensory techniques, they create original and highly specialised theatre for the young audiences (http://www.oilycart.org.uk/about_us/)

Theatre education is considered by many individuals with learning disabilities to be a welcoming and friendly environment. Almost all of the events and activities run by theatre resource are accessible to those with mild or moderate learning disabilities. Such activities usually include activities with strong visual images and actions. The theatre resource with ICT workshop has a range of software applications including symbol writing systems which may help to improve the performance of the learning-disabled children. Exhibitions and facilitated visits are also arranged for these children which may greatly benefit them (<http://www.theatre-resource.org.uk/>).

Theatre education may be able to help dyscalculics by arranging facilitation / personal assistance. It can also prove to be useful to develop the arithmetic skills of such learners to a certain extent. The adoption of theatre education as an innovative strategy could create a wide range of learning opportunities for educationally backward learners. Also it helps to enhance the learning of such pupils by using different instructional techniques and thus integrating educational technology in the classroom (Kumar & Raja, 2009 e: 13).

RESEARCHES ON DYSCALCULIA

A learning disability like dyscalculia is a life-long condition but the effects of this disorder can be controlled with appropriate support, guidance and interventions at home and school. Arithmetic skills are indispensable for academic excellence and researches in this area are becoming increasingly needed. Dyscalculia is seen to be a developmental as well as an acquired learning disability and the effects of this disorder can be controlled with appropriate support, guidance and interventions at home and school. Acquisition of arithmetic skills is indispensable for academic excellence of the learners and so the need of researches in this area is keenly felt.

Educational planners need to address the concerns of these intellectual sufferers and come to their rescue with the provision of sufficient funds for researchers to find out ways and means to minimize learning disabilities in mathematics and for the development of infrastructure for inclusive learning in as many schools as possible. So it is becoming imperative for researchers to conduct surveys and experiments in this area to meet the special needs of dyscalculics who need special attention.

7.1 STUDIES ON ASSESSMENT OF DYSCALCULIA

There is a great need to identify and help dyscalculics and early intervention programmes are essential. Early identification and prevention are needed for any category of dyscalculic problems of the schoolchildren. For the development of arithmetic skills, early intervention programmes are essential. Early intervention programmes help in provision of services to such educationally handicapped children for the purpose of lessening the effects of the condition. Since the child's early learning provides the foundation for later learning, early intervention would help prevent the child from developing additional problems or disabilities.

- The findings of a study (Moomaw, 2008) reveal that mathematics-based curriculum measure which can be used to assess the ongoing development of quantitative reasoning in children is a valid and reliable measure of number sense.
- Posner (2008) examined socially the emergence of dyscalculia as a credible explanation and a durable classification of pupils' poor mathematical performance and to investigate the various ways in which dyscalculia is produced, understood and practised by multiple stakeholders from four communities of practice namely
 - (i) Pupils (self) identified as dyscalculics.
 - (ii) Advocates for and against dyscalculics.
 - (iii) Professional considered experts in assessing and diagnosing dyscalculia.
 - (iv) Neuroscientists involved in conducting research on dyscalculia.

The findings reveal that dyscalculia and dyscalculic subjects are constituted by a system of interdependencies between the four communities of practice and that these communities have little in common aside from a shared understanding of dyscalculic difference that is shaped by mathematical sovereignty.

7.2 STUDIES ON DYSCALCULICS AT VARIOUS LEVELS

A learning disability like dyscalculia cuts across class, age and intelligence. Children with arithmetic difficulties are found at all age levels and early identification is very important (Nakra, 1996: 157). A learning disability is found across all ages and in all socio-economic classes. Learning disabilities may affect individuals differently at different stages of life – early childhood, elementary school years, adolescence and adulthood. Students with learning disabilities may be identified at any age, but most of them are first noticed in early elementary school grades (Ysseldyke & Algozzine, 2007: 247).

7.2.1 Studies at Primary School Level

- While analyzing the neuro-psychological processes and the

arithmetic errors committed by the students studying in primary schools, it was found that majority of the dyscalculics experienced difficulty in reading and writing more than two digits, in sequential reproduction and seriation of numbers, and also in solving problems involving spatial and numerical relations (Ramaa, 1990).

- Drueck (1997) on examining second-grade average-math achievers and low-math achievers who were at-risk for mathematics learning disabilities on factors related to conceptual understanding and solution procedures for two-digit addition and subtraction found that average-math learners and low-math achievers did not differ on the accuracy of their computations but rather on their use of conceptual structure and representational methods. It was also found that the low-math achievers used the more immature unitary conception for a longer period of time than did the average-math learners. It was also found that the low-math achievers used the less sophisticated concrete representational methods in solution procedures more frequently than the more advanced methods of mental strategies and standard written algorithms used by the average-math learners. The low-math achievers were also found to have decreased automaticity for labelling numerical information, poorer basic fact retrieval and lower performance on a composite of memory tasks.
- Robinson (2002) on examining about number facts performance in a sample consisting of 318 children with learning disabilities of third grade in six public schools who were divided into three groups – group of students with mathematics disabilities alone, group of students with concomitant mathematics and reading disabilities, and a contrast group and the findings revealed that children with both phonological processing and number sense weaknesses had greater difficulty in mastering the number facts and that students with mathematics difficulties alone were able to use their phonological processing skills to compensate for observed weakness in number sense.

If these problems are not detected at an early stage, it will prevail at the later stage of learning. This is covertly supported by the studies conducted out on dyscalculics at secondary schools.

7.2.2 Studies at Secondary School Level

- Tishler (1981) conducted a study on the factors of cognitive development in two groups of seventh-grade students evidencing dyscalculia with a sample of thirty students in each of the two groups – the dyscalculic and the control groups. It was found that students evidencing dyscalculia were different from their mathematically achieving counterparts on two factors of cognitive style namely field dependence and independence, and spatial visualization.
- On assessing the children with learning disabilities at secondary school in the area of equation-sums in algebra conducted by Bhattacharya (1988) it was found that students had more learning disabilities in application than in the knowledge of linear equations and also it was found that the simplified method was more effective than the method of transposition in solving linear equation sums.
- Vasanthi (1991) has done a study which explored the incidence and content of certain mathematical learning disabilities in relation to certain psychological, social and educational factors. It was found that the mathematical disabilities were greatest among pupils in government schools affiliated to the State Board, less among pupils in matriculation schools and least among pupils affiliated to the Central Board of Secondary Education and that these disabilities had a significant negative relation to intelligence and socio-economic status and a positive relationship to behaviour problems.
- On studying the effectiveness of certain instructional strategies to overcome learning disabilities in arithmetic among secondary level schoolchildren, it was found that there was significant difference in the post-test performance of learners than pre-test by using various instructional strategies (Kumar, 2003).

- An investigation into the learning difficulties of simple fractions of Indian schoolchildren at secondary level show that one third of all the mistakes in division of fractions were due to the student's negligence to invert the divisor before the process of multiplication; one fourth of all mistakes in the division of fractions were due to the student's lack of comprehension of the process involved (Maite & Mete, 2006).

7.2.3 Studies at Tertiary Level

- Toppel (1996) investigated on the effects of a labeling plus diagramming strategy and a labeling only strategy on the mathematical word problem solving ability of learning disabled community college students and their attitude towards their mathematical ability. The results of the study showed that only six students of the labeling plus diagrammatic group did not improve in their ability to solve mathematical relational word problems; however these learning disabled students labeled the numerical values in the relational word problems as compared to only two out of the seven learning disabled students in the labeling group. It was also found that the attitude towards mathematical ability of the learning disabled students in labeling plus diagramming strategy instruction group improved.
- The results of the study by Myers (2001) explore the relationship between perceptions of postsecondary mathematics instructors and students with learning disabilities showed that students had neutral attitudes towards the nature of mathematics, were concerned with instructor's personalities and prefer approachable, friendly and patient instructors who involve students in class and teach through examples. Instructors were found to perceive mathematics as a way of thinking that involves logic, procedures and models. Some had negative stereotypes with learning disabilities while others describe them as conscientious and intelligent.
- The study of Evans (2003) showed that students with learning disabilities were satisfied with the accommodations they received in their university-related mathematics courses. It was

reported that students with learning disabilities performed better in a class that is reserved for them than students enrolled in open sections.

7.3 STUDIES ON RELATIONSHIP OF DYSCALCULIA WITH OTHER LEARNING DISABILITIES

Even though the cognitive sciences have not yet been able to establish a thorough understanding of the origins of dyscalculia, there have been several discoveries that have helped to develop some important correlations between dyscalculia and other learning and psychological disorders. Many studies have shown that a considerable number of dyscalculic children suffer concurrently from additional ascertained difficulties. Approximately 17 percent of dyscalculic children are also dyslexic and another 26 percent experience the effects of attention deficit hyperactivity disorder (Michaelson, 2007).

7.3.1 Dyscalculia and Dyslexia

Dyscalculia is just as common as dyslexia and yet it is not as widely recognized by teachers, parents, school authorities or by the government. Hence dyscalculic learners require special education in the same way as dyslexia. There is a considerable overlap between the two disorders dyslexia and dyscalculia. A few studies claim that dyscalculia is more common in children than dyslexia or word blindness. But unlike dyslexia, very little is known about its prevalence, causes or treatment (<http://www.topnews.in/>).

Studies suggest that somewhere between 20 and 60 percent of pupils have both dyslexia and dyscalculia. Deficits in language and memory may create problems in the acquisition of mathematics and literacy skills (Hannell, 2005: 4). Children who have difficulty in literacy skills also have trouble with mathematics. Research studies show that rapid retrieval of abstract knowledge from long term memory is also likely to be shared both by literacy and arithmetic learning. It has been estimated that 40 percent of dyslexic children can also have trouble with learning mathematics (Pollock & Waller, 1994: 122).

- Friedman (1989) conducted a study on reading and arithmetic achievement scores of learning disabled students to develop information about subtypes of learning disabilities employing cluster analysis of academic achievement as measured by subtests of the Woodcock Johnson Tests of Academic Achievement. The results of the data revealed ten distinct subtypes of learning-disabled students. Significant differences were found between the subtypes on Verbal, Performance and Full Scale IQ scores. This study identifies subtypes of disabled learners who are relatively weak in mathematics but strong in reading, subtypes who are weak in reading but strong in mathematics and subtypes who demonstrate deficits in both reading and mathematics. Several groups of disabled learners were identified who were relatively strong in academic skills requiring comprehension and weak in those requiring rote application of skills. Only two groups were identified who were relatively strong in academic rote skills, but weak in comprehension.
- White (1997) analysed the effects of cognitive learning strategies interventions with learning disabled students in the topical areas of reading and mathematics. The results showed that the interventions were effective with the learning disabled students. It was found that the interventions were most successful in the elementary and junior high grade levels in reading while interventions were most successful at the junior and senior high levels in mathematics.
- A study (Orly & Avishai, 2006) revealed that dyscalculic population has difficulty in automatically associating numerals with magnitudes but no problem in associating letters with phonemes, whereas dyslexic population shows the opposite pattern.
- In a study on "Naming speed in dyslexia and dyscalculia", It is suggested that the cognitive bases of dyslexia and dyscalculia are independent of each other (Willburger *et al.*, 2008).

7.3.2 Dyscalculia and ADHD

- On assessing the familial relationship between dyscalculia and

attention-deficit hyperactivity disorder (ADHD) by using structured diagnostic interviews and a cognitive test battery, it was found that ADHD and dyscalculia are independently transmitted in families and are etiologically distinct (Monuteaux *et al.*, 2005).

- Reysa (1995) investigated on the mathematics computation performance associated with ADHD and LD with a sample comprising of four groups of boys which included 17 boys diagnosed with ADHD, 11 boys diagnosed with mathematics learning disability, 16 boys with both ADHD and mathematics learning disability diagnosis, and 15 normal comparison (NC) boys. It was found that there were significant differences among the groups on several error types. LD boys made significantly more bugs, number fact errors, and total errors than ADHD and NC boys. Additionally, ADHD and ADHD/LD boys made significantly more slips than NC boys.

The necessity to study other learning disabilities connected with dyscalculia is essential in order to know how they hinder the mathematical abilities of students.

7.4 STUDIES ON COMPARISON OF DYSCALCULICS AND NORMAL CHILDREN

Regarding the researches on comparing dyscalculics with normal children, only a few studies have been conducted.

- Wisniewski (1990) has done a study to assess the patterns of errors between students with a learning disability and those of their non-disabled peers. The findings indicated that students with a learning disability had greater difficulty in acquiring the concept of regrouping than their non-disabled peers. They were also observed to make a different pattern of errors.
- Lee-Sachse (1998) had done an investigation on the relationship between working memory and mathematical problem-solving in children with and without learning disabilities. The results of the study showed that significant ability group differences emerged on all measures. It was found that learning-disabled

children were inferior to age-matched controls but their performance was statistically comparable to that of the reading level controls on most measures. Significant correlations were obtained between problem solution accuracy and working memory in children without learning disability but not in children with learning disability.

- Belmarez (1998) on doing a research on the relationship between co-teaching and the mathematic achievement of groups of students with and without learning disabilities found that: (1) students with learning disabilities do not achieve greater academic gains by receiving mathematics instruction in a co-taught classroom rather than in a resource classroom; (2) students with learning disabilities in the co-taught classroom attained significantly higher standardized test scores; (3) with the exception of the case significantly higher standardized test scores, the co-taught classroom in this study was not conducive to greater mathematics achievement for students with learning disabilities and (4) no significant difference existed in mathematics achievement for co-taught, experimental groups of students without learning disabilities when compared to that of the control groups who received mathematics instruction in the general classrooms.
- A study (Owen, 2005) done on the comparison of mathematical problem-solving errors between third-grade students with learning disabilities and peers without disabilities indicated that students with learning disabilities made more errors in the translation of word problems than in computation.
- On comparing students with mathematics learning disabilities and students with low mathematics achievement in solving word problems, it is shown that students with low mathematics achievement had more computational errors but fewer translation errors when compared to students with mathematics learning disabilities who had conceptual difficulties in the areas of analyzing, reasoning and abstract thinking (Hartmann, 2007).

7.5 FINDINGS ON STRATEGIES FOR OVERCOMING DYSCALCULIA

Dyscalculia is seen to be a specific learning disability and requires diagnosis as well as support apart from classroom teaching. Diagnosis may be done through observing and testing all the areas of academic skills. Teachers play a crucial role in diagnosing the learning difficulties of such students and parents are not an exception. It is obvious that there is a need for reliable and supportive strategies that help to overcome this learning disorder. The technological devices fused with the established laws of learning do serve this purpose.

7.5.1 Strategies using Computer

Computer Technology can greatly aid the process of mathematical exploration and clever use of such technology can help engage students with learning disorders. The use of technology like computer-assisted instruction may facilitate the process of mathematical exploration in dyscalculic learners.

- Wagh (1991) has done a research on the development of a multimedia instructional system for remedial measures for fractional numbers and to compare the results of this approach to those of the traditional approach of remedial teaching and thus to find the difficulty levels of skills experienced by the students in fractional numbers. It was found that both the traditional instructional system and the multimedia instructional system remedial approaches helped the students in improving their performance on the six computational skills in fractional numbers and that the six skills were found to differ from each other in their difficulty level.
- Shiah (1994) studied on the effects of computer-assisted instruction on the mathematical problem-solving of students with learning disabilities and the findings of the study showed that the students in all conditions improved significantly on mathematics word problem solving from pre to post testing and that students in all conditions performed significantly better on the on-line computer tests than on the paper-and-pencil tests.

Finally, all students across all conditions reported that they enjoyed using the computer programmes and that they enjoyed using the pictures.

- Wang (1997) had done an experimental research to investigate the effectiveness of a computer-based self-instruction training programme for teaching mathematics problems to children with learning disabilities and the results of the study support the efficacy of computer-based self-instruction training programme.
- Stultz (2008) researched on the effectiveness of computer-assisted instruction for teaching mathematics to students with a specific learning disability. The objective of the study was to determine if computer-assisted instruction was as effective as other methods of instruction that do not use computers for teaching mathematics to students with a specific learning disability. It was found that a statistically significant difference did not exist between the two methods of instruction and that individual student characteristics or other factors may interact with the method of instruction utilized when teaching students with specific learning disability.
- Kumar & Raja (2009) conducted a study to examine the effectiveness of using computers for teaching mathematics to dyscalculic children and the results of the study indicated that computer-supported instruction enhanced the mathematical ability and academic performance of dyscalculic children.

7.5.2 Other Strategies

It is very essential for school teachers to adopt innovative methods of teaching to meet the needs of dyscalculic learners.

- The study which centred upon the problem of development of teaching steps for handling arithmetic disabled children through developing scientific steps in teaching addition and subtraction revealed that with training and following the teaching steps, the disabled subjects could perform in a better way and retain in the memory for a long period (Mishra, 1991).

- Flores (2004) on comparing the effects of two methods of teaching multiplication facts to middle school students with learning disabilities found that among the two instructional methods namely strategic instruction and constant time delay, strategic instruction is more effective than constant time delay with regard to skill maintenance and generalization.
- Chen (2004) conducted a meta-analytical study on evaluating the efficacy of mathematics interventions for children with learning disabilities. The findings of the study showed that behavioural, cognitive and technology-based intervention categories were highly effective for group design studies but moderately effective for single subject design studies and they could be effectively implemented to students with learning disabilities in mathematics.
- Tavani (2004) studied the impact of testing accommodations on students with learning disabilities and the results of the study indicated that the use of testing accommodations did not significantly impact the performance scores of students with learning disabilities on the mathematics assessment. It is shown that testing accommodations may not always help a student with a learning disability and that alternative measures may need to be implemented to help students display their true abilities on mathematics assessments.
- Carluccio (2005) researched on examining the use of the graphing calculator to support the learning of function concept in a mathematics classroom. It was found that the graphing calculator could foster active student participation and assist students in making connections to real-world data and that the graphing calculator used in conjunction with explicit teacher modeling could assist students in their conceptual understanding of the function concept.
- Shih (2006) on studying the effects of number sense intervention on second-grade students with mathematics learning disabilities, the results showed that students who received repeated practice followed by number sense instruction had better initial performance on fact retrieval and could

generalize what they learned to more novel tasks such as solving word problems.

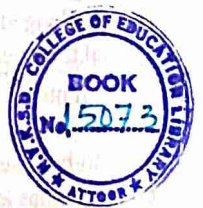
- Scheuermann (2006) attempted on studying the effects of a mathematical instructional model on the performance of students with learning disabilities on one-variable equations and found that participants learned to illustrate and manipulate one-variable equation word problems using multiple illustration modes and there was an increase in the students' ability to transfer their skills to a variety of situations including mathematical notation, textbook word problems and standardized mathematics achievement measures.
- Sanders (2007) made a quasi-experimental study on embedded strategies in mathematics vocabulary instruction. The findings of the research indicate a strong relationship between vocabulary and mathematical comprehension identifying vocabulary understanding as a key component in understanding the subject. It is found that vocabulary instruction incorporating mnemonic strategies has consistently resulted in substantial increases in learning and retention for students with disabilities as well as non-disabled peers when compared with other approaches.
- A study regarding methods for ascertaining and accommodating dyscalculic children in the classroom conducted by Michaelson (2007) suggests that certain practical methods and instructional designs can be implemented in the classroom to address the specific learning needs of dyscalculic learners.
- A study (Moomaw, 2008) on measuring number sense in young children reveals that mathematics-based curriculum measure that can be used to assess the ongoing development of quantitative reasoning in children is a valid and reliable measure of number sense.

7.6 EPITOME

Dyscalculia is a learning disability which requires special support apart from classroom teaching. However, only a very few

studies have been focussed on the various types of dyscalculia; dyscalculics at various levels of education; relationship of dyscalculia with other learning disabilities; comparison of dyscalculics and normal children; and strategies to overcome dyscalculia. Compared with other learning disabilities like dyslexia, only a very few studies have been done on dyscalculia and ways to overcome it. It is becoming imperative for researchers to carry out more intensive studies on this area to meet the needs of this category of students who need special attention.

The problems of dyscalculics need to be studied from different angles. The need to study each and every type of dyscalculic problem is quite essential. Identification of different types of dyscalculics in different stages of education namely primary, secondary and college level needs to be done. Studies need to be carried out on comparison of dyscalculics with learners affected by other disorders like dysgraphia, dysphasia or dyspraxia. A few more studies could be done on comparisons of dyscalculics and dyslexics and pupils with ADHD. More studies in this area will shed light on the differences between dyscalculics and normal children. Dyscalculics clearly require help to learn normally through early recognition and specialized approaches to teaching. It is essential for researchers to carry out investigations on new technologies that may be most appropriately used to facilitate learning.



RECOMMENDATIONS TO THE CLIENTS

8.1 RECOMMENDATIONS TO PARENTS

Dyscalculia is seen to be a developmental as well as an acquired learning disability and the effects of this disorder can be controlled with appropriate support, guidance and interventions at home. Parents should accept the fact that their wards must be left to learn at their own pace of learning. When they notice that their wards have severe problems with arithmetic, they must consult with their teachers and create a friendly environment which is conducive to their learning.

Parents are not optimally aware of learning disabilities like dyscalculia which hampers their wards' performance in arithmetic. Awareness about learning disabilities alone helps parents to give the right type of guidance and support to their wards. Learning-disabled children are found to have average or above average level of intelligence and it is a highly sad condition that many parents are not aware of this fact. Parents need to be aware about arithmetic learning difficulties and they need to take adequate steps to help this challenged learners through individual care and attention or special treatment.

Parents should involve actively in the child's education and the future. They need to understand that children with special needs have to be able to practice what they learn at school in home. A child who has learnt to do something independently at school must be given opportunity to do it at home as well. Parents need to provide individual attention to their wards to fully grasp certain concepts. Parents should make them to work with individual care after school hours and they can be provided a place to work with few distractions.

Parents have a great role to play in bringing emotional

development among learning-disabled children. Home atmosphere exercises a good amount of influence over the emotional stability of such children. Parents should seek active co-operation of teachers in making the home atmosphere suitable for their proper emotional development. They need to co-operate together in designing appropriate programmes at home and school to bring about positive emotions for learning-disabled children. Also instead of accusing students of being unmotivated and lazy, parents need to observe the children more closely at home and school and have them evaluated by trained personnel for the presence of any type of learning disability. Once parents notice that children have severe problems with academic skills, they should seek help from qualified professionals. Rehabilitation programmes have to be planned for these children according to their level and also according to their nature of dysfunction.

Parents should not discourage their children when they lag behind in their studies and they must find out with the help of experts what hampers their progress. They have to accept the fact that their children can learn only at their own pace of learning. They must know the capacity of their children and also understand that it is no use pushing them beyond their capacity of learning. They can encourage their children to develop their learning skills to the maximum extent possible. With proper parental care, dyscalculics can be made to do mathematical calculations in correct ways and hence to develop their academic skills and achievement.

8.2 RECOMMENDATIONS TO TEACHERS

Teachers are the torchbearers in a society. They have to cater to the needs of all students in a class who have different intellectual and socio-cultural backgrounds. Often teachers come across some pupils who may have learning difficulties and are discouraged by their own weaknesses in their learning. Teaching profession is a very challenging one and teachers have to address the special needs of these children. If schoolteachers gain the insight into the difficulties their pupils face and display the qualities of leadership needed to bring these children out of their isolated world and help

them bring out their best, these children can be enabled to integrate into the rest of society and achieve positions of eminence.

Awareness about difficulties that dyscalculics face can enable teachers to open their eyes more to the ways of helping them. Teachers have to become aware of the compensatory strategies that they can use to make these students complete the mathematical tasks and to learn mathematics successfully. As a teacher learns about the difficulties faced by each student in learning mathematics, he/she can adopt the right kind of instruction to cater to their specific needs. The task of teaching mathematics to dyscalculics is indeed challenging and by becoming aware of the strategies that can mitigate the difficulties, instructors can grow in confidence in accomplishing this complex task.

Children with learning disabilities require special assistance on the part of teachers. Special educational programmes can be designed by teachers to meet the special needs of these learners. With proper care and teachers' guidance, dyscalculics can be made to do arithmetic calculations in correct ways. In addition, these children with disability need a great deal of structured practice and immediate corrective feedback to develop their numerical skills. Repeated reinforcement and specific practice of straight forward ideas can make understanding easier. Many students need individual attention to fully grasp certain concepts and it is the duty of teachers to provide individual care and attention to them to help them cope up with their learning.

Early identification and prevention are needed through intervention strategies for any category of dyscalculic problems of the schoolchildren. The purpose of positive intervention programmes will be of great help to pupils to overcome their disabilities and to make effective choices and decisions in their ways of learning. Helping the students to identify their strengths and weaknesses helps greatly in achieving academic success. Following identification, teachers and other educators can work together to establish strategies that may help the students to learn more effectively.

8.2.1 To Use Different Technologies for Instruction

The teachers have to be aware of the compensatory strategies that they can use to make these students to cope up with the academic tasks and also determine how they may be most appropriately used to facilitate learning. They need to be specially helped to overcome their problems through different attitudes and teaching methods. There is a great challenge on the part of teachers to deal with those children with arithmetic disorders by using innovative teaching strategies. By these specialized approaches to teaching, most dyscalculic learners can be helped to learn normally. With more and more emphasis on classroom performance in this era of perfect competition, teachers need to apply the best known techniques to make the children intellectually superior. When properly applied, such techniques help to overcome learning difficulties in reading, spelling or mathematics.

It is necessary for teachers to get rid of technophobia and be familiar with all aspects of technology. It is essential for teachers to be acquainted with the new technologies, learn more about them, and also determine how they may be most appropriately used to facilitate learning. It is essential that teachers adopt different kinds of technologies in the classroom to meet the needs of dyscalculics so as to overcome their learning problems in mathematics and attain tangible improvement in mathematical abilities. By specialized approaches to teaching, most dyscalculic learners can be helped to learn normally.

Technology can greatly aid the process of mathematical exploration and clever use of such technology may help engage such students with learning disorders. To meet the needs of all students, regardless of learning style, attitudes towards mathematics or ability level, teachers should use modern technology such as computers or calculators. Innovative use of technology may help dyscalculic learners to overcome their disability to a large extent. It is very essential for school teachers to adopt innovative methods of teaching to meet the needs of dyscalculic learners. The use of technology like computer-assisted instruction by the teachers may be a help in effective learning of students. Computer-based

education has a very important role to play as an advanced technological instruction. It employs different instructional techniques and meets the diverse needs of the learners through the use of technology in education. Educational technologies like web-based learning can help disabled children in overcoming severe learning problems and permit a greater number of opportunities for learners' epistemological styles, pace of learning, flexibility, self-correction and modification of learning.

Multimedia can be used for the benefit of learners with special educational needs. The use of different instructional media such as projected media and non-projected media, print media and electronic media or the non-print media, real objects etc can benefit such learners as they provide a variety in learning. The variety and flexibility of different multimedia applications offer the opportunity to adapt any media-combination to cater to the needs of learning-disabled children. The use of different media could facilitate the process of acquiring the various academic skills that are needed for learning and create a wide range of learning opportunities for these educationally backward learners. By choosing materials and activities suited to their level of learning and by stimulating their urge to bring out their best, teachers can help the pupils with learning disabilities to turn their difficulties into special opportunities to be model achievers.

8.2.2 To Understand Different Learning Styles

It is very essential for school teachers to adopt different learning styles to meet the needs of dyscalculic learners. Most individuals with dyscalculia need help from a teacher specially trained in using multi-sensory or structured approach to teaching. It is important for these individuals to be taught by a systematic and explicit method that involves several senses at the same time with visual, auditory and kinesthetic elements. Various technological devices provide learners with visual, auditory or kinesthetic experiences. It is very essential for school teachers to adopt different learning styles to meet the needs of dyscalculic learners. Special help can be provided to dyscalculic learners to visualize mathematical problems by looking at any visual information provided through

pictures, charts, diagrams etc. While teaching mathematical concepts, the teacher can provide examples and try to relate problems to real life situations. The teacher can introduce new skills beginning with concrete examples and later move on to more abstract applications. Also the use of real objects provides kinesthetic experiences to the children. Adopting different learning styles can help engage such disabled children to learn in an enjoyable and meaningful way.

8.2.3 To Improve Mental Health of Students

Schoolteachers have a great role to play in meeting the needs of pupils from a larger number of diverse backgrounds and with increasingly diverse special needs. It is necessary that teachers have to change their roles and identify the challenges faced by the children instead of discouraging them with senseless homework. Various learning experiences are to be provided to children in order to develop their physical, mental, and emotional abilities. Since the child with learning disability represents a whole person, including a psychological self which is as important as the child's academic self, any programme which attempts to deal with only the educational aspects is inadequate.

There is no greater gift the teachers can give to their students than laying the foundation for their emotional health, positive self-esteem etc through inculcating values in them. It provides the opportunity to have a positive attitude towards life and imparting of ideals for a healthy and stress-free life. Building values provides the fuel to mould a child's self-esteem and feelings of self-worth through positive approaches towards problems confronted in life. It has the power to transform children's misguided actions into more fruitful work. It focuses on strengths and positive attributes and acceptance for effort. Helping individuals with learning disabilities to develop greater self-awareness about their disabilities is important for their ability to make effective choice and decision-making in their ways of learning. They must feel better about themselves and be more capable and resilient as they learn the meaning of healthy self-esteem, responsibility, respect for individual differences etc. It is hoped that by motivating the youth

for introspection and self-analysis, the desired results would be achieved.

Without developing emotional stability, students will not be able to face life with confidence and courage. It is by being emotionally stable that students can have the power to cope with their learning problems. Apart from teaching the children to read, write and do arithmetic, teachers must also provide conducive learning environment to children which are supportive to their emotional development and stability. For many children with emotional problems, supportive services or intervention outside the classroom is essential. Developing emotional stability provides the fuel to mould a child's self-esteem and feelings of self-worth through positive approaches towards problems confronted in life. It has the power to transform children's misguided actions into more fruitful work.

Learning disabilities should not be regarded as an indication that an affected child cannot succeed against the achievement of some of history's famous personalities. Teachers have a great role to play in moulding the mindset of children with learning disabilities in such a way as to enable them to convert their challenges into chances for their intellectual and emotional development.

Appropriate guidance and counselling may be required for learning-disabled children to reduce their anxiety and frustration and to develop confidence, positive attitude and high self-esteem. With proper guidance given by the teachers, dyscalculics can be made to do arithmetic calculations in correct ways. Counselling by teachers can assist students with learning disabilities to develop greater awareness of their disability and to understand how they have to adapt and adjust to their limitations and strengths. Teachers can help students to promote self-determination which help them to make effective choices and decisions. It is necessary for students to understand their strengths and limitations together with a belief that they are capable and effective which are essential for self-determination. Children need to know how to handle mistakes in a positive manner. If teachers support students in becoming more self-determined, then they can enable them to learn how to make

choices and decisions that are based on what they most value. Children need to know how to handle mistakes in a positive manner.

8.2.4 To Use Different Evaluation Techniques

It is imperative for teachers to adopt various evaluation techniques to help these academically weak learners to improve in academics. Through evaluation, different traits such as achievement, attitude, interest, ability, personality, skills etc are assessed. Evaluation techniques can be used for evaluating the performance of learning-disabled children. They can be used both for screening and measuring the learning outcomes of the learning-disabled children. It involves the use of different quantitative and qualitative techniques for the assessment of the educational activities. These techniques can be used to assess the cognitive, affective and psychomotor behaviours of such children. Such techniques can be used by teachers to improve their teaching skills and also to adopt different instructional methods to suit the needs of disabled learners and to enhance the learning of such pupils.

8.3 RECOMMENDATIONS TO RESEARCHERS

Mathematical skills are indispensable for academic excellence and more researches in this area are becoming increasingly needed. Dyscalculia is seen to be a specific learning disability and requires diagnosis as well as support apart from classroom teaching. It is to be noted that very few research studies have been done in the field of learning disabilities like dyscalculia. It is imperative that researchers come forward to study these learning disorders and adopt certain ways and means to treat these academic sufferers.

Awareness about learning disabilities like dyslexia, dysgraphia or dyscalculia is very much essential to investigate about new technologies that can be most appropriately used to facilitate the learning of disabled children. Technologies have the potential to create a conducive atmosphere to active learning by the students. Awareness about dyscalculia is very much essential to investigate about new technologies that can be most appropriately used to facilitate the learning of mathematically disabled children. It is

imperative to study about ICT technologies like Web-based learning and investigate the effectiveness of different communication technologies such as e-learning, ubiquitous learning (u-learning) on the mathematical ability of such learners. Also experimental studies, both culture fair and culture specific, on innovative methods of instruction which may benefit these arithmetic-disabled children other than the computer technologies are to be done widely for the sake of developing countries. Hence researchers need to come forward to carry out more intensive studies on this area and search suitable measures to treat these disabled learners.

There are different kinds of learning disorders which affect the performance of school children. Studies in the areas of dyspraxia and dysphasia are lacking and more studies have to be conducted in these areas. Psychological factors other than self-esteem, emotional maturity etc concerned with children with learning disabilities are to be taken into account and studies on areas like intelligence, emotional intelligence etc should be conducted. Studies on management factors like leadership, communication, decision-making etc concerned with children with learning disabilities too need to be done for the benefit of these educationally challenged children.

The problems of dyscalculics need to be studied from different angles. The dyscalculics need to be identified and studied at all levels of schooling – primary, secondary and higher secondary, and at tertiary level. Locale-specific studies in the area of dyscalculia are lacking and attempts have to be made on this. Rehabilitation programmes may be planned for these children according to their level and nature of dysfunction. Studies need to be carried out on comparison on dyscalculics with learners affected by other disorders like dysgraphia, dysphasia or dyspraxia. A few more studies could be done on comparison of dyscalculics and dyslexics and pupils with ADHD. More studies in this area will shed light on the differences between dyscalculics and normal children.

8.4 RECOMMENDATIONS TO ADMINISTRATORS

School administrators are not much aware about learning

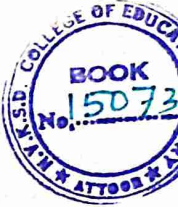
disability like dyscalculia which is very much prevalent these days and does a lot of harm through delay in intervention. Early intervention programmes help in provision of services to such educationally handicapped children for the purpose of lessening the effects of this disorder. It is essential to identify students with learning disabilities as early as possible to prevent or alleviate the frustration and failure these students face. Early intervention is needed for schoolchildren who are at a risk of developing a handicapping situation that may affect their development and it is the duty of school administrators to organize such programmes.

There is close to no effort on the part of school administrators at correct treatment or adoption of strategies to remove the learning blocks that hamper their educational progress. It is possible for these children to be enabled and equipped with the skills they need and to empower them to catch with the rest of their peers through different teaching strategies. It is highly desirable that our schools sensitize their staff to develop in these children the skills they normally fail to develop. The school administrators should not hesitate to seek help from qualified professionals in consultation with the parents of the pupils concerned. Special education services can be organized by the school administrators to help the dyscalculic learners to overcome their problems. There is a great need to generate a base of qualified special educators equipped with skills to diagnose the learning disability and craft a coping strategy.

The school administrators have to provide the impetus and support to make inclusive education happen. Along with their staff and parents, the administrators need to plan and have a vision to provide equal opportunities to all the students. As a first step, they can facilitate cross-disciplinary collaboration. Staff training, continuing education and ongoing professional development are the next step. Administrators can support teachers in inclusive schools by providing in-service training that addresses teacher-identified needs, employing competent personnel to deliver the training, offering incentives to educators to participate, using diverse methods and co-ordinating the training with other districts or institutions.

School administrators can implement certain academic accommodations and modifications to help the educationally backward children to catch up with the rest of the class. For instance, introducing language laboratories or mathematical laboratories may go a long way in helping these learners to resolve their problems. Students can benefit from conversations and also pronunciation of words through tapes, earphones etc. They can also benefit from visual representations of pictures, diagrams etc and through the use of various media. Innovations in the design and use of such material must be encouraged by the administrators so that their use makes school mathematics enjoyable and meaningful. There is a need to cultivate infrastructure to facilitate the detection and management of schoolchildren so that the students are diagnosed for the potential they have.

School administrators have a great role to play in the minimization of difficulties in learning. Various innovative methods of teaching could be implemented in all educational institutions for the benefit of all learners who face severe problems in learning mathematics. It can be certain that those with learning difficulties in mathematics could enhance their performance in academics at least to some extent through the use of such innovative methods in the classroom.



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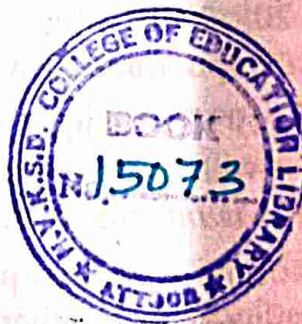
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SPECIAL EDUCATION

(FOCUS ON MATHEMATICS LEARNING DISABILITY)

B. William Dharma Raja
S. Praveen Kumar

In the present era, special education is being considered as an important field of study. All around the globe, there has been significant gains in special education services and policies supporting children with disabilities. But among the various categories of disabilities, learning disability is the one in which least importance is given to or which is ignored. A learning disability like dyscalculia is often ignored or not all identified.

The book is designed with the intention to address some of the basic issues related to learning disabilities in general with a special focus on dyscalculic problems. Writings in the area of learning disabilities represent an important dimension of creating awareness about those special wards who need special attention to develop their academic skills. This book outlines the essentials of the condition called dyscalculia and offers certain practical ways in which these difficulties can be addressed. Chapter 1 of this book introduces the concept of disability and the various types of disabilities. Chapter 2 focusses on learning disabilities and provides a discussion of prevalence and causative factors of learning disabilities and the problems of learning-disabled wards. Chapter 3 discusses about integrated and inclusive education and also the need of inclusive settings for learning-disabled children. Chapter 4 concentrates on analysis of dyscalculic problems by discussing about its types and causes. Chapter 5 presents an overview of learning styles and the different learning styles that are suited to dyscalculics according to their needs. Chapter 6 deals with the use of technology for the benefit of dyscalculics. Chapter 7 reviews the researches done on dyscalculia and addresses the need for conducting intensive studies on this area to meet the needs of dyscalculics. Chapter 8 helps the clients of education such as parents, teachers, administrators and researches on adoption of strategies to overcome the problems of these special children. This book will be useful to all those involved in the field of special education, especially, teacher educators and students of special education. It is hoped that this book will be of help to teachers and parents dealing with children with learning disabilities. It may also be helpful to researchers who wish to do researches in the area of learning disabilities.

The authors are indebted to all those sources which have been consulted covertly and overtly in preparing this book. Also suggestions and comments for the improvement of this book are most welcomed and appreciated.

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